Surimposium

The double look

To Veronique,
my most personal meta-principle.

To my children and grandchildren, generators of the 'why(s)' on every level, and the 'because(s)' that they share with me.

To Sally, for becoming entangled in my obligations so effectively that I was able to take time off to a metaphysic.

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Presentation

Surimposium is a general theory of reality. Its departure is the recognition of a complex order, with two actors at its ends: real and mind. They are mentally modeled as non-self and self. The two are examining each other, two opposing directions. This is the definition of the double look, the subject of the first chapter.

Since these representations operate entirely in the mind, it is this that I focus on in the second chapter. *Stratium* is a model of the self-organized mind. It must satisfy the double look, the privileged epistemic in philosophy and the ontological in neuroscience. I compare it to other models of the psyche and show how it is alone in solving the "hard problem" of the phenomenon of consciousness.

The third chapter examines our conceptual foundations: individuation, interaction, representation, error, order and information, certainty and uncertainty. Each concept is often given different names by the double look, requiring them to be joined. Or, on the contrary, the concept is monolithic and deserves to be split.

The fourth chapter continues the fundamental inquiry with the systemic, self-organizing, and emergence. History of emergentism, up to its contemporary vision: emergent causality does not arise out of nothing but unmodeled aspects of initial conditions and approximations in the delimitation of a system.

The ontological reality of emergence is the subject of the fifth chapter. There are causal breaks in topology, phase transitions, thermodynamics, quantum decoherence. Reality makes approximations. At the same time, transcendental phenomena such as the critical point and renormalization appear. I will show how causal breaks are hidden in a simple sign '='. The notions of entropy and energy are deciphered. We will witness a veritable epistemic reversal of ontological information.

The sixth chapter reveals the complex dimension. Not just a plan of juxtaposed systems but a vertical hierarchy bringing an additional

dimension to reality. The double look is embedded in reality. A representation is no longer virtual but real, even in matter. *Surimposium* defines entirely new principles: surimposition of information levels, complex attractors, local frameworks replacing the general spatio-temporal framework, which becomes the surimposition of local levels. Hypothesis of the individuation/collectivization conflict (I am / I am part) as a principle transcendent to this dimension.

The seventh chapter seeks a metalanguage for the complex dimension. Investigation of the hierarchy of mathematical language and the possibility of a metamathematics. The most mysterious of concepts is discussed: time. The property of time as a sequence is given back to each complex level. The problems born from the comparison of times dissolve. The phenomenon of consciousness is part of a temporality emerging from the surimposition of its constitutive interactions. Does a course of time animate reality or not? This potential tension is no longer necessary with the complex dimension. Finally, it is possible to reconcile continuity and discontinuity with the double look, ontological continuity and discontinuity of representation, both as realistic as each other.

I will conclude on the different sections of the complex dimension, which I have called *Quantum Matterium Stratium Societarium*, within the *Diversium*: the self-organized reality, from the apparent uniformity of quantons to the diversity of consciousnesses.

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Introduction

The theoretical object we are going to investigate here is self-organized reality. Totally observable vision according to which reality is discontinuous, formed of independent elements. Elements brought together, however, by a certain number of common criteria, notably proximity, which bring them into contact and build an organization. The orderly appearance ranges from chaos to an almost eternal structure. The groups formed can in turn join together in a higher organization. The process is spontaneous. A priori without a Great Organizer himself ordered and endowed with divine intentions, the origin of which we could not explain. However, the spontaneity of the process involves a driving principle. By its origin we call it *(transfer of) energy*, by its effects *intention*. Is this principle itself heterogeneous, or homogeneous?

I call the theoretical object *Diversium*. Where does this name come from ? The organization produces, level after level, elements of increasing diversity. Reality is not just a factory of order; it continually reshapes and diversifies this order. Its forge is the edge of chaos. *Surimposium* is a *model of Diversium*, the self-organized reality.

Within *Diversium* there is another important theoretical object: the human mind. Although we are personally committed to it, it is nothing of an exception inside *Diversium*. It is no different in nature. Its remarkable peculiarity is the height of its complexity, which is no longer in the material field but conceptual. This object has priority to be described: it represents *Diversium*. Mine writes these lines, yours reads them. By immediately casting the author on paper, we avoid the dualism inherent in most works, which sanctuaries the viewer in an invisible balcony above reality.

This second theoretical object is called *Stratium*. *Stratium* is a model of the human mind that is self-organizing to understand its physical and social environment. Another strange name? Its origin is more complicated. The inputs to the brain are simple sensory stimuli, the outputs a wide variety of elaborate behaviors. How do simple things become complexes? Between the two there is necessarily a large number of organizational layers. Recruitment and assembly of data in tiered concepts. The whole is like an

organized pyramid, with multiple gateways between neural centers. Inside an atrium. A atrium with strata. *Stratium*.

This book uses a particular framework of thinking, the double look. We will constantly go back and forth between the representation and the essence of the subject represented. In other words, we will be attentive to how *Stratium* and *Diversium* influence each other. Because *Stratium* is not just a thinking tool. Our representations are effective. They model *Diversium* down to its material essence. How do they do it? This way of thinking is in itself a justification for your reading. If it does not give you any additional knowledge, the double look will allow you to relate them all. Its pretension goes so far as to distinguish you, on subjects in which you are new, between the plausible and the suspect. It is an epistemological rather than a scientific framework. Scientific formalism is a proven, well-known mode. However, it remains to create a meta-science linking the different disciplines, in particular the physical and human sciences, while respecting their proprietary paradigms.

By its ambitions *Surimposium* could be improperly called 'Theory of Everything'. No, its primary interest is the creation of a framework of thinking on the issue, not of authoritatively asserting fundamental principles and patterns of "Everything." For this purpose, I will justify the concepts of self-organization and emergence. The reality of emerging properties is always the subject of heated debate, rooted in the meaning given by each to the fundamental postulates of knowledge. We will therefore carefully examine the following terms: order, causality, law, space, time… An ambitious task? This is not the most difficult, however. The trickiest thing is to compare the way in which our mind forges these concepts. Indeed, any epistemological and ontological investigation is a logical production resulting from a mysterious black hole: the human brain. It is impossible, in attacking 'Everything', to neglect the sources of reasoning. Logic, consciousness, intuition… How could our coherence be entirely independent of the subjects analyzed? The brain is part of reality. Logicians warn us against circular reasoning, but how can we avoid it when the mind is investigating the foundations of its own reason? In practice *our linear reasoning is always sections of a larger circular reasoning*. The postulates used are practical limits, but if we remove them, the chain of

"why?" reappears, curls into itself or vanishes into the immeasurable. I will suggest a solution to this problem. Since taking a global effect as a global cause makes us fall into the undecidable (for example justifying the existence of God because He would have created Himself), I will divide the vast circularity of 'Everything' into small independent sections of 'causes > effects'. I will show how they are articulated by going back and forth between the conceptual mechanism and the essence of the observed phenomenon.

Surimposium program, third theoretical object: the model. What determines the organizational crossovers of reality? Do they follow common principles? Where does the additional specific information of the whole come from, if it cannot be reduced to its micro-mechanisms? If *Diversium* is the organism, and *Stratium* one of the organs, *Surimposium* would be the delivery system. We're going to dive under the hood of *Diversium*, and seek to understand how it works, from quantum vacuum to mind fulness.

One more book on consciousness? Again old chestnut of emergence !, you may already sigh. Is this the preaching of a new enlightened holist, the umpteenth rehash of subjects who are hardly making progress? Wouldn't you make better use of this time by closely following developments in the Human Brain Project, advances in AI, or micro-cosmic as well as macro-interesting findings at CERN? This book is neither a review of current knowledge, nor a challenge to their hearts. It is a general theory born from a particular idea: that a fundamental principle of reality, if it exists, in no way describes its structure but only *the way in which it is organized*. It is not owned by any discipline and ties them all together.

This idea grew completely independently, at the junction between human and physical sciences (as a doctor, I deal with both people and their biomolecules). The most exciting part of birth? The progressive inclusion by this idea of scientific and philosophical achievements, the welding, the solutions to contradictions. The mainstay of this work is the paralleling of the layered hierarchy of the mind with the hierarchical continuity of reality. Much remains to be done. At a minimum, however, by closing this book, you will come away with a new skill in examining areas of knowledge that are foreign to you. At most, if this logic applied to the consciousness

phenomenon is correct, you will know how it is possible to endow artificial intelligence with it.

You will need to familiarize yourself with the terms used, the commons which only have appearance (vocabulary listed in the appendix). Words are never neutral, they are *opinions*, and we cannot build anything together without using the same bricks of meaning. Also familiarize yourself with my neologisms about our theoretical objects. *Diversium* is therefore reality structured in self-organized levels: fields / atoms / molecules / biomolecules / organelles / cells / organisms / organs / brains / societies… to name the best known. It is divided into sections, the names of which speak for themselves: *Quantum Matterium Stratium Societarium*.

One of the priorities of this book is to regain *intention*. Systemic and self-organization paint the world with a mechanicality from which human consciousness feels excluded. The reception of cybernetics, the first science of control, has been rather cool among the general public. It has generated a multitude of fears and doomsday predictions. Individuals intimately controlled by mechanics, stripped of their shimmering human facets. 1984 was for George Orwell a horizon close enough for mankind to be transformed into an assembly of robots. The date has now passed. A contemporary of Orwell attending a family lunch today, where guests tap their smartphones rather than talking, might think the prediction has come true! The intention has shifted a lot since the 1950s, but it has not disappeared. It continues to style the control, which has expanded considerably. *Surimposium* shows that intention arises from the very principle of self-organization. One grows as the other builds up. Control constantly elevates intention rather than stifling it, as long as it does not turn bottom-up paradigms into top-down tyrants. Principle of relative independence, which separates the acting representation from what it represents. Intention must be blind to the conflicts that produced it. It is the organization of them. Conflict is both a driving force and a stabilizer.

After the chapters listed in the presentation, which will establish the legitimacy of *Surimposium*, we will criticize it together in the conclusion. The first trap where you see it, probably, is that of circular reasoning. Doesn't he pretend to explain itself with its own principles? That is true. A

tool seeking its manufacturing method. Hmm… However, its case is different from the others: it includes *all the tools* available to our mind. What if it also includes the one who tells you to beware of circular reasoning, and explains its role? Circularity is dangerous for reductive theories, those which want to transform Everything into a set of points, easier to remember by the mind. Here we are only seeking to straighten out the skeleton of reality. Everyone can attach their concepts of identity to it as they see fit. The goal is in the name of *Diversium*: to drive diversity. Protect the conflict, as a fundamental principle, but by limiting its destruction on our scale, because self-organization often backs up.

Since I elevate the place of conflict, it must be exercised. An appendix is devoted to the competing Theories of Everything. It's a wave. Does everyone have their Big ToE? These theories, thanks to the double look, are easy to classify into two categories: spiritualists seeking to reconcile reality with our conscious impressions, materialists seeking to unite consciousnesses around scientific realism. None seriously attack the inner workings of the mind, which remains a black box. Theorizing is an intention. Understanding where our intentions come from is a priority. Yet Darwinian evolution does not seem to follow any pre-established plan. Assign it an end goal? Not the least. Under these conditions, how was it able to create desires as incisive as ours? Where did they arise from, in this universe based on an insensitive reality? In this investigation, human and physical sciences are forced to collaborate. A theory of Everything can only be multidisciplinary.

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1
Prelude to foundation
The double look

It is by exercising a dualism
that our mind deciphers a monistic universe.

In this pre-chapter, a philosophical reflection allows to observe both of us, author / reader, writing / reading this book. To categorize the contents of our thoughts, let's start by defining their different *dimensions*. We have to briefly retrace the path from the original 'I am' to 'I am within something else'. Philosophy is thus defined as the beginning of otherness, the exit from pure solipsism that claims to make us the owner of everything we experience. It directs us towards two great paradigms of thinking: dualism and monism. Then within monism: eliminativism and emergentism. But before making this inventory, let us return to these dimensions which exclusively characterize thought, independently of 'something else', the essence of reality which is not directly accessible to it :

1) *Between imagination and reality*. Despite the existence of an independent real, this dimension is entirely mental: our reality is made up of representations. About the self and the non-self. Each occupying power is declared separate from the other, we will see how. Beginning of an alternation between spirit considering the real and the real considering the spirit. I will call them in this book the Spirit pole and the Real pole. The mind looks for regularities in this chaotic conflict. Structuralism founding scientific knowledge. This creates two additional dimensions:

2) *Between horizontal and vertical thinking*. In the horizontal dimension, the mind studies elements organized together, derives a principle from it and then attempts to extend it. It is the induction / deduction couple, the motor which enlarges the horizontal dimension. Other organized groups form different levels of reality. Vertical thinking is concerned with their relationships, trying to find consistency between their principles. It can do this in two directions:

3) *Between downward and upward approach*. The spirit looks at how the real is constructed (the spirit descends towards the real) or the real (its mental symbolization) indicates to the spirit how it chooses to build itself (the real ascends towards the spirit). The paradigms are opposite. The downward approach imposes laws dictated by the spirit on reality. The upward grants the real the possibility of intention. That is, it has the reasons for its organizational choices, and these choices are not strictly predictable from the initial conditions. Otherwise it would be the same path as that seen by the downward approach, taken in reverse. This is not the case. The downward knows the present outcome, investigating the past. The upward tries to predict the outcome, its future beyond the present. Reductionism versus holism.

4) *Last dimension of thought: its temporality*. Two temporal frames of reference for the mind: within itself and within reality. As for the real itself, does it experience temporality as a special quality in the midst of the dimensions of space, with a single direction? Does the question even make sense?

Let us add to these dimensions translators, which are *languages*. Each horizontal space delimited by thought has its own words. The more we descend to the root of reality, the more the language which connects us to it is stereotyped, apparently inseparable from its essence. This is why some researchers see in mathematics the very essence of reality. But is it not rather the resolution of our discernment that becomes coarse and prevents us from seeing beyond descriptive language?

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The Spirit Pole / Real Pole conflict

The mind cannot leave itself. Even when it represents itself, it represents. Spirit Pole.
What is represented is the Real Pole. Impossible to refuse it, except by pure solipsism ("nothing else exists except my own mind").
Solipsism cannot be formally denigrated. It resists demonstrations of inconsistency. On the other hand, it is possible to dissolve it by showing that it is built on a non-solipsistic foundation.

We host a self / non-self conflict, defined more broadly as the opposition between the Spirit and Real Poles.
The mind of a pure solipsist is entirely subservient to her Spirit Pole, the pure materialist to her Real Pole. Between these two never-before-seen extremes, a multitude of postures define real individuals and their opinions.
The only general theory is that of the conflict between representations, between the individuation of each and the collective of representations.
Spirit / Real positioning is a fundamental characteristic of the conceptual universe of a human being. It produces a specific personality in its relation to reality, from the mystical to the materialistic.
These Poles each have their crucial, irreducible criteria. Let us internalize and resolve their conflict within ourselves, before exerting it against others.
Consciousness is a Spirit / Real fusion. It is enriched in an alternation: by experiencing and analyzing things.

A mind awakens, a world appears to it.

Plato wanted to widen his eyes even more with the help of a cave myth. The man trapped in his cave, lit by candle, surrounded by shadows and uncertain images, can go out and contemplate the stars of ideals. But, dear Plato, *are you not in a new cave*, only larger than the first? Have you not this time, by the severe contingency of ideals, lost the ability to see its limits? You've just designed a self-observation. Did you get out of your mind for all that? Impossible. The removal of the ceiling that you were looking for is to note that it is always possible to add an observation on top of the previous one, by invoking new concepts, by organizing the underlying benchmarks. Because our prisoner, in his cave, already possessed ideals, certainly more crude, but sufficient to manage most aspects of his existence.

The mind cannot leave itself. Even when it represents itself, it *represents*. Its only truth is what it feels, as a spirit. There is only one way of escaping the idea of representation : *pure solipsism.* There would be only my spirit, which then becomes the essence of everything, because no other reality surrounds it.

It is not possible to radically eliminate solipsism. Foerster tempted it with the allegory of the Man with the Bowler Hat. This man imagines himself as integral consciousness, devoid of any environment. He is the only reality. However, he cannot deny that his imagination makes him appear to other people also behaving as thinking, autonomous entities. As they seem similar in every way to himself, he must grant them the privilege of thinking that they too are the only reality. For each of these people, everything else is a product of their imagination, including The Bowler Hat Man. The contradiction is flagrant. It can only be dissolved through the intervention of an independent real world in which all these thinking entities frolic.

Foerster's demonstration is unfortunately false. It is easily disproved by another allegory: the Man with Two Mirrors. Let's take Foerster's (and Magritte's) favorite actor, the Man with the Bowler Hat (Mr Bowler). Let's put him in front of a large mirror. He holds in his hands a smaller mirror, directed towards the first one. Mr. Bowler sees an endless number of mirrors held by Bowlers of decreasing size. The Bowlers appearing similar to himself, he is entitled to imagine that each one holds his small mirror in front of a larger one, and thinks himself at the origin of the series. Maybe he, convinced he is the father Bowler of the series, is just one element in the queue.

In this experiment, Bowler may indeed be the original, genitor of the reality of the infinite suite of Bowlers, conceived from two truly real mirrors, or he may be a Bowler of the suite, equally persuaded to be the original but actually only one of its iterations. *The original does exist*, however. Solipsism remains a valid thinking system.

Valid, however, provided that the mind is not an uniform and orderly environment. Thought is heterogeneous. It comes into conflict with itself. It looks at itself. Here is where the mirrors that we called upon in the previous experiment come in. Cheating that is not if we integrate the mirrors into the solipsistic universe. Two mirrors provide subtly different images of the same thing, at least because they are two spatially separate entities. The two images, independent and yet of the same thing, create a

conflict. Even in the very reductive universe of solipsism, *the engine is conflict*, the fundamental nature of which I will show in this book.

This observation allows us to go beyond the problem of solipsism. Whether we are talking about an external or internal conflict in thought, the opposition is there: there is something in the self that does not want to be reduced to… something else in the self. That one of these actors is called 'reality' can be considered as illusion or convention by the solipsist, but this puts him in front of a problem identical to the realist: there are at least two independent actors in his thought, and one appears strikingly similar in all the 'illusions' of autonomous minds that his universe of thought is capable of forming. Reality does exist in the solipsist, with the only peculiarity that he sees himself as an encompassing whole, instead of being only a part of it. Apart from this sudden swelling of identity, the workings of the universe can be modeled in the same way. The theory of Everything will simply be, for the solipsist, the theory of Himself.

What is more difficult to believe and maintain in the solipsist is that he is necessarily immortal. Indeed, if he is Everything, for what reason would he be subject to the same finitude as the characters inhabiting his thought? What would remain if his end was possible? Nothing ? But the true Everything admits no other concept, no 'nothing' or 'time' outside it, imposing a finitude on it.

Finitude is just one example. In the solipsistic universe there is a host of incomprehensible things. Where would such mysteries arise if the consciousness making them was the origin of everything? We fall back on the idea that there is something foreign to the experienced consciousness. Pure solipsism dissolves.

Is it so necessary to dwell on a philosophy that seems sterile to most of us? Yes, because there is a progressive gradation between pure solipsism and pure materialism, the latter making consciousness a simple epiphenomenon of matter. There are multiple philosophical and scientific postures interspersed between these extremes. Each of them sees problems arise when it emphasizes too much one pole of the spirit-real relationship, neglecting the importance of the other. Take classical empiricism, which

makes experimental confirmation the heart of the truth of things. Knowledge can only be gained through the experience of the five senses, he says. Hand extended from the spirit to the real, which is asked to offer the support of knowledge. But verification by observation is actually very close to solipsism. Knowledge remains the property of a mind fed by sensory data. Its universe is enclosed in this space which, in the light of what science has subsequently discovered, reduces and tampers with its own contents. Classical empiricism is a more courageous position in the face of reality than solipsism. It agrees to give it some power. But hardly.

The eliminatory materialist, on the other hand, discards it completely. He sees intention only in the unchanging march of insensible reality. He exercises his will only as a part of the general process of reality. He could not claim to own it, since there is no real causation from the mind. His intuition generally prevents him from pushing this argument to the point of the inexistence of responsibility, a posture whose disastrous social consequences can be imagined.

The eliminatory materialist is therefore the counterpart of the solipsist. Pure product of the Real pole against pure Spirit. What the materialist eliminates is his own conscious experience, his first person impressions. He treats these feelings, which are more intimate than any other mental representation, as illusions. In the same way that the solipsist is in reality while denigrating his presence, the materialist is in his spirit while denigrating his existence.

Philosophical and scientific postures range between these radical forms of solipsism and materialism. Identity positions, chosen for the way they reconcile our personal assembly of concepts. The scientist, whose consciousness is busy daily around materialist representations, naturally tends to bow to reality. The philosopher, keen on phenomenology, prefers to designate consciousness as the initiator of knowledge. These postures are embedded in the fabric of reality, they are not a description of it. These are *opinions*. The description is limited to showing the bidirectional relationship between spirit and reality. There is indeed an interest in looking at one or the other more closely to understand the exchange. But this interest is contextual. We can in turn summon the solipsist, empiricist, logicist,

materialist vision to specify an aspect of the relation, without making it a theory of the relation. This theory can only come from a synthesis between the fragments of observations. It must be able to include these different postures by organizing them together.

More than a philosophical / scientific paradigm, the posture between the Spirit pole and the Real pole is one of the most striking personality settings for each of us. Towards the Spirit pole and solipsism, the person defines her 'I' as what she is experiencing. 'I' like it or not. 'I' assess, consider. 'I' is the origin. Behind lurks the soul, mystical and mysterious, receptacle of the ego, strong and immanent individualization. Towards the Real pole and materialism, the person defines her 'I' as determined by the environment, a product of the everyday context. 'I' exist but its independence is illusory. It is not the origin, only the remarkably sophisticated shell of a complex mental machinery.

Neither of these two forms is to be banned. Both are constitutive of the true "I", whose balanced synthesis is that which listens in turn to the two discourses: "I experience" and "I am a process".

The dualism of the Spirit / Real poles defended here is a dualism of representation. It has nothing in common with classical Descartian dualism, which declares a gulf between the essence of spirit and that of matter. Our Spirit / Real dipole is combined with a monism of reality. The brain and its productions are perfectly integrated into it. The double gaze corresponds to a separation of our mental images between properties of the mind and reflections of reality.

The interest of this dipole is not purely philosophical or psychological. It is essential to the practice of the hard sciences. A brief example, about time: Boltzmann, after the statement of Theorem H, states that there is no arrow of time but the macroscopic level creates the illusion that there is one. Prigogine flips the argument: there is an arrow of time but the microscopic level creates the illusion that there is not.

It is simply the double look at the same phenomenon. The arrow is inscribed in the Spirit pole, which declares it real, while it is absent from the

microscopic Real pole, made of reversible processes, which declares it illusory.

*

Horizontal and vertical thinking

Horizontal thinking sees reality as a puzzle. Recognize the parts. Assemble them. Understand the reason for their shapes. What is happening around the edges?
Vertical thinking shakes the puzzle box, sees how the pieces have come together, makes other more directed attempts. It collects the solutions, looks for why some are preferred. Then put another box on top of the first one, the elements of which are solutions from the previous puzzles. It starts again. Another level of reality.
Horizontal thinking resolves internal questions, within the framework of its postulates.
Vertical thinking resolves external, transcendent questions.
These two thoughts are complementary. In the absence of the other, each one gets lost easily:
'Vertical' errors: transposing a solution from one problem to another without having analyzed them extensively. Rush to the first available 'reason'. Invent fanciful and unprovable causes. Excessive confidence in intuition.
'Horizontal' errors: use of reliable results for conclusions at a different level of information. Flattening of reality into a single system where the same set of rules are applied.
Example in education: horizontal knowledge is offered extensively to the pupil without checking that it can fit vertically into his existing conceptual hierarchy. This is not assessed individually.

We now have a framework on which to spread thought. At each end of the mental field sits a beacon, on one side the I-Spirit pole, on the other the Real pole. How does this framework influence our thinking? There is no intention in this book to sweep away existing ways of thinking, but rather to watch them do. From a belvedere we will observe ourselves using them, in order to verify their relevance. Dualist, reductionist, complex thoughts, perched on analytical, deductive, systemic, intuitive, holistic, speculative reasoning, etc. Categories seeking to bring together the very wide diversity

of ways in which our consciousnesses apprehend reality. Let us compress these categories again into two main ones, *horizontal* and *vertical* thinkings, because we can affiliate the others with them.

Horizontal thinking is seeing reality as a puzzle. Our understanding constructs concepts which are the pieces of the puzzle. How to assemble them? By looking at each piece of pattern and looking for pieces that complement it. Are some missing? Yes, as long as the image is not fully drawn. Why do the pieces have this shape? Let us enlarge the borders: appear the fine convolutions allowing them to mold to the neighboring pieces. Micro-mechanisms. Horizontal thinking allows us to reconstruct the puzzle, each piece in the right place, its contours delimited with increasing precision. The overall image is a finely cut mosaic. Representation and not essence of what is represented.

Vertical thinking is looking at the box containing the puzzle pieces. Grab it, shake it, open it and see that the pieces form a particular image. Close, shake differently, and see a different picture. Understand what each image represents, why it formed so. Understand the rules of organization of the puzzle, the different solutions it can find to become alternative final representations.

Horizontal thinking is essential for building elementary concepts. Form the pieces of the puzzle. Cutting reality into fragments that can be manipulated because they are structured by their internal rules. Instructions to assemble. A general image is hardly recognizable until horizontal thinking has drawn its border, assembled all its parts, illuminated its corners, increased its resolution.

Vertical thinking is essential for walking through the library of images, saying what you are looking at. It merges the mosaic of the rooms, escapes this grid. The library has many floors, each dedicated to a scientific discipline. Using vertical thinking involves taking the stairs and looking over the shoulders of other researchers. An activity that is not necessarily remarkable or appreciated by your own colleagues, but which stirs the mind…

Horizontal thinking resolves *internal issues*. Faced with a set of interacting elements, it establishes postulates, derives a model, checks its validity through experimentation. It achieves intrinsic coherence.

Vertical thinking resolves *external issues*. It looks at how a horizontal model interacts with other levels of organization, looks for a transcendent principle, or keeps models independent if it cannot find one. It builds an extrinsic coherence.

What in the world are these ways of thinking aimed at? What fundamental principles of reality dialogue with them? Why does reality accept to respond to both of these approaches? Would it be structured the same as the human mind? What separates them? Each mind creates its imaginary universe. Without letting go of the thread connecting it to reality. Stretch it without breaking it, only to better bind, later, this reality. Increase one's power over it. Concepts are our henchmen. An army of trained concepts bends reality.

The Spirit / Real dialogue is continuous and two-way. Fragments of meaning exchanged for bits of organization, intentions born of the signifier exchanged for transformations of the world. There are indeed, in reality, principles that respond to our ways of thinking and make them famous.

The principles responding to horizontal and vertical modes of thinking are the two intricate phases of the self-organizing process, details of which occupy much of this book. In summary :

Connection phase: elements are compared together by properties bringing them together in the same system. Horizontal thinking. The pieces of the puzzle fall into place. The search for an organizational solution occupies them for a variable time. Sometimes so brief that an observer thinks he is witnessing an instantaneous reaction. Sometimes so long that the organization seems impractical; the observer speaks of disorder, chaos. When a stable solution is found, the system acquires new properties. Skills

surimposed[1] on the properties of the elements themselves. The elements always behave like individualities, taken in isolation, but they also have a precise function in the whole. Information has been added to them as part of the whole. This collected information represents a new level of information, an additional essence of reality. The image of reality acquires a surimposed level of meaning. Source of vertical thinking.

The errors of hasty vertical thinking are the prerogative of the layman and his too short "horizontally" knowledge of the world (supported by too few criteria and experiments). Please note that this remark is not intended to separate the candid and the learned. We are both, depending on the topic. Every brain is constantly computing. If one bathes in a difficult social environment and the other in a laboratory, the first increases his horizontal knowledge of human relations (which is not only sleeping with the other sex!), the second clears the horizontal extent of the systems it analyzes.

The characteristic 'vertical' error is to transpose the solution from one problem to another, without going through the horizontal stage, which makes it possible to identify the elements of the system, to aggregate the criteria intervening in their relations, to trace the context, finally build the model from which the solution came. Vertical thinking willingly strips this solution of its clothes to make it a disembodied principle and apply it elsewhere, dispensing with a careful comparison between elsewhere and the origin.

This facility shortens investigations about the causes. The first reason is the correct one. It influences behavior even before it has been verified. The popularity of the most famous patterns is translated into fantasy universes. We believe in the reality of our own imagination. There are Heaven and Hell which function like human societies.

Intuition is vertical thinking. It operates with varying success. It all depends on the criteria aggregated by this rapid assessment within the

[1] *Surimposition*: one piece of information is surimposed on another when it cannot exist without the first, but has relative independence (it is not contained in the first).

conceptual stages hidden in the unconscious. The quality of these horizontal representations makes that of the resulting intuitive thinking.

The deviations of exclusive horizontal thinking lie in wait for the scientist, who remarkably develops and refines the model of a system, succeeding in solving all its internal questions. The discourse narrows around this unique paradigm and dares to provide vertical conclusions, without having resolved the external questions. This is the root of most of the tricky manipulation of data in science. Many studies make false projections from correct internal data.

Take one of these high profile cases. Context: the 2012 US presidential campaign. Faced with a weak female vote in his favor, Mitt Romney proclaims that the Obama administration has made times hard for women: they account for 92.3% of the jobs lost during Obama era. The figure is rigorously correct. Between January 2009 and March 2012, 740,000 American jobs disappeared, of which 683,000 concerned women. 92.3%. What really happened to the US labor market during this time? A recession took place from January 2009 to February 2010, taking a tribe of 2,971,000 male jobs, 1,546,000 female. From February 2010 to March 2012, the recovery gives 2,714,000 jobs to men, 863,000 to women. In fact, men were twice as likely to lose their jobs during the period, but more to get it back. How then to judge Romney's proclamation? Tendentious, we should say temperately. The Washington Post declared it "right but wrong," sparking jeers from Republicans. This prevarication are commensurate with the disorientation caused by being locked into horizontal thinking.

Whereas vertical thinking immediately separates the two levels of information mistakenly amalgamated. One is right, the other wrong. The 92.3% figure is correct, not the "Obama administration penalizing women" interpretation which must incorporate the larger data we have reported. In the horizontal level all these figures are correct, but their organization in order to create a level of analysis "situation of women vs men" implies not to forget any. The verticality of the solution is only correct if it is surimposed on the whole of the horizontal level.

Let's jump into a completely different area: education. The hegemonism of horizontal thinking also triggers perverse effects. In a course, a student is exposed to the entire horizontal content of a new topic, long before showing him how to fit it vertically within his existing conceptual hierarchy. Stage often absent even. It implies a personalization of teaching incompatible with the timetables. Missing plans would appear in the minds of many students. Problem at the root of school failure. The student gets tired of accumulating the horizontal ramifications of the concept being studied. He does not know where to place it in his pyramid. The program is for him a juxtaposition of knowledge. Force-feeding. He must memorize the arrangement of the pieces of the puzzle. We leave it to his initiative to straighten out this knowledge vertically, to grasp why such and such a part goes to such and such a place.

In defense, the ability to verticalize knowledge is much less easy to assess than horizontal memorization. Student consistency cannot be quantified like the simple transcription of data. It is qualitative and each assessment must adapt to the conceptual level involved… and to the student. School tests celebrate horizontal logic, which is not the only glue for the mind. The vertical, more fuzzy logic of intuition, along with empathetic intelligence, often dramatically increases results. But we won't have room here to develop all of these ways of thinking.

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Downward and upward looks

In the horizontal dimension of thinking, two directions: deductive and inductive. *Deduction* extends a central concept to related elements. *Induction* seeks the central concept in the related elements.
In the vertical dimension, the mind straddling the real, two directions: downward and upward. *Downward* (or representative): what is the appearance hidden under the appearance? *Upward* (or constitutive): how do things come together to form these appearances?
The downward look is close to the *epistemic* in classical philosophy (the mind looks at the real); the upward to the *ontological* (the real 'looks at the mind). Difference: for ontology, it is the real in itself that speaks; for the upward look this is its representation. Internal dialogue in mind.

Like horizontal and vertical thinking, the two looks are complementary. It is important to recognize in which thinking and in which look the speeches which you hear are situated.

Having defined the dimensions of our thinkings, let's now talk about their directions. Without exhausting your patience! These approaches are essential to understand the deep originality of the book. If we seek to integrate the mind into reality, we will inevitably find in its modes mimicry of the processes used by the rest of the real. This pre-chapter clears up the subject. We will come back to this after studying the layered organization of the mind.

How do we move in the dimensions of thinking? In the horizontal dimension there are two directions: *deductive* and *inductive*. Deduction consists in extending a central concept to the elements in relation. Induction seeks in the related elements to return to the central concept. This torque increases the range of a model while maintaining its consistency. It also brings height to this horizontal vision by creating… the model, located above its elements.

The vertical dimension of thinking considers the organization of reality, from its micromechanisms to the constitution of the mind itself, with its Real / Spirit poles. Vertical thinking can thus take two directions: downward and upward.
Downward look: how are the elements organized in their existing appearance? The Spirit looks at the weaving of its structure, unties the threads, spreads them out, unties the strands, calls all the fragments "Real" without knowing where it stops.
Upward look: how will the elements fit together in their future organization? Spirit tries to experience itself as the Real and wonders what its organizational choices are, without assuming that it will come to something like spirit.

Let us test with a simple example the interest of this double look. We want to know what the effect of repeatedly throwing a die will be. For the upward look this is a deterministic process. Each throw has an outcome determined by the physical parameters involved. However, the repetition

of the throws with different parameters means that each side of the dice will come out a near number of times. For the downward look it is a set of probabilities. Each face has a probability of 1/6; the number of takedowns for each face is the total number of throws divided by 6.

The two views, that of determinism and that of probability, describe the same phenomenon. Yet they don't say the same thing. It is almost impossible, from a large number of throws, that the result obtained (the realization of the deterministic process) is exactly that predicted (the realization of the probability). The physical reality has not conformed to the probability. The upward look refuses to conclude like the downward. Why then, when there is no error in the probability calculation? We must conclude, as we will discuss again, that the representations of the two looks are always approximations. The certainties are fictitious and belong exclusively to them.

In philosophy the downward look relies on *epistemology* (the mind looks at its own ways with reality), upward on *ontology* (reality comes to mind). I will use these classic terms but keep 'downward' and 'upward' for the following reasons: the philosophical terms are attached to a dualism: epistemic world on the one hand (the mind conceives reality), ontological world on the other (reality exists independently of the mind). This dualism is not itself inscribed in any ontology of reality. It is artificial, property of the mind. Yet the mind is included in reality, we postulate in the absence of another continuum that has demonstrated its existence. Epistemology is structured from mimicry of reality. It adds its own organization to reality, without being separated from it. What exists for sure is the two-way relationship, which we are defining.

Because of the dualistic heritage, ‘epistemic’ and ‘ontological’ are not exactly synonymous with ‘downward’ and ‘upward’. There is an insurmountable gap between the first two, and on the contrary an organizational continuity which traces a common path for the second. To tell the truth, the downward/upward couple is not satisfactory either for our presentation because it creates confusion, depending on the starting point chosen: the materialist starts from the Real pole, the phenomenist

from the Spirit pole. By convention when I use 'downward/upward' consider Spirit above, Real below.

In order to avoid any hassle, I initially considered replacing 'downward/upward' with *katephoric* (from the Greek katēphoriká, κατηφορικα, "descent") and *anephoric* (from the Greek anēphoriká, ανηφορικα, "ascent"). If used, these terms will be accompanied by their synonyms in the book, as I fear my modest authority will not allow them to survive apart from it.

These semantic considerations are boring but essential. Many fruitless quarrels, including among high-level academics, arise from confusion over the modes I have just described, which can reverse the meaning of a sentence.

The current controversies, however, arise more from the exclusive use of a single direction in thinking. It is sometimes so deep in the identity that the protagonists cannot observe each other in this exclusivity. Steven Weinberg was a cartoonish example of an elective top-down / reductionist approach when he opposed Anderson on emergence. He asserted that by repeating the "why?" One always arrives at the microscopic, so that the latter is hierarchically superior to the macroscopic. Weinberg did not realize that by repeating the "what becomes of?" we also regularly arrive at the macroscopic, and that this organization can be considered as hierarchically superior when the mind manipulates matter towards a destiny that it would not have spontaneously followed.

A little mnemonic advice, in the end, to remember my neologisms:
Downward approach, spirit > real = *katephoric* (memo: *categorical*, reductionist).
Upward approach, real > spirit = *anephoric* (memo: make *an effort*, think complex).

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Time of thought and timeless reality

Thought ***is*** its unfolding. One-way. What to do with a temporal dimension of thought, if its direction is constant?
This time is specific to each consciousness. The conscious frame of reference is both spatial and temporal. Perception *offers* a common spatial framework. Whereas consciousness *defines* its time frame, and expands it by its *predictions*.
It is possible that reality is *timeless* outside of our consciousness.

There is one last dimension of thinking that we need to talk about. Concealed. Occulted because we cannot imagine a possible thought in its absence. This is the *time* of thinking. No direction to specify. Only one possible. In fact, thought *is*, in essence, its unfolding. Constitutive but subjective time, that is to say specific to each consciousness. We must therefore deploy this dimension to escape solipsism, the solitary time of our own consciousness. Especially since it is possible to conceive of a timeless reality outside of it.

Where does the feeling of walking in the same present, shared by human beings come from? It is based, science tells us, on a common inertial frame of reference (the Earth) and on the neighboring operating speeds of our brains. The present, and the liveliness of time, are illusions. Science is not alone in affirming this. We experience it in full awareness under the pressure of events and as we age. One hectic day disappears in a flash, another routine goes on forever. The years are endless for the young brain; they stream like the wagons of an express for the mature brain. In a conversation, you have to slow down for some to follow you; others interrupt you quickly because they finished your sentence before you. These subjective time differences are modest but very real.

The inertial frame of reference has even more astonishing effects, explains Einsteinian relativity. Compare our present with that of a valiant explorer we teleported to the distant planet Omega. If the distance between Earth and Omega does not vary, that is, the two planets move together, the explorer's present and ours coincide. If Omega is rapidly moving away from Earth, the Explorer's present corresponds to our past, especially as

Omega is distant and its flight speed is great. As Omega draws closer to Earth, the explorer's present is our future. There is simultaneity, in this universe, only for objects moving in the same inertial framework.

It’s impossible for our brains to escape the present. Is it the same for the whole of reality? Can our minds be a process lead us to conclude that reality is one? Anthropic and hasty. Reality can be described, in the most economical way possible, as a juxtaposition of states. It is not obligatory to add a direction to it, the arrow of time, except when the process which observes it cannot be freed from it. Then this arrow is the property of the observer (the mind) and not certainly of reality.

This thrifty vision shows reality as a four dimensional world, including time. The present of each included entity is a 'section plane' (with 3 spatial dimensions) oriented in time according to the inertial framework specific to the entity, and moving at the speed of the 'mind' process of this entity, within of an immobile Whole, made up of all the juxtaposed states. A vision already immortalized by the Nornes tapestry in Norse mythology, which lends these deities great powers: indeed the weavers need to extricate themselves from our temporal dimension to carry out their work. In what orthogonal time? Mythologies temporarily displace mysteries out of the reach of our ingenuous ‘why?’. Physics is content to point out its ignorance. What matters to us in this review of modes of thinking is to clearly distinguish on the one hand the time of consciousness, strictly personal but shareable with our fellows, and on the other hand the timeless reality by default, which potentially encompasses our subjective time. and does not care.

The time being a major subject to structure our Real pole, we will decipher it in detail later, in our investigation on physics. It is at the heart of *Surimposium*, a self-organized conception of reality, as a characteristic specific to each of its levels. This implantation allows us to understand why our subjective times differ: each mind is a specific pyramid of neural organizations. We're going to talk a lot about layering in this book, and the next one you need to know is about languages.

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A language for each level of reality

Language is the common translator of a neural code specific to each conceptual organization in the mind.
Its hierarchy is flattened in practice. Phrases and texts mix words from different levels of organization.
The hierarchy is evident during its construction, during learning and then when it is necessary to reorganize poorly constructed concepts.
A fundamental word is fossilized under the layers of information built upon it. Its contrasting meanings in people's minds become difficult to reconcile. Example: 'belief' in a theist versus an atheist.
Each conceptual level owns its words. Their meaning is an entanglement of the underlying levels. Differences in meaning frequently make them unfit for communication. *Communicating is already a conflict*.
The stratification of language extends to that of matter. Codes based on energy or organization levels. There is not one but several mathematics.
Mathematics is simple for conforming objects, complicated only to transpose into spoken languages, which are dedicated to human and social organizations.
Within the mind itself exist languages incomprehensible to consciousness, such as the reflex of catching a ball in flight.
Even when a language anchored in a level of reality is difficult to appropriate, it must *be named*, so as not to assimilate it to another which is easier.
No language connects all the others, including within mathematics.
Such a *metalanguage*, if found, is the key to a general theory of reality that includes us.

Languages are translators. Brains, each building the specific neural code of a unique mind, could not exchange without languages. This omnipresence of language sometimes makes it confused with thought, especially since words embrace conceptual stratification: there are some for the roots of thought (order, causality, time, etc.) and others for highly differentiated entities (object names, proper names…) but we mix them up in linear sentences. Their hierarchy is then flattened into a vast protean system: everyday language. Mischief of exclusive horizontal vision. The hierarchy is however apparent to us. First, because we patiently build it, during our learning, by forming new concepts from the previous ones. Then if a

concept turns out to be poor or wrong, you have to go back, take back its components and find a better way to put them together. This progression is not only temporal; it takes place *in the organizational dimension*, vertically.

In vertical vision there are terms belonging to each conceptual stage. In general they carry the same meaning, from one mind to another, when they concern very differentiated entities: an apple, a car, a celebrity… While a term belonging to the base of the hierarchy of language can have a very different meaning depending on the concepts built on it. 'Time', for example, does not have the same meaning in the mind of a child, a physicist or a philosopher. 'Belief' equals 'truth' to the theist, but 'imposture' to the atheist.

Moving on to vertical vision, let's apply our double look. Certain terms, almost synonymous with a simple glance, then take on their full meaning. For example 'principle' and 'concept'. They both relate to the same realization of the mind as seen by two different operations. The 'principle' is the upward operation, the *way of organizing* things. The 'concept' is downward, a *representation applied* to something organized in this way.

There is a specific language at each conceptual level, and many common words are an entanglement of different levels according to the interlocutors. What makes these words in reality unsuitable for communication. A surprising number of interpersonal conflicts and mutual misunderstandings arise from this simple observation. There are language neuroses. *Communicating is already a conflict*.

The stratification of language is in part mimetic of that of matter. Quantum excitations assembled into subatomic particles then into atoms, molecules, etc. Each level corresponds to a scientific discipline and its specific language. The further down the scale of micromechanisms, the more compelling mathematical formulations. It is indeed "the" mathematics and not a single language. The branches used differ according to the energy levels involved. They are based on sometimes contrary assumptions, as if 'white' in one mathematical language meant 'black' in another. Pluralistic universe.

We will deepen the subject of mathematics in a next chapter, but affirm now that contrary to appearances they are simple languages. Hearing that « nobody really understands the fundamentals of quantum mechanics » is a trick. The equations are rigorous and consistent. What is difficult is to take them into the unknown and bend them so that they stick to reality. Because we are not asking them simply to name the unknown (which we do by applying a new word to a recently invented object) but to give birth to the observable, to predict its behavior. The mathematical object must be faithful to what has not yet been observed.

Mathematics appears complicated when it is necessary to integrate it into common languages. A priori futile task since few things in our usual communication really correspond to them. Mathematical objects are not observable. The 'manifest time' of the mind has nothing to do with the time of physics. The correspondences that we can find between equations and everyday language are masks, often mediocre. The graphics seem to be the best point of contact.

Without correspondences, languages are incomprehensible to each other, and this even within our minds. For example, try to understand how your body catches a ball on the fly. Isn't it amazing that your brain calculates so quickly the parameters of movement involved and manages to coordinate an effective gesture? Your consciousness is integrated into the action and at the same time it is contemplative: the reflex is at your service. You would be hard pressed to reproduce the calculations *consciously*. It takes sophisticated machines and programs to do it.

The neural code called in the reflex is however perfectly *natural* to your mind. It is only if the consciousness seeks to transpose it into its own mental code that the difficulty arises. The same is true for mathematical languages: they are 'natural' for the levels of reality they describe. There is no other *realistic* way to describe them. Attempting analogies in everyday language truncates the description, or even makes it erroneous. You will remember this when I do, like most authors. By proceeding in this way I simplify the description of things for you, but from their point of view I make it *more difficult*. As if I were placing a garment on their nudity, but

these mechanisms do not know what a garment is or what it is used for. Do not be surprised if the garment is foreign to their identity.

Knowing the name of the language usually allows us to know what strangeness we are talking about. Above all, you have to be able to situate yourself. For example, it is a Hamiltonian who describes the ballet of subatomic particles, or a Lagrangian who focuses on classical mechanics. It is not necessary to know the detail of the equations, unless you want to *experience* yourself like these particles, and then the detail will bring you closer to that perception. Very few equations await you in this book. I am neither a mathematician nor a physicist; it is only a matter of integrating these disciplines with the rest of the observable. No language currently allows the levels of reality to be linked together, nor mathematics any more than the others. This deficiency explains the neologisms that I am going to use.

A metalanguage is the key to a general theory of reality.

Now equipped with a few tools to appreciate the ways of thinking, let's review the most popular…

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Classical ways of thinking and *surimposition*

Classical ways of thinking: dualism, reductionism, emergentism, evolving into complex pragmatic thinking. At the end: *surimposition*.
Dualism is the easy mode: unexplained phenomena are placed in a place independent of reality. Their mystery is managed, protected.
Reductionism uses considerable means. Impressive machines for dividing reality down to its building blocks. But by adding the bricks according to their own rules, the diversity of the results is infinite and the probability of ending up at our universe tiny.
Classical emergentism failed by trying to introduce configurational forces incompatible with the principle of exclusive ontological causality.
Contemporary emergentism, or complex thinking, provides what reductionism lacks. The universe is getting organized.

But it does not solve the dualistic problem. The gap between information and conscious experience persists. Something is missing…
… that this *Surimposium* will give you?

The Whole. Our attention is a zoom with variable focal length. We can focus it on a fragment of reality or expand it. How far ? Few venture to really think about the totality of things. We inevitably forget. How could it all fit in a brain? You squeeze it in a drawer-concept, in a single word, like 'totality'. The tote, should I say. It's easy to come together around a tiny fragment of reality and have the same talk about it. The focal length is so high that the fragment seems to us a point, a photon, a quantum excitation. While by widening the field to the totality, we aggregate a set of things that is very personal to us. Each has its own representation of *Everything*. Isn't our work very pretentious in seeking to federate these visions? What saves it is the existence of mimicry. Our visions are borrowed from our fellows, from all ancient humanity through the books they left behind. These mimicry allow us to categorize visions of Everything, keeping in mind that no two are alike. Let us differentiate the main categories, which are very unequally represented, then we will show how each tells the origin and evolution of the knowable.

1) *Dualism*: this category alone unites undoubtedly more than 99% of contemporary minds, if we use the term in the broad sense: dualism opposes two irreducible principles. Regarding the Everything, it separates spirit and matter. Depending on how the division is placed we have *two major dualisms*: That of religions is the most widespread. It postulates an invisible spiritual universe (most of the time) paired with the material universe. That of the philosophers makes reality a phenomenon entirely constructed by our perceptions and our instruments, while its essence is inaccessible.

Dualisms spirit/matter and appearance/essence. As for scientists, most claim to be monists but in fact practice a hidden dualism: they do not include their own mind in the theories. These stand alone on the stage, validated behind the scenes by the paradigm of scientificity. The mind is

reduced to a mathematical tool in a Popperian framework. No reference to how it came to be like this (yet it came from an evolution).

The angle of analysis that best separates these dualisms is undoubtedly their concern to understand the relationship between the two irreducible principles they describe. The religious is happy to be satisfied with the mystery connecting the spiritual and the material, which makes it possible to protect her beliefs in the invisible. The philosopher strives to decipher the appearance/essence relationship knowing that the second is inaccessible. The scientist considers that everything is ultimately understandable. The way of thinking is above all a way of power.

Dualism is a simple method of grasping the Everything: on the one hand what can fit in a homogeneous and coherent understanding (knowledge), on the other what escapes it. In this elsewhere float different metaphysical bubbles specific to each variety of dualism: deities, souls, consciousnesses, essences, mathematical objects, various holisms… The success of dualism has never wavered thanks to this ability to maintain a space of safeguard for any belief. It thus protects the original identity of our mind.

The other categories are monisms, with one caveat: none manages to completely get rid of the idea of a real substance definitively inaccessible to our understanding:

2) *Reductionism* is in principle simpler than dualism. Everything comes from micro-mechanisms. But our limited calculation capacities prevent us from understanding the Whole and predicting it. The Universe is a machine busy calculating itself. We are one of its results and we assist the others. Reductionists do not use this belief on a daily basis. They do not calculate themselves. They use empirical behaviors like the others, but think that these actions come directly from micromechanisms, without it being yet possible to establish the sequence. Historically this is a rejection of religious dualism. The rejection of esoteric beliefs makes any form of metaphysics look skeptically. Yet, as we will discuss later, the mental sleight of hand is similar: the incalculability of the real plays the same role for the reductionist as the enigmatic purpose of God for the theist.

3) *Emergentism* is a mode built on the shortcomings of reductionism. It struggled to… emerge. It forces us to reconsider causality. But causality is not a *way of* change. It *is* change. Tyrant indestructible in any transformation. At the beginning of the last century, classical emergentism wanted to double it by introducing 'configurational' forces specific to chemistry, biology, etc. It was buried in the trash cans of knowledge by the discovery of the quantum foundations of matter.

Contemporary complex thinking has reconstructed a new emergentism that better reconciles reductionism by keeping a very ontological and computational vision of reality and its imperturbable processes. Complex thinking refuses dualism ; nevertheless in systemic the *function* suddenly appears, which separates the simply relational systems from the functional ones, then without warning, the *intention* of the living. Embarrassing ditches for a monism. Intention is evidently reinforced between a simple cybernetic loop and human consciousness. Addition of information, which complex thinking takes into account, but I will criticize its overly simplistic tools such as logical depth.

Reducing something to a quantity of information obliterates that it has qualities foreign to each other. The essence of a thing is not defined by quantifying the information it contains. Complex thinking sees reality as a set of interactions, yet their nature varies and this specificity cannot be included in a variable. A still reductionist posture in its desire to lock up notions such as morality, emotion or free will in a barracks where computational micro-soldiers transmute them into information and calculate their depth. Number printed on the can at the end of the line. Didn't we lose something essential in the process? The pure computational approach is denigrated by the mere existence of consciousness, not as a process reducible to its physical mechanisms, which is doable, but as an *experienced fusion*. The uniqueness of this impression is not translatable in terms of information.

4) *The particular monism that I will defend in this book is that of surimposition*. It recognizes the diversity of information present in reality. It frankly rejects eliminatory reductionism (eliminativism) including in its masked form which consists in transposing a paradigm of the fundamental sciences

directly to complex objects. It gives reason to the philosophers who refuse to confuse *explicandum* and *explicans*, the phenomenon and its explanation. Dualism is not eliminated from it; however, it is so finely sliced that it becomes invisible. Among contemporary complex thinkings, that of *Surimposium* has the following originality: for it a stable level of organization is a representative fusion of the information that forms it. This fusion is the essence of this level of reality. The substance is made from an addition of these stacked essences. Hypotheses are made about what motivates the relationships between the different qualities of information and not about their forms. Consciousness fits perfectly into this pattern since it is the surimposition of successive organizations of information. Consciousness is a unique sensation whose informational field is variable. The purpose of this book is to detail and justify these somewhat cryptic statements.

Let us now see how each of these attitudes cope with the delicate problem of the history of the universe. Each tells it in its own way, but what interests us in particular is whether a 'why?' is added to the 'how?'.

Dualism has the easiest task. By placing the mysteries and their explanations in an inaccessible place, all theories are possible. A few clusters of facts suffice. Theory cannot be subjected to experimentation. Yet even the great religions affirm it: the reality of existence is won by trial. No trial, no proof, only beliefs and bets.

Reductionism seizes upon considerable means to make the task also easy: it determines fundamental laws and a linear causality to infer them all the processes of reality. These follow a military and predictable march. If the universe is like that today, it couldn't be otherwise. The slightest deviation would have made today's world different. When the existence of the human is regarded as a finality, it is only possible thanks to the miraculous conjunction of a series of very necessary cosmic factors. Anthropocentrism that perverts pure reductionism. Involvement of a dictatorial downward look in addition to the upward look. Instead of being self-justified, our universe becomes so ineffective at explaining our presence that it encourages us to create a multiverse to take it out of statistical nothingness.

Reductionist theories are enough to make the multiverse possible, but *making the human probable* is what makes it so popular.

Contemporary emergentism is pragmatic and ambitious. Without refusing the dissections of reductionism, it adds its reconstructions. The universe becomes a huge information factory. So much so that we can find in it those relating to consciousness, in the incompleteness of the "initial conditions". But the dualistic divide has not really been crossed. How do we go from numerical values to experiencing this information? To say that consciousness is a subjective phenomenon of active neural networks is not convincing. Because subjectivity has no more informational definition than consciousness. Term born of dualism and that complex thought cannot use if it wants to reintegrate consciousness into physical reality.

Surimposium finally seeks to get rid of all these obstacles. Indeed, what may be the point of changing your usual way of thinking for the one proposed in this prelude? Originality is not a sufficient reason. Does it have practical consequences? They will scroll through this book, with one thing in common: our vertical thinking dissolves every dispute between philosophers and scientists on the relations of the mind and the rest of reality. Take, for example, the old debate between representationalism and anti-representationalism:

Scientists readily replace the term ‘epistemic’ with ‘cognitive’, which refers to neural processes and sits on the right side of the mind-matter divide, along with other subjects of science. There is a controversy over cognition: is it based on mirror representations of reality (representationalism) or is it the adaptive form of a coding agent interacting with the environment (anti-representationalism)?

In the way of thinking that I urge you to adopt, it is exactly the same. Only the direction of thought changes. The starting point is the representation, or the interacting events. The phenomenon looked at is one. All phenomena can be viewed thus in two ways, through the Spirit pole or the Real, and are one in reality. It includes the processes of the mind itself, which is not outside of this reality.

I still have a small place in this prelude to launch the heart of *Surimposium*. I compress the gist of the book here, and the number of unusual statements makes this passage indigestible for those who do not already have eclectic knowledge. Do not be discouraged ; everything will be taken up in detail and justified in a more conventional manner later.

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Stage for *Surimposium*

Multiple laws create more questions than they solve. Let us seek an elementary engine which weaves reality.
In reaction to animism, historical science stripped matter of all intention, thus locking the investigation about the birth of our own.
Intention begins in representation, that is, information that organizes other information. Credible alternative to mind / matter dualism. The stacking of representations creates one on top of the other.
Reality thus becomes a sum of surimposed meanings. Installed in this reality as a representative process, our mind analyzes them independently, by its own surimposed representations. It experiences their fusion. Simplifying reason and synthetic personal experience.
Astonishing paradox: how do layers of independent meanings form a merged reality? This book tries to explain it.
The reality is as it is observed... from one floor in particular. Reality divided in the dimension of its organization. It remains to unify its general structure.
If the 'Whole' is inaccessible to our understanding, there is no need to postulate about it. Trap for too precise and anthropocentric theories.
Knowledge enables a theory of the *observable Whole*, constantly expanding.
If it is a chain of links linked by a unified principle, it is reasonable to think that it continues beyond its current limits by the same principle, without prejudging its past or future forms.
The complexity of an object is redefined as the height of its surimposed meanings.
When the fate of a system seems random to us, it is because we do not know the underlying organization.
When the development of a system seems surprising to us despite the knowledge of the initial conditions and relations, it is because there are levels of organization hidden from our understanding (example: the 'hard'

problem of consciousness indicates a great number of levels of organization between neurons and consciousness).

When we observe reality, we think it obeys rules. Anthropic idea. Does it *obey*, or does it *make* its rules? If it obeys, to whom, to what? What is behind the precise accounting of 'laws'? If it is made on its own, what principle drives it? On the ontological level, the framework of laws is more mysterious than that of self-organization. Searching for a unifying theory for a patchwork of fixed laws and universal constants devoid of obvious fabric, is a task perhaps insurmountable, without certainty of being able to go back to the origin. To suppose that an elementary principle has set about weaving reality, a never-ending rhythm, detectable at any point in its history, is more verifiable. This is the path we are going to take.

The human mind is not trained to look for intentions different from its own. Our ancestors, hearing the celestial din and seeking their origin, invented a God of Thunder. The context suited it. The first humans evolved in a dynamic world, where other species jostled, also full of intentions, often aggressive. It was not an *inert* world. That something was *in motion* was more important than defining it alive. Everything seemed to have a purpose, and those objectives frequently clashed. So it was reasonable to inquire about the intentions of lightning, fire, or even a boulder rolling down the slope.

Gradually it appeared that our human intentions made little sense to much of reality. The Gods did not show themselves, seem indifferent to our worries. Another way of looking at it became popular: the animate has no purpose, no desire. It stupidly obeys laws. Science was born. Living decided separate from the non-living without will. Today, when this border has become difficult to discern, should we keep the dualism of an intentional reality on the one hand, and a mechanical one on the other? Is it not rather a question of sophistication between intentions? Are not ours just highly complex?

I am not preparing you for any *thinking matter* mysticism. The pebble rolling under your shoe didn't "decide" to knock you down. Even though

everyday objects sometimes seem reluctant, obnoxious and sneering, in fact it's their lack of intelligence that annoys us. Frustration that the trend for connected objects hopes to diminish.

But these mechanical sidekicks only reflect a few aspects of the logic of their creators. They didn't get smart on their own. So how do you see the spontaneous start of an intention in a rock? Where to detect the origin of consciousness, if not as a force present from the birth of the universe, as some people believe? The answer that I will support is simple: the intention starts in the representation, that is to say in the appearance of information which symbolizes others, is surimposed on them. Foundation of complexity. A representation, in reality, is never entirely passive. It is information in its own right, susceptible to interaction. It has stability, has a feedback effect on the elements it organizes. Human consciousness, as we shall see, arises from a considerable surimposition of these layers of representations, adding to their complexity.

Look around you. What are you observing? Do you see quarks, atoms, molecules? From an ontological point of view, they are indeed the support of reality. Yet would a unified theory of fundamental physics, the Grail of physicists, be enough to explain our environment? Consider a man paying for his purchases with a credit card. Each of his gestures could be described by the equations determining the motion of his elementary particles. Yet even if we had the tremendous computing power to model its behavior, we would not have the slightest embryonic explanation to give it in the paradigms of the microcosm. Obviously, the reality we observe is made up of entangled meanings (in this book we will say them surimposed). Levels of information that pile on top of the simple movement of elementary particles.

A general theory of reality must be rooted in something universal. What is it that brings together all of them today, from philosophers to scientists, to theists? What? What can there be in common with these people whom their visions radically oppose? Two things ; on the one hand, all have a mind, based on the same processes. On the other hand, structuralism is omnipresent and has buried the Newtonian vision of immutable matter,

guardian of reality, assisted by its impassive laws. New universal slogan: *The world is not what it is by substance, but by what is observed*.

By formalizing the manners of each: The scientist observes a multiverse of mathematical information. The philosopher observes the productive nothingness (which is not *nothing*). Finally the theist observes God, and submits to His observation. Note that the theist ultimately does not add so many beliefs, other than the fact that we too are *Observed* :-)

Everything is reduced to a universe of information, which is indeed the domain of the mind. Computation joins spiritualism. The substance becomes optional. The reality is as observed rather than native. Triumph of the Real pole over an essence of reality impossible to grasp. And this is where *Surimposium* makes a further paradigm shift: Observation is not univocal, but organized in successive levels of meaning. *Reality appears as viewed… from one level in particular*. Its appearances change depending on whether the instrument of 'vision' is a particle accelerator, a thermometer, a paleontologist's shovel, a human eye, an algorithm, a sublimated ideal… All these ways of seeing are not balls placed by chance in a basket, but an organization whose structure must be found. The observed reality is divided into the dimension of its organization.

This division and the surimpositions it entails *thickens* the tenor of reality. If we do not see substance in the micromechanisms, it appears in their successive organizations. The gap between pure information and substance is gradually blurring. It is possible that the root of the real is made of pure mathematical objects, but what they produce is a substance of increasing density, the "density" here being the multiplication of surimpositions. From the perspective of this astonishing speculation, consciousness would be the most substantial phenomenon of reality. Paradoxical for something so fleeting and elusive…

Whatever the finesse of our instruments, our Observation of reality only reveals a certain number of floors, without prejudging those who support and overhang them (will overhang them?). The only thing we can be sure of: *there are* floors. Discontinuities. What determines them? Is there a common principle, not to their content and laws, but to the processes of

transition? This is what this book attempts to demonstrate. So if we cannot grasp the essence of reality or its limits, at least we can feel its framework. Blind people chasing a dinosaur skeleton on an excavation field!

Theories of Everything are holistic, or integral, that is, see a unity in diversity, in the pooling of individual differences. Unity in diversity? Paradoxical, at first glance. And yet we have an example in front of us: the world *works*. What interests us is precisely how unity and diversity interact. How are they intertwined, and especially how do they manage to reinforce each other, when they are pure opposites? Cold War ? Rather eternal oscillation, as we will see: each outcome of a confrontation systematically strengthens the loser.

We will try to avoid the trap into which most theorists of reality have fallen: to consider the Whole as inaccessible to human consciousness and nevertheless to serve fundamental ideas about it. How did the author's mind take hold of this wholeness? How did this incomprehensible thing produce the author? Anthropocentric approaches. The basic hidden postulate is Cartesian: "I am here". Good starting point. However, in a theory of everything, we cannot give it the advantage over "Something else is there". We must bring the two positions into dialogue. Thus stretching our stature over the unassuming reality beyond.

Theory of the Observable Everything. Baudruche expanding, at a speed that we expect will exceed that of the universe, in the hope of catching up! Certainly it lends itself to Gödel's incompleteness theorem and circularity. However, the accumulation of experiments explained within its framework brings it exponentially closer to universality. If all the paradigms are woven together, which party will remain to judge them from the outside and agree with Gödel?

See a theory of the Observable Everything as a chain, each link in reality linked to the next according to a reproducible principle. When the chain disappears into the unknown, beyond the reach of our experimentation, it is reasonable to think that the invisible links continue to link up with the common principle, which remains of our knowledge. So here is the program of *Surimposium*: understanding the dialogue between spirit and

reality, deciphering it until you find its skeleton, then imagine how this spine continues, beyond the head and the hindquarters.

A word about complexity, which we will talk about extensively in this book. Will it make it even more indigestible? No. Paradoxically, it simplifies our life, if we redefine it this way: the complexity of a system is neither the astronomical number of its elements nor the variety of criteria to which it is subject. This is the height of its surimposed organizational levels. Which immediately provides valuable practical guides:
1) When the future of a system seems unpredictable/random to us, it is because we do not know its underlying organization (NB: chaos is not random).
2) When the fate of a system seems surprising to us despite knowing its origin and its mechanisms (including cellular automata), it is because there are hidden levels of organization.
Equipped with these two guides, we can for example assume, about famous mysteries:
a) That the vagaries of the quantum vacuum show that it is an organized system.
b) That the 'hard' problem of consciousness shows that there are a large number of levels of organization between neurons and consciousness.

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Synthesis

What did we learn from this chapter? The classic ways of thinking each have their advantages and disadvantages. None correctly addresses the problem of the mind / matter divide experienced in every consciousness. Dualism just evacuates the mystery into a hypothetical continuum. Monism denies the problem without providing a satisfactory answer. I am going to keep in this book the best of the two postures to make the weld. The dualistic and monistic ideals are points approached asymptotically by reality without it being able to reach them. I will do the same with our models: refusal to introduce unknown continuums, but also to make reality a horizontal and continuous framework.

Thought is a dialogue between the Spirit and Real poles, self and non-self. People's personalities situate them between pure solipsism (only the Spirit pole exists) and pure materialism (only the Real pole exists). The Spirit pole experiences, the Real pole analyzes. The two would be confused if it weren't for the need to communicate with others, to present your personal version of the world and find that it is not like everyone else's. Individualism pushes to shift one's version further, collectivism to bring it closer.

Thought follows two dimensions to represent the world. Horizontal thinking sees it as a puzzle to put together. Vertical thinking sees it as a pile of incomplete, overlapping puzzles. The arrangements of some can be tried elsewhere. The two thinkings are complementary. It is necessary to have progressed in solving a puzzle before surimposing the following ones on it. Both hasty vertical thinking and exclusive horizontal thinking are sources of misguidance.

In the horizontal dimension, thought uses two directions: deduction and induction. Extend an initial concept to the other elements, or look in the elements for the central concept. The alternation between deduction and induction extends the horizontal dimension. An elementary volume is brought to it by the existence of the concept over the elements.

In the vertical dimension the mind is surimposed on the real in a single reality. This dimension has two directions. The Spirit pole looks at the real (downward or epistemic vision), the Real pole looks at the spirit (upward or ontological vision). The downward view is backed by reductionism: how did the elements come together to produce the *observed* results? The upward vision is backed by complexity: how can the pieces fit together to produce a *future* result? The vertical dimension is waiting for a formalism as effective as that of the horizontal.

Reductionism is used in science as idealism. This is eliminativism: all causation comes from micro-mechanisms, with the hope of finding the ultimate mechanism. Religion is also an idealistic reductionism, with reverse causality: everything comes from a single macro-origin, God. Both

are in practice untenable. One-sided look. There are a multitude of independent causalities, each implanted in its level of reality.

The double look clarifies the meaning of the neologisms created in this book: *for the upward look*, matter towards spirit, self-organized reality appears as a perpetual scroll of conflicts, with pauses on their solutions. The resolution of one conflict creates the conditions for another, a higher one. The increasing complexity increases the differentiation of contexts. By building itself, reality is diversified. The upward look sees a *Diversium*.

For the downward look, mind to matter, the models stack up. Each is a representation of one of the cited conflict levels. Models can be chained but do not disappear into each other. They represent the actual levels of information constructed by reality. Both independent and indissoluble levels. It is the paradoxical combination of these two terms that I call *surimposition*. The downward look sees a *Surimposium*, the structure of *Diversium*.

The double look is a dimension of thought which is perhaps the only one in common with reality: that of complexity. It is possible that all other dimensions are models, that is, frames created by the downward look. Only one requires special attention: time. Thought is an unfolding and this unfolding defines a personal time of thought. But it is possible that reality is timeless outside of our thoughts. This point will be detailed.

I stress the importance of the vocabulary used, Spirit / Real poles, and the difference in meaning with spirit / reality:
'The real' designates the essence of reality, inaccessible to our minds, but they come together to surround it. 'The spirit' thus designates the collective of our spirits and not an individual spirit. A brain generates a specific iteration of this collective, which borrows heavily from others.
The brain forms mental representations. They are grouped into two main parties: Real pole and Spirit pole. The Real pole is reality for the non-philosopher; it is *considered as* reality by the philosopher, that is to say the representation closest to the inaccessible essence of reality. The Spirit pole is 'the mind' for the non-philosopher; for the philosopher it is *the part of the*

mind which considers, the set of representations which are experienced as the 'I'.
So there is *one* 'real', *one* 'spirit' (collective), and a multitude of versions of the Real and Spirit poles, each unique to the individual spirit that hosts it. Each brain accommodates its specific reality and 'I'.

The notions of Spirit and Real poles are all the more useful as they allow you to understand who you are talking to (or to what in what):
The personality of the layman is a preferential Spirit pole, formed of representations that are experienced, intuitioned, not including the concept that they fabricate their own reality. The Real pole is reduced to a simple background (things, matter, the world).
The personality of the scientist is a preferential Real pole, formed of representations modeled on the essence of the Real, removing from the process the spirit that made them. The Spirit pole is reduced to a simple background (reason, logic, refutability).

Consequently, we must be careful not to use the paradigms of the Spirit and Real poles far from the observations which formed them in their own right. Pure imagination is insufficient to understand microphysical mechanisms. Likewise a neuroscientific theory of consciousness is invalid if it contradicts conscious experiences.

For philosophers, the double look presented here resolves the incompatibility between representational and computational theories of the mind. It confirms that these theories are not reducible to each other, although their subject matter is the same. They are two realistic approaches but come from a different end of the complex dimension.

This book is concerned with enriching the representations of the two poles to relaunch their dialogue. The languages used belong to the organizational levels of the two poles. Finding a metalanguage is the key to a general theory of reality that includes us.

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Interlude

The difference between reductionist and complex thinking is the difference between 'finding' and 'inventing'. A reductionist finds the explanation for an already established phenomenon. A complex thinker invents the future of the phenomenon by organizing it with its future conflicts.

Turn-around now! The Spirit pole has just investigated its own modes (downward approach). Let us now let the Real pole intervene on the same subject. Upward approach: how do large neural assemblies manage to fabricate thought, and make it both so whimsical and precise? How do cells only capable of local physical acrobatics (changing their excitation rates, their synaptic sensitivity, emitting new extensions) manage to form virtual information as complex as self-consciousness, where they become the subject of their own representation, a double spiritual and material image?

The leap in understanding seems so unlikely to be accomplished that it is not surprising to see the continued hegemony of dualism. The neural / mental correlations are continually advancing in clarity. Still, a correlation… is not an explanation. The next chapter, *Stratium*, is devoted to this 'hard problem' of consciousness posed by philosophers to neuroscientists. The solution presented is based on the surimposition of the levels of information processed by the neurons. Simple principle to explain, but it is unconventional. I will make it a universal principle attached to information later. It cannot afford to barge into neuroscience alone without warning. All knowledge of reality is now based on structuralism!

I will therefore have to justify this principle in a further investigation of the workings of reality. Investigation all the more necessary as we no longer know if it has any *substance*. The Spirit pole still uses this notion on a daily basis while the Real pole no longer offers it in its contemporary shaping by science.

Could there be a link between consciousness and substance, these two dangerous whirlwinds in the open field of knowledge? The principle of *surimposition* provides a sufficiently solid answer that I ask you to trust it provisionally in the next chapter.

*

2

The main character

Stratium

The model

Multistage system *surimposing* levels of meaning.
Example of vision: points> lines> volumes> objects, faces> people… Neural groups codify hierarchical levels of meaning.
A level has relative independence. Its existing structure search fo itself in the data. There is already an intention.
Remanence and synchronization surimpose the levels for a more complex meaning. Synthesis that does not make the underlying information disappear. Both are essential for surimposing.
Relative independence prevents the check-back control of conscious levels from directly accessing the unconscious. Balance between stability and plasticity of intentions.
The hierarchical discontinuity is the anchor of the double look. Each level is both a constitution and a representative fusion. A level is self-representing. A brain does not wait for the pre-frontal cortex to observe itself. Neurons are self-observing.

Stratium is a model of the brain as a multi-stage system adding levels of meaning. Take the example of visual processing. Starting from the retinal stimuli: Receptive cone: “I am a point”. Neuron of the 1st hierarchical level, grouping the signals of the cones: "I am a line". 2nd level: "I draw eyes nose mouth" 3rd: "I am a face" 4th: "I am a famous person" 5th: "I play such and such a role in society", etc. The levels are arbitrary and simplified. The gateways to other aggregates of criteria are multiple, producing a particularly complex hierarchy in the immense neural web.

The essential point is that each level of representation has relative independence. Reason for using the pronoun ‘I’. Each of these representations searches itself in the signals. The more it is solicited the more it becomes famous and extends its relationships. Conversely, it slowly

disappears if it is no longer found. Thus the trace of the preceding signals creates, by its persistence, the start of an intention.

Hierarchical self-organization adds levels of meaning to intention, expanding its domain, clarifying it by adding new criteria. The final consciousness is the surimposition of all the levels. The remanence and synchronization of neural excitations makes that all participate jointly in the conscious experience, making it rich.

The relative independence of the levels accounts for the limited access of conscious feedback to the information that structures it (the subconscious is perceived as impulses, the unconscious is not accessible). This independence guarantees a certain stability of intentions. We are not the toys of our environment.

This theory is simple and supported by neuroscientific studies (some to be reinterpreted). The visual process example is validated. How then does *Stratium* differ from current paradigms and how can it better satisfy philosophers who are still faced with the 'hard' problem of consciousness?

It all hinges on the term 'relative independence' and the creation of the double look that it allows. You understood its interest in the previous chapter. Now it is time to embed it in the brain process.

'Relative independence' brings together the notions of *discontinuity* between levels of mental representation and their *entanglement*. Unlike artificial data processing systems, neural transmission is not sequential; it is *added*. Additional neurons synchronize with the first excited. They add (surimpose) their own meaning. This is not a phenomenon reserved for neurons. It is important to recognize it as very universal in reality. So we can convince ourselves that consciousness does not "start" in neurons, that it is not an unknown field that they would set out to create. When you want to understand how atoms become self-replicating biomolecules and then cells, you are forced to surimpose different levels of significance. Impossible to reduce them to micromechanisms. It is also impossible to speak of emerging meanings while ignoring micromechanisms. The levels are conjoined, indissoluble and yet independent from our observation.

Does this independence also exist *in reality per se*, or is it purely related to the way we look at things? You can guess that the double look will be valuable to answer in the next chapters. For now, concluding is not necessary. Clearly our mind is structured in a mimetic way, modeling the environmental systems in which our own organism bathes. It reproduces the organizational stack of reality. But the merging of these representations into conscious experience causes us to experience them as pieces of a horizontal puzzle, rather than a vertical stack. Consciousness juxtaposes and confronts concepts of the same level. It is by self-examining our mental functioning that we guess its vertical arrangement. Take away a foundational principle such as causality or time: everything collapses.

Conscious fusion and its relative independence are responsible for the felt body-mind duality. Duality but not separation: we *experience* our body. Without perceiving the detail, we always know that it is there. Having a liver or a kidney is not just medical knowledge. The absence or trouble of their signals disturbs our bodily impression on a level vague to consciousness and yet real, sometimes intense! These perceptions are deeply identitary. They sculpt our behavior in a sequence which our consciousness assists, comfortably installed in its belvedere. Consciousness establishes a self-observation of it. It is not a mirror, as some neuroscientific theories postulate. A mirror is in fact incapable of transforming its original image. Consciousness is deeply linked to its micromechanisms by retro-controls. Relative independence of each other.

Critics can maintain that there is no formal evidence that the process I have just described is conscious experience. Isn't that still a *match*, no matter how close? Neuroscientists who have written theories on consciousness defend themselves from this criticism by noting that magnetism is also a correspondence of the alignment of electronic spins and that no one thinks of placing it in an alternate reality. Materialism is but a series of assimilation of the properties of matter as "natural". Why refuse to include consciousness in this concrete whole which is ultimately tolerant enough for the most astonishing of phenomena? But consciousness seems to us a phenomenon sufficiently exceptional for the criticism of philosophers to remain.

Stratium shields itself from this criticism by confirming that *as a model it is indeed a match*. Only consciousness can be *experienced*. The rest is representation. However in this matter consciousness is no different from any other level of reality observing its structure. Consciousness does indeed belong to the same whole. It came out of it. There is no argument to sanctify it.

A complementary answer is to take the problem backwards. Let us place ourselves in an older reality that does not yet contain any example of the entanglement of information as performed by neural networks. Time travelers, we land in this ancient reality as evolution brings the brain to life. We are not 'on board' but spectators of the phenomenon. What can we imagine about its origin?

In our team of travelers there is a behaviorist. She claims that the creature with this new centralizing organ is a ‘zombie’. The creature shows thanks to it a behavior much more sophisticated than a plant. But why should it be the seat of different experienced phenomena? It remains a biological entity, belongs to the same material order as the plant. The team philosopher is unable to contradict her. Going back in time all evidence of the consciousness phenomenon has disappeared, except when one projects one’s own on the creature. To invent it would be to fall into mysticism. Why would anyone believe more in consciousness than in God, at a time when neither was ever observed? The philosopher is silent.

The team is moving ahead. The brain completes its organization under the watchful eye of our attentive travelers. The bipedal being endowed with it gives all the appearances of innovative properties. He observes himself in a mirror, begins to draw and then to write, constructs social circles, and declares himself conscious. Surprise in the behaviorist, whose explanations become insufficient to explain the unexpected claims of the biped. While the philosopher frantically begins to fill notebooks with observations. She has just invented a new discipline: the philosophy of the mind.

Our story ends by re-asking the question: What could we predict about the outcome of neural organization that might contradict the onset of

consciousness? What could make it less inevitable than the appearance of magnetism with the alignment of electronic spins, if our travelers had ascended to the appearance of elementary particles? How is consciousness less integrated into reality than any other phenomenon?

We will see in detail in the chapter 'Metalanguage' how deep this integration is. *Stratium* is a stand-alone theory but can only be fully understood within the general theory of reality that is the subject of this book. Spirit and matter inseparable.

Which exposes the accusation of circular reasoning. All reasoning is ultimately circular within its framework. A general theory of reality is necessarily more so than any other. Coming from a mind that is a priori included in reality. Even when mystical beliefs expand its claims, they are still products of the mind, which theologians intelligently recognize: God is denominable but not conceivable. As for solipsism, which denigrates the existence of physical reality, it does not escape circularity. On the contrary, it is the most self-centered posture possible: the mind is all reality. How to relax this infernal circle, shift the productions of our mind from its mechanisms? Let's start by asking physical matter what it thinks of our mind. Of course this personification only exists in our minds. *Real pole*. But this one is multiple. Don't you learn amazing things about yourself just by staring in a mirror?

Basic questions: What engine drives our thinking tool? Why does part of this functioning produce the phenomenon of consciousness and the rest is inaccessible to us? Why does intelligence vary when all brains are equally active and contain approximately the same number of neurons? Let's take a look at neural processes, how they organize data. We will then take a leap to the psychological floors, where an assembly of higher concepts decide the contrasting dynamics of the personality. We will come back down to neural physiology, to its ability to support multiple levels of information. Finally, it will be time to look at the most discussed transition: neurological organizations becoming the phenomenon of consciousness. At each step, in this journey, we will do a little about-face: matter looks at consciousness, then consciousness looks at matter. This is how we will bridge the gap between them.

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Connecting neurons and thought: how to proceed?

Some amazing observations to explain:
The variety of brain functions is not provided by a diversity of specialized cells like in other organs, but by a rich connectome between conductive neurons.
The brain takes charge of abstractive tasks that take it outside the framework of natural selection.
Intelligence does not correlate with the number of neurons.
Similar brains develop very different personalities. The personality of one easily jumps from one consistency to another, without falling into chaos.
Genetic code different from one individual to another, but the same predisposition for common language.
Neural network accidents are repaired spontaneously by neighboring regions. How do they know what information has been lost?
The network is programmed by sensory influxes but also by conscious 'intentions'. How do these influences coordinate?

Two approaches: upward for neuroscience; neural field to be modeled. Downward for psychology; consciousness that self-represents and corrects itself. Lack of coordination between the two approaches.
Handicap of Cartesian dualism. Start from matter or from mind. The gap remains the same. The two paths do not meet. One explains physical properties, the other explains mental phenomena. "Hard" problem of consciousness.
The methods used accentuate the divergence. Models targeting large numbers of neurons versus models targeting personality singularity.

Stratium approach: starting from relationships. Show how parts reorganize into different whole (s) depending on the context. Break down the parts down to the sensory foundation.
A single path but two ends separated by the complex hierarchy. Two irreducible looks at each other, equally real.
The upward look *constitutes* the impression, the downward look *experiences* its constitution. The problem of consciousness finds its solution.

A functional theory of the brain must explain some astonishing observations:

The functional anatomy of organs is usually precise. Each cell is differentiated and dedicated to a standardized task. Nothing like that in the brain. It certainly has different regions and specialized centers, but overall its structure is relatively uniform, that of neural networks assisted by their supporting tissue. If more than 200 varieties of neurons have been identified, these are morphological differences linked to their great plasticity. Some have neurohormonal secretory activity. The main and universal function is to receive and transmit electrochemical signals. The physiological variety of the brain, compared to that of other organs, is insufficient to explain the incredible extent and diversity of the tasks it performs : finely coordinate the sensorimotor apparatus, discriminate between events, be moved, decide, calculate, identify a face among hundreds, remember the multiple episodes of one's life, construct imaginary universes, etc etc.

The depth of information processed by the brain is beyond comparison with other organs. It is not explained by an equivalent variety of specialized cells, but by a peculiarity of neurons: their connections form a sort of gigantic railway network, called a 'connectome'. But this network doesn't just transmit loads of information from one point to another. It makes it more complex. How ?

The brain is able to take over functions for which it was not designed. Binary programming, engineering, or politics are not reasons evolution has selected it. Yet he adapts to these new demands, manages to transfer them to other brains without any physical contact.

No matter how smart a brain is measured by ratings, its anatomical appearance remains the same. Some astounding cases of atrophy reducing brain matter to 10% of its normal volume (congenital hydrocephalus) are not accompanied by any profound deterioration of intelligence. It is therefore not directly correlated with the number of neurons.

Likewise, the personality produced by a brain is unique, its reactions unpredictable, despite its anatomical similarities with others. Even more surprisingly, a brain can radically change its personality during its existence while remaining morphologically the same. The tiny details of the connectome are of critical importance.

The genetic code differs for each individual. Despite these discrepancies, the brain manages to spontaneously form the networks of a common language. Genetic singularity does not prevent self-organization that brings people together.

Accidental or intentional amputations of parts of the brain lead to impaired function, but the rest of the network is able to mitigate the consequences, or even to recreate the function, with greater effectiveness the more it is young.

Mental functions are in part programmed by the initial organization of neurons. The stimuli received modulate the information patterns. Conscious space accommodates 'intentions' that do the same thing. How do these influences work together?

All these observations seem allowed by the particular properties of the brain: very high plasticity, self-organization, sectoral independence associated with deep integration. The connectome hides a remarkable complexity. The recording of its excitations shows correlations with mental functions but does not give the code.

Two complementary approaches strive to find it. Neuroscience is an upward approach. It sees the neural field as a huge chaotic system to be modeled. Difficult, groping investigation, requiring large technological resources. It links physical changes in the brain with mental phenomena. But this is a translation, not an explanation. Why these phenomena rather than others?

The successes of neuroscience in biological diseases of the brain have eclipsed the older, downward, consciousness-based approach. The mind is indeed capable of observing itself and of self-modifying its contents,

without any biochemical intervention. Psychology is concerned with our intentions and this personality's ability to self-correct. Less easy to model. Some branches of the discipline, such as psychoanalysis, are controversial. However, it is sterile to deprive oneself of the downward approach, which alone shows that neural interactions are also phenomena.

The lack of coordination between the two approaches is not unrelated to the persistent deficiencies in brain knowledge. No explanation of consciousness, no model of personalities, treatment of disorders by an empirical combination of drugs and cognitive techniques. Why do the neurons of the digestive tract, numbering a hundred million all the same, not produce consciousness while those of the cortex do? These are the questions *Stratium* answers. What approach did I use?

Understanding of the brain is hampered by an old barrier: Cartesian dualism. Terrible gap between spirit and matter. Nothing to cross. Depending on their training, a researcher starts from the 'matter' region or from the 'spirit' region and pushes back the gap. But don't cross it. Reductionism took place in both regions. On the matter side, the brain is broken down into its neural micro-interactions. On the mind side, the personality is dissected into its unconscious mechanisms. Did the two tracks succeed in merging? It's the contrary. No one on either side has any idea how to connect.

Major obstacle: the researchers' methods differ to the point of being incompatible. A neuroscientific model must be falsifiable. A model of the mind is not, for a simple reason: it is possible to be persuaded of its validity. Conscious intentions can retro-control the mind, to a certain extent, to make the personality function according to the chosen pattern. In other words, everyone can follow their own personal theory of mind and be fine with it. *It is objective in this consciousness*. Example: no scientific demonstration is possible of the Freudian triptych founding psychoanalysis, nevertheless it is a rigorous model that its followers begin to follow.

The methods only adapt best to what researchers see across the Cartesian divide. The matter of the brain is made up of billions of neurons. The scientific method is for really large numbers. Statistics, reproducibility,

refutability. Principles targeting the cohort of neurons and not the *neural individual*. Psychology does the opposite (or should, as it is increasingly colonized by neuroscience). It is interested in the individual through surveys targeting their general character traits. Personalization of the particular model of *being* by the brain.

You have no doubt recognized the two directions of our double look, presented in the previous chapter. From the brain to its micromechanisms, and elements of character to the personality. But these two directions do not coincide in the case of the brain because they are on different paths: that of physical properties and that of mental phenomena. The material is only linked to the virtual. How to solder them? This question is called the 'hard problem' of consciousness by philosophers.

My approach was to start from the middle of the ditch. Refusal to choose the matter or spirit region. Both show relationships. Measured or proven, it doesn't matter, let's start with relationships. How do the relationships of physical or mental elements produce a particular whole rather than another? The example of social interactions producing a homogeneous social consciousness appealed to me. I used an analogy to decipher individual personality. A social group functions with its individualities, its conflicts, its consensus. A process very similar to the assembly of ideas in a thread of thought. Personality is based on an inner society of mental representations. I use two terms about it: *Psociety* (psychic society) and *polyconsciousness*, which pictures a scene where small independent consciousnesses compete for advantage. Each symbolizes an aspect of personality. Several films have illustrated this *polyconsciousness*[2]. They plunge you into the hero's head in full thought. You discover a rather heated mental board. Each member is camped on a radical position and tries to impose her vision of things.

The *Psociety* model explains an amazing, everyday observation about our behavior: sometimes we switch instantly from one facet of our personality to another. Source of perfectly contradictory attitudes, and yet we do not

[2]*Identity,* James Mangold (2003), *The young and prodigious T.S. Spivet,* Jean-Pierre Jeunet (2013), *Split,* M. Night Shyamalan (2017)

see any inconsistency! How to explain this phenomenon if the underlying concepts were organized in a fluid and continuous way? We would be smooth mentalities and not those character characters capable of astounding those around them.

Consciousness is a place of expression and fusion of our acting representations, proto-personalities that I have called the *persona*. The *persona* symbolize the influences of our loved ones, the small mental voices, the phenomena of persistence such as the memory of the deceased after a death. They also explain the profound reorganizations of the personality, sometimes overwhelming when an extremely serious event is not manageable by the existing personality. Serious illness, vital risk, bereavement, disaster, war, family tragedies…

Conscious persona fusion is prone to trouble, which are expressed in polyphrenic disorders and other dissociations of personality. The personas are not a division of the brain into new boxes. They can be likened to personality strange attractors, conceptual aggregates that keep an identity and stable form even when environmental data changes. The personas are themselves composite, organization of concepts encoded by multiple neural areas. As we continue to separate the parts, we dive into the mental hierarchy to its base: sensory stimuli. We just climb down *Stratium*. The neuron is there, a central complex of hyperconnected data. A gem passionately scrutinized by neuroscience. When the scientist ascends the pyramid of mental organizations, she must find the path we just have come down. Neuron finally entangled in the mind.

I superbly ignored the dualistic divide. No big leaps, either way. Only micro-jumps, because you have to quantify the progression from the physical to the mental, to get it out of a single vast neural system. The ditch only accommodates those settled on its edges. Sanctuarization of the spirit, sanctuarization of matter. However, by placing the sleepers on the track and showing the two directions, have I for all that merged the two paths, that of the physical properties and that of the phenomena experienced? Not yet.

The 'hard problem' of consciousness is of a different order. There is indeed a unique physicalist path between consciousness and its material processes. We must be convinced of this if we are to escape Cartesian dualism. But a single path does not mean that its two ends are of the same nature. They are distanced by the complex dimension, which we will concretize in this book. Two ends produce two looks, neither reducible to the other, each as real as the other. The upward *constitute* the impression, the downward *experience* its constitution.

*

Multi-centric brain versus stratified brain

The multi-centric vision of the brain juxtaposes its functions without principle to coordinate them.
Ordering the chaos of stimuli involves the neural network establishing organizational discontinuities. Principle of organization level. Neurons grouped into a functional unit.
The levels are linked hierarchically. Increased depth of information.
A neural group keeps the same state within a range of neighboring stimuli. It categorizes them, recognizes itself in these stimuli. Beginning of an intention.

The multi-centric view is historical and based on the heterogeneous anatomy of the brain.
Its first hierarchical theory is the *triune brain*. Instinctive *reptilian* brain surmounted by the emotional and memorizing *paleo-mammalian* then by the linguistic and abstract *neo-mammalian*. Three-party competitive model, abandoned in favor of further brain integration.

Stratium models the hierarchy of the neural network as a globular edifice. Many neurons at the base receiving the related signals. Increase in their number in the middle to deal with the multiple possible organizations of their regularities. Decrease at the top for more synthetic representations.
Notions of *Inventor* and *Observer*: symbolize the two complementary directions of the work of mental integration.
The Inventor is an upward principle, organizer of data into alternative solutions.

The Observer is the downward principle. Retro-control. Compare the solutions and evaluate the results.

All levels are potentially active. The lower levels have been effectors earlier in evolution and generally retain this role. They are retro-controlled by the higher levels.
Actions start at unconscious levels, can be interrupted or corrected by conscious retro-control, secondarily warned. Chronology confirmed by Libet in 1980.

The corpus callosum connecting the two hemispheres has been the object of therapeutic section in severe epilepsies. The effects confirm the hierarchical organization. There are not two mental individuals but one, with two decision-making retro-controls from separate hemispheres.
The bottom of the hierarchy is made up of neural centers grouped around sensory afferents.
The top is made of network units extended across the entire brain.
The multi-centric and stratified theses are no longer contradictory.

Where does the classic multi-centric conception of the brain come from? What problems does it raise? Flattened vision of the brain, juxtaposition of functions without principle to coordinate them. These difficulties are solved by adding a vertical, stratified view of the neural organization, which gave the *Stratium* theory its name.

How does self-organization manage to find a compromise between order and chaos, between balance and instability? Should we first oppose them? Chaos is a variety of order scattered over a considerable number of elements. To the point that the individual interactions become indistinguishable and allow an exact statistical approach. A stable level of information is created on top of the chaos.

Let's apply this principle to neurons. Each is a functional unit. If we considered them together in one workspace, they would form a chaotic system. Everyone would happily discharge into the network under the influence of sensory stimuli. System open to the environment that would have no chance of achieving any balance. The brain is not chaotic.

Grouping neurons by anatomical centers around the same function is also not appropriate. Who coordinates the centers? How do elementary representations become *concepts*? Centers are suitable for specific functions, such as vision, but not for the general organization of the mind.

The network must therefore accommodate discontinuities: stable levels of information above the chaos of sensory stimuli. These levels are groups of neurons gathered in a functional unit. Principle successfully reproduced by artificial intelligence researchers. The levels are those of the depth of information created by the grouping of processors. The principle is modeled by graph theory, which I will not detail here.

Within a neural group, interactions synchronize in a steady state for a certain range of afferent stimuli. The state "recognizes" this range. It is the *representation*. It changes if the data differs markedly. It goes from 'I am' to 'I am not'. Categorization work that absorbs modest differences in the clusters of related stimuli. The recognition area may move if a new stimulus pattern occurs repeatedly. It obscures the celebrity of the old one. The neural group says 'I am'… something different. The system is both stable and adaptable.

The classic multi-centric conception of the brain is historic, based on the discovery of heterogeneous brain anatomy. Morphology of regions, organization of neurons, myelination of fibers, contrasts are important. Certain pathological symptoms are strictly correlated with the situation of the lesion. In the middle of the XIXth century, Broca and Wernicke showed without having concerted that the destruction of a cerebral area (bearing since their name) causes aphasia. The words are no longer understandable. From the same period dates the popularized case of Phineas Gage, a man whose skull is crossed by a bar, selectively destroying his prefrontal cortex. He becomes temperamental and unstable, unable to control his moods, whereas he was previously skillful, shrewd and persevering. Speech center, emotional control center. Identification of the workings of the brain continues over the century and is refined thanks to functional MRI (fMRI).

The brain is the result of an evolution, analyzed by neuroembryology. The first multi-centric view to take this into account is Mac Lean's theory of the *triune brain* (1949). According to him, the cranial box hosts three independent organs corresponding to a phylogenetic succession: 1) The reptilian brain or *archipallium*, which has become a brainstem in humans, with a homeostatic and reflex function. 2) The paleo-mammalian brain, which has become the limbic system, the seat of emotions and memory. 3) The neo-mammalian brain, or neo-cortex, of exuberant development in human, generating all this obscure content that terribly complicates her life: abstractions, logic, languages, long-term anticipations.

To this simplified vision of the brain have been grafted such simple advice on personal achievement. The reptilian brain, instinctive, territorial, aggressive, must be kept on a leash by the evolved brain, triumphant tamer of the buried beast. Which cage, which whip to use? How to protect yourself from the claws and fangs of the animal? Theory says nothing about it. *Stratium* will not come down to three levels. Neither is neuroscience satisfied with the model today. It favors the integration of the three brains in a more general network which would be the support of consciousness. Note, however, that the triune brain was hierarchical, while the contemporary neuroscientific view becomes horizontal again, with a single neural system. The poor beast is flattened. We walk on its skin ;-)

The successes of the multi-centric model are numerous. Interruptions or stimulation of neural connections have spectacular therapeutic effects. It is necessary to intervene in a specific place. But let's qualify these exploits. It is changing the faulty part of a vehicle without understanding how it is built. If we work on neurons high up in the hierarchy, it is difficult to recognize the side effects. We do not know how to take a photograph of a personality before and after. If *Stratium* is right, very few mental functions are wisely protected in their anatomical box.

Take the example of the bird brain, tiny and devoid of cortex, yet capable of particularly complex and rapid cognitive tasks. Would the bird not have any consciousness? No. Its brain followed other evolutionary paths. Let us

also quote this study[3] of five women devoid of olfactory bulb and having a strictly normal sense of smell. The brain seems perfectly capable of producing mental function in the absence of the dedicated center. The impulses coming from the olfactory cells imperturbably create their own organization in the neural field. The multicentric anatomy of the human brain thus appears to be more atavistic than a functional imperative.

The most embarrassing shortcoming of the multi-center model is this: while the sensory functions are anatomically well localized, the model says nothing about how they *present* their information. How is it related to others? How do their meanings blend together and how do they end up forming a *decision*? The classic model does not succeed in eliminating, in the background, the presence of a homunculus associating all the data, digging into the function it needs, in short a sort of mechanical excavator operator who shakes her levers with very specific intentions. A brain of the brain. The mystery is just out of place, still whole. The Consciousness fortress remains untouched.

The concept of hierarchical neural groups is advancing in neuroscience. The processing of visual signals was the first major success. Such an organization is only apparent in fMRI on the first levels of analysis, immediately following the stimuli to be processed. Higher up, the plan is lost, due to exponential complexity. The synchronizations are mixed. The planning of neural effervescence spans larger regions. It is correlated with the mental tasks in progress. But the model loses its discriminating and explanatory power.

Let's go back to *Stratium* and place ourselves in the middle of its hierarchy. In the middle levels, neural groups process different aspects of signals. One codifies, for example, the shape of an object and the other its color. These partial representations are spliced together into an integrated image of the object at the top level. The bridges are short between groups close together anatomically by their function (processing of visual signals). The more complex the staging becomes, the more the anatomical grouping

[3] *Human Olfaction without Apparent Olfactory Bulbs*, https://www.sciencedirect.com/science/article/pii/S0896627319308542

disappears. Long connections are increasing. The notion of group must be replaced by that of unit-network, which can extend throughout the entire brain. The 'center' loses its explanatory value.

But it retains its value for the integrator neurons, the most significant in the architecture-network. These neurons symbolize high level information : known person, elaborate object of the environment, who are not confused with others, because there are these specific neurons to represent them. We must oppose the lack of localization of the unit-network and the symbolic value of local neurons.

Stratium is a globular structure rather than a pyramid. At its base, the myriad of sensory signals are correlated by the first rank neurons. Different groups analyze the different regularities of the signals. Neurons are trying to deal with apparent chaos. Their number involved in this task is not less than that of neurons relaying sensory signals. It expands further for the integration of signals. The primitive concepts multiply, translating the diversity of the solutions to organize the regularities. The building widens.

The higher concepts become more synthetic. The number of neurons involved in these stages is reduced. Conscious workspace is the least abundant in neurons. Most of the coding is done below. But these neurons, called pyramids, are particularly rich in long connections.

Identifying network units requires recognizing their temporal as well as their anatomical boundaries. The synchronization of the unit is an essential criterion. Ungrouping the levels is difficult. The gateways predicted by *Stratium* are not just long connections. An action starts as soon as the sensory signals are received. Reflex loop open to the data processing hierarchy. Long connections activate after local recognition of signals and before final consciousness retrocontrol. The action has started but can still be changed.

In classical multi-centric theory, the prefrontal cortex is presented as the conductor because of its dense connections with almost all other areas of the brain. This separatist approach gives it superior functions. It occupies by default the role of the famous homunculus. In support, architectural

features (presence of an additional granular neural layer), relational (privileged projection zone of the medio-dorsal nucleus of the thalamus, regulator of vigilance) and functional (its stimulation does not trigger movement). But to relate the function of a brain area to its local architecture is often misleading. There is great variability between species and sometimes between individuals of the same species, all of which demonstrate conscious integration. Limitations of the multi-centric model. Architecture is valuable but must disentangle local network units from generals. The necessary functional tests are difficult to implement.

What characterizes the prefrontal cortex is its participation in highly specialized functions: motivation, management of affects, abstraction, deduction, decision, initiation of reward. It is essential in the evaluation of developed behaviors, social behaviors, mood control. To show the continuity of these functions with the rest of the neural hierarchy, I'll explain the notions of *Inventor* and *Observer*. They symbolize the two complementary directions of the work of mental integration. It is at the level of higher functions that they are best personified in these terms.

Networks inherently have the capacity to form new associations. They are *Inventors* of alternative solutions at their level, which compete with existing ones. The *Inventor* is an upward principle, an organizer of raw data. In the immature brain it manifests itself from the first levels of sensory processing. The hierarchy is still embryonic. No retro-control. Contingencies on the *Inventor* are genetic. In the mature brain, the *Inventor* is less active on the levels sculpted by habit. It manifests itself mainly in the conscious space, in which the prefrontal cortex actively participates. Its common name is *imagination*.

At this level, the *Inventor* is our petulant inner researcher. It manipulates mental representations to suggest new ones. It is the emerging summit of intuition, that ascending pulse of the psyche which offers consciousness its flow of creations. The *Inventor* is a rather quantitative principle: its agitation is judged by the number of alternatives it sets out to create. The mind is bubbling with ideas, going all over the place.

The *Observer*, on the other hand, is the principle of feedback, downward, rather qualitative. It compares the solutions and evaluates the results. Are they in line with expectations? Could other solutions have had better predictive power?

We all possess *Inventor* and *Observer* principles. Their varying power forms different personality profiles. Awesome *Inv* + mediocre *Obs* = imaginative profile but not very attentive to expectations. Modest *Inv* + sharp *Obs* = pragmatic profile that transforms the creations of others into success. The *Observer* is behind Stigler's law of eponymy: « A scientific discovery never bears the name of its author ».

You have met these characters. Faced with the preferred *Inventor*, you feel like chaining the guy to his desk to get him to complete his project, he is so dissipated. In front of the preferential *Observer*, the urge is to kick his butt so that he stops telling you what to do (knowing he's always right). Your own *Observer* can tire you out, so much it examines your life under the microscope and never lets you enjoy it. "To let go" is to send your *Observer* on vacation…

With *Stratium*, the brain is a fully integrated entity. Without it, you hear false dualistic formulations, “the brain associates…”, “the brain activates, inhibits…”, “the brain seeks the memory of…”. What then is it that associates, activates, seeks? The soul? The genes ? No, it's the neurons themselves, united in a hierarchy that turns them from generators of impulse to producers of symbols.

The theory fits perfectly with the disturbing observation made by Benjamin Libet in the 1980s: when a person decides to perform a gesture, the activation starts in the motor circuits before manifesting itself in consciousness. In other words, the initial decision is unconscious; the consciousness is secondarily aware of it while having the impression of being the decision-maker. Can one imagine a more destabilizing idea? An analogy would be that your email software starts to write a message itself and sends it, while making you believe that it is because you typed on the keyboard that the message has this content!

For *Stratium*, the levels are all potentially active. Their exit code can point to internal feedback, effector pathways (motor neurons), or to the next level in the hierarchy. Acts begin in a level when it has been linked to the necessary effectors, evolutionarily speaking. The brain has a phylogenetic history. The fact that an additional hierarchy is installed above the level does not eliminate this ability to act. It brings retro-control to an initially free act, which is also more risky. The assessment of the conscious *Observer* comes and imposes on the current reflex, with the possibility of correcting it or stopping it if it is not yet too advanced. Consciousness can stop a reflex gesture that has not hit its target. It cannot catch up with hasty words already wrapped in sound waves…

There is nothing contradictory about the theses of the multi-centric and stratified brain. They must be combined to account for the neural activities observed in fMRI, which form networks that extend far beyond anatomical regions. The general phylogenetic model is this:

Sensory afferents, present long before the appearance of the cortex, come together to arrive at a main crossroads: the hippocampus. This structure is also central to the registration of long-term memory. Coherent. It is an early profitable function even for an archaic nervous system. The hippocampus dispatches signals for post-processing to their dedicated cortical areas. Then returns them to the motor neurons when they have become effectors, checked by this sophisticated retro-control that we call 'will'. The cortical areas have a large number of reciprocal connections between them, supporting the intermediate stages of the *Stratium*. The corpus callosum, between the two hemispheres, is a rich example of over 200 million axons.

Now, would you believe it, when this enormous beam is intentionally severed for therapeutic purposes, in severe epilepsies, the patient does not become an uncontrollable robot, as one might have feared. Her mind is not the seat of two rival consciousnesses either, but of two feedback controls, a main and an accessory. The overall locomotor coordination is preserved. This finding reinforces the hypothesis of a hierarchical self-organization of the brain and not of an assembly of specific centers of consciousness.

The rule of the model is this: the closer the processing networks are to the afference of the signals, the more they are concentrated in the same anatomical area. Due to the very large number of neurons involved, most of the brain tissue seems to be organized into centers specializing in each perception. Hence the multi-centric aspect.

The second rule is corollary: *the further the integration networks are from the afferents, the less they are grouped together*. But made up of a smaller number of neurons and embedded in the middle of the brain tissue, they are hardly visible to current functional explorations. Researchers attempt to 'see' consciousness by comparing networks illuminated by unconscious mental tasks or announced conscious by the guinea pig. But these are simple correlations. As if you were to capture sunlight in open space and count the photons to quantify the effects, without taking into account the effects of this celestial projector on the Earth, of the life it raises there. When an fMRI looks at a consciousness, it now identifies only traces of its contents, an object contemplated by the guinea pig, a general mood. Abstractions are otherwise difficult to grasp. What then to say about a personality? Doesn't every consciousness have a unique color? How to grasp it with only quantifications?

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Superior properties and functions

Consciousness as relativistic as time? Two phenomena proven without being able to be explained.
Zombie Argument: A human could function with the same mental processes and have no consciousness.
I invalidate zombism with another thought experiment, where neurons are replaced one by one with a mechanical equivalent. When does consciousness disappear?

Intelligence is the stacking of levels of information about a subject. The quality of organization of neural patterns creates intelligence by subject.

The general mechanism of (structural) memory is based on the modification of synaptic connections and weights. *The structure contains its own memory*.
Two types of forgetfulness: rapid, when a neural pattern replaces the previous one. Slow, by under-utilization of the schema, which is erasing itself.
Biographical memory (episodic): events tattooed by the hippocampus, surimposed on structural memory by a specific level of codification in the synapses.
Working memory: persistence of synchronous excitations in networks, re-excitation of recently stressed neurons.

Consciousness and zombism

'Consciousness' like 'time' are terms for something that everyone can recognize, without being able to verify that another feels it the same way. Consciousness is as relativistic as time. Its definition poses two problems: What is the phenomenon of consciousness? Where does its content come from?

The first question can be rephrased as follows: how do you go from an impersonal neural activity, no matter how complex, to a feeling experienced? For those Owen Flanagan calls *the followers of mystery*, a line of classical thinkers culminating in Leibnitz and continuing vigorously today, consciousness can never be the subject of a materialistic explanation. The 'mystery' has lost a bit of stiffness. Nagel draws an analogy with the electromagnetic field both irreducible and necessarily associated with the behavior of charged particles, which is ultimately a very physicalist position.

We have in philosophy the *skeptics*, who react to the excessively reductive discourse of neuroscience. Chalmers has made consciousness a 'hard problem' and contradicts eliminativism with the *zombist* argument. The philosophical zombie is indistinguishable in its behavior from a normal human being. Neurons compute. But they do not generate any consciousness in the zombie.

Zombism is easily invalidated by another thought experiment. Imagine that technology develops the perfect artificial neuron. This mini digital powerhouse is able to reproduce stimuli, react to metabolic changes, exhaust itself like a cell, grow its connections, etc. Take a healthy, conscious human brain (this is a thought experiment because we are still looking for a donor). Let's replace each of the brain's neurons, one at a time, with our artificial model, preserving the connections. Let's repeat the operation a hundred billion times. Initially, a biological brain. On end, an artificial, fully digital brain. If Chalmers's hypothesis is true, it's that of a zombie. Zero consciousness. Question: At what point in the operation did consciousness disappear?

The only non-absurd answer would be to say that consciousness would have disappeared, in fractions of 1 / hundred billionths, during the process. So that consciousness would be a property inherent in the neuron, additive. But this explanation does not hold. Neurons can interact without making any conscious impression. They are one hundred million gathered in the intestine and do not generate any second consciousness. It is in the organization of the brain that consciousness arises. No logical way to imagine how its exact reproduction could result in a zombie rather than a conscious human.

The only point of zombism is to show it lacks a concept for understanding consciousness from neural networks. Let's look at how disciplines older than neuroscience coped on such an occasion. The naturalist Darwin, faced with the variety of species, created the theory of evolution. Several biologists, confronted with the transmission of hereditary characteristics, created the theory of the genetic code supported by DNA. Chemist Krebs, faced with a series of chemical reactions, created the theory of the cell energy cycle. At each instance, the theory falls under a level of complexity higher than the elementary processes it describes. It is a level of information surimposed on its elements, invisible to them, apparent only to the downward look. Understanding comes from a leap in complexity.

Logically, the same approach should be applied to neural networks. And for them things are extremely simple: *consciousness is the experienced theory of their processes integrated into a higher level of complexity*. There is no longer a

downward look from a higher level. Consciousness is the starting point for this look. This is why we can only experience it, not explain it.

To *explain* it, there would have to be higher levels of complexity of which it is constitutive, just as chemical reactions are constitutive of the Krebs cycle. The explanation should "fall" from that higher level, and it would seem natural to the entity hosting such level. But it doesn't exist yet. *Societarium* (social section of the complex dimension) is not the extension I'm talking about. *Societarium* is a complexity within our consciousness and not surimposed on it. What imposes itself on our consciousness is a simulation that it constructs in itself.

For our consciousnesses to build additional levels of complexity, they need to integrate their information together. Simply simulating information in others is not enough. Integration is only complete with a physical connection of neural networks to each other. A super-brain will be likely to experience a higher consciousness that will allow it to explain the nature of the consciousnesses of its parts (but more than experiencing them as they are, only higher integration will be experienced).

Don't we already have, in fact, an idea of what such a transformation can be? Doesn't our experienced consciousness change fundamentally from infancy to adulthood, and then wither away in old age? The transformation is slow enough to appear to us as a continuity. But imagine we suddenly went from infant to adult cerebral wiring. Certainly the leap in complexity would cause the sensation of shifting to a consciousness of an entirely different order. Our infant ex-consciousness would then seem easy to understand, crude as it appeared from this new altitude.

*

Intelligence

“The“ intelligence does not exist any more than “the“ volume. " You only find smaller or larger ones. It is a measure of scale according to a criterion. The criterion is simple for volume: an amount of three-dimensional space. It's more complicated for intelligence: organizational efficiency. Very subjective. Let us try to clarify. Let's start with what is organized. Parts for a volume, concepts for intelligence. A simple addition is enough to organize the parts of a volume, while the concepts are woven into a hierarchical

succession. The higher it is, the more the concept synthesizes a vast set of criteria. Quantifying intelligence involves measuring the height of the stack, not the mere addition of parts.

The remarkable characteristics of our intelligence have two joint origins: 1) The multiplication of criteria by the presence of five senses, instrumental data and social learning. 2) The high stacking of analysis stages enabled by a large neural field.

For the same reasons, intelligences are sharply contrasted from one individual to another. The variety of environments specializes intelligences. All neurons participate in the representation of something. People have similar amounts of them. The variation in intelligences therefore comes from organizational qualities. None are frozen. The influx of data stimulates the intelligence concerned. Their rarefaction diminishes it. Hence the question: does one intelligence develop to the detriment of others? This seems attested by the litany of geniuses, brains famous for their hyperspecialization, who have lost their foothold in everyday life. Nietzsche, Camille Claudel, Maupassant, Lautréamont, Van Gogh, James Joyce, Hölderlin, Sade, Poe, Kafka, Strindberg, Virginia Woolf, Hemingway, John Forbes Nash, Morphy, Bobby Fisher…
Show me someone who thinks only of that and I will show you how poorly they think the rest is. But then are those who think of nothing genius generalists? :-)

We have seen that the coding performed by neurons is very different from the numerical method of computers. In microprocessor operations, data and results use the same language. The translation must be programmed into a user language. On the contrary, neurons organized in hierarchical groups construct their own language, as data moves through the discontinuities of the network. The code is embedded at each step in the data. These are the fusion of information and code. They gradually expand and that's how a few neurons at the end of the chain manage to become the support of an elaborate idea, with the help of the same stupid neural excitations.

Digital technology offers a beginning of similarity through the layering of its code: electrical, binary, machine code, programming language, user interface OS. Five levels. There are many more of them in the brain, which is why the biological organ accesses high level consciousness and not the inorganic one. But above all, each level of the brain organizes its own code; it self-creates its consciousness. We dare not leave such latitude to our silicon assistants yet. What 'artificial selection' would eliminate the failures? Are we capable of the necessary wisdom?

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Memory

We keep as memories what the routines of our mind do not know how to transform into banality.

The general mechanism of memory is homogeneous throughout the brain. These are synaptic structural changes that establish preferential relationships between neurons. A uniform network becomes differentiated, informative, by the specific configurations taken by neural excitations. Each mental function is registered in these favorite patterns. *The structure of mental work contains its own memory*. Nothing like a computer, where some circuits are dedicated to storing information and others contain the algorithms that use them. In the brain, *algorithms are memory*, because they are constantly changing depending on how they are called upon. There is no master plan for using memories. No soul that comes to fish them. This old paradigm is still widely used, even in scientific journals, which makes consciousness a sort of superior algorithm using mental functions like processor boards. It is only their integration, a space for negotiating each other's fame, and not an independent process.

How is memory formed? Any information reaching the brain builds and maintains memory. Sensory impulses are active and not passively processed. The same configuration reinforces the mark it left. An unusual pattern changes the track with a greater probability of repeating itself. Ascending, structural, *procedural* memory. The term ‘ascending’ clearly indicates programming by the received data. Among the afferent information, part comes spontaneously from the physical environment, the other is administered by the social environment. Stimulating memory by increasing learning is not enough. The organization of networks must

benefit from this. An intention must have formed in parallel to use this data.

Two varieties of forgetfulness in procedural memory. The first is rapid, when a neural configuration advantageously replaces the old one. The previous way disappears because the procedure has changed. The other forgetfulness is slower. It comes from a scarcity of information that created the configuration. The organization crumbles if it is not regularly called upon. Forgetting is a natural, inescapable process. Its speed varies greatly depending on the individual and the age.

Refreshing a faded memory structure is easier than creating it. Imagine a withered shrub, tree having lost its leaves (uncertainties, lack of the word). A new influx of information that trained it is enough to make it green again. *Stratium*'s foundation is most shared by memory objects. It remains the best maintained. This is where the 'memory exists' information comes even when it is not complete. Explanation of this paradox: we know the existence of a *forgotten* word. Searching for it using conscious feedback is random. More effective: relocate to a flow of information associated with that word. It quickly recreates it in memory.

Biographical memory is more specific to conscious intervention. It is formed by its feedback when a significant event triggers a lively, emotional reaction. Conscious assessment is necessarily involved. It makes a memory of it, an object of particular, lasting memory, even if it is not solicited. The tattoo uses special treatment by the hippocampus, the creator of biographical memory. This process is not yet understood. The hippocampus cannot keep a copy of the countless configurations associated with memories. Most likely explanation: that the biographical memory is surimposed on the structural, in an independent level of codification at the level of the synapses. As if a 'like' tag was applied. Very interesting work exists on this subject[4].

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[4] Symmetry of learning rate in synaptic plasticity modulates formation of flexible and stable memories, Youngjin Park, Woochul Choi & Se-Bum Paik, Nature, Scientific Reports, volume 7, Article number: 5671 (2017) doi:10.1038/s41598-017-05929-2

Working memory (short term) differs markedly from the previous two. It is not based on persistent neurological changes. On the contrary, the characteristic of this memory is not to be one, that is to say not to keep anything durably, to quickly replace thoughts with others. It is based on synchronous and persistent oscillations of neural groups.

Indeed, awakened consciousness is a wisp of neurological activity walking on the integrating network of mental functions. It is maintained by the hyperexcitability of these frequently stressed neurons, by stimuli mobilizing conscious attention, by hormonal secretions. Awakening nuclei add their effervescence. Working memory is thus based on maintaining the excitement of the network.

The associations produced can awaken memories or secondarily retro-control structural memory. Working memory is the library worker: it pulls out the requested books and stores those returned, without checking their content. Its role is not to rewrite these books. They are references. Working memory is a property common to all network units. It corresponds to the intervals when the group performs its representative task: maintaining synchronous oscillations in a stable configuration of synaptic weights.

When the group is that of conscious integration, we call it 'short-term memory'. In this interval we can retain sequences of numbers, words or images. Working memory is not waterproof with others. The longer the representations last there, the more likely they are to reappear later. Parrote is nothing else. An authentic brainwashing! Working memory loops sentences until they become embedded in long-term memory. It doesn't matter that they are not even understood. Words can be memorized independently of concepts.

In the detailed development of *Stratium*, I bring these different memories closer to the psychological components: 1) *Psociety* (psychic society) emerges from unconscious procedural memory, assures the usual behaviors, offers consciousness the information to be evaluated. 2) The conscious *Observer*, with its attention managed by short-term memory, judges the consistency between actions and results, adjusts unconscious mechanisms. 3) The *biographical ego* is based on long-term memory, ensures

a temporal dimension to the psyche. It presents to the conscious Observer the state of the project of existence, data gathered in the axis of time and whose evaluation produces anticipations.

Here we find a continuity between the neurological and the psychological.

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From neurons to consciousness

How do action potentials become consciousness? The act of representing is at the heart of the problem.
To abstract is to extract the regularities of the signals. Abstraction is the beginning of intention. Symbolic information is created. Discrepancy between the objectivity of the signals and the subjectivity of the symbol. But the symbol is objective in its own reality. Imaginary reality is intention.
The symbol (synaptic pattern) survives because it is useful. Natural selection of patterns.
The symbol is a compression of the data which does not replace it. Information overlay.
The constitution of consciousness is the stack of information levels. Its experience is symbolic compression.
It expands or fades depending on the degree of connectivity of the conscious network.
Partial integrations: dreams, sleepwalking, mild comas and alternate states.
The stacking of symbolic levels erases the pointillism of the initial data.
The higher the stack, the more difficult it is for consciousness to get its retro-control back into it. Relative independence of levels.
The bridges between piles of different heights explain the mixture, in a *qualia*, between poorly defined (emotions) and precise (visual) sensations.
The number of gateways makes the extensive integration of certain functions (emotions).

The key question has not yet been resolved. The neural < > mental correlation does not provide a clear bridge between the two *phenomena*. How does the organization of action potentials become an experienced consciousness?

Let's take a closer look at the *act of representing*, which is at the heart of the problem. To represent is both to abstract and to recompose (simulate). To abstract is to isolate symbolic information in the middle of composite information. It is not a skill reserved for higher mental functions. It appears at the first level of *Stratium*, when neurons react to the regularities of a set of stimuli. They extract the corresponding information, codify it by their excited configuration. They separate it from the background noise to abstract it. For example, visual neurons identify a series of retinal stimuli of the same intensity to symbolically define a *line*.

The elementary abstraction that we have just described is a mental *subjectivity*. Organization of signals that serves as a symbolic representation of the mind. It is not yet a function associated with the described object. It can be a mere appearance to it. This subjectivity, the simple act of abstracting, is the initiation of *intention*. Abstraction, by separating information from its context, creates a kind of imaginary object superimposed on the real object. The imaginary is out of step with the real, yet *the imaginary is given to the mind like the real*, at this elementary stage of representation. *Intention is born in the subjective assimilated to the objective*, neglecting the gap.

The most consistent regularities for the purpose of the system (survival, etc.) make the most famous representations. Their stability designates them as part of a higher organization. Here we have as fine a parallelism as possible between the physical medium and its purpose. On the neurological support side, ‘representation’ means ‘persistent synaptic weight pattern within a range of stimuli’. On the finality side, 'representation' means 'survival of the diagram because of its usefulness', either directly because the organism survives (reflex utility), or by the evaluation of a hierarchical retrocontrol (*Stratium*), or by its ability to multiply (mimicry and learning).

Abstraction is *pruning*. It separates the symbol from the uninformative noise. The second part of the process, in the act of representing, is integration / compression. It merges symbolic data of different orders into a single representation, without losing its composition. Think about your family home. It only takes a moment for its image to appear, perfectly clear

in your mind. It produces a rich impression, different from the evocation of another house. Yet it does not contain any detail. It's a flash thought, merged. Now suppose you are thinking about this house because it should be sold. The details emerge. The memories present themselves in a rush. The representation is revealed in its complexity. You can browse the tree to the beginnings of its history, extend it to its construction, graft technical aspects. The whole composition has become visible, has temporarily removed the fusion of your initial evocation.

Suppose your wedding takes place in this house. Later the evocation will have a different coloring. Most of its elements haven't changed one iota. An emotional memory was added. Conscious impression retains its uniqueness while having *mutated*. Prestidigitation operated by the fusion process.

The error, about the phenomenon of consciousness, seems to seek a discontinuity between composition and fusion. There is no transition, neither anatomical nor temporal. Consciousness does not come from transferring signals from some networks to others. Since the receiving cells are identical to the transmitting ones, why should the signals adorn themselves of a different quality? Why would they become a conscious experience when they weren't in the other network? What magic power would these new neurons have?

Neurologically a thought is formed from *the extent and persistence of the excitation of the layered architecture* that gave birth to it. Its substance is not based on the number of neurons involved but on the height of their stratification. Adding up a level adds an extra layer of meaning. Without removing the foundations. The stacking of these strata in the same time unit is the *thickness* of a thought.

Why is our consciousness not continuous? Why does it disappear during sleep, while brain activity continues? This problem is the easiest. Its resolution confirms the composite character of consciousness.

The waking state corresponds to a hyperconnectivity of the conscious network. All the higher representations communicate. They are integrated

with bodily effectors. *Persona* can act. The body buzzes with signals, informative and responsive. Sleep interrupts hyperconnectivity and all of these signals. Integration vanishes, and with it the conscious experience of awakening. Mental functions turn in on themselves. They become independent sub-consciousness and experience themselves within their limits. The body reacts autonomously by shaking mechanically. The *Inventor* dreams of its fantastic tales. Biographical memory is not connected. Nothing is registered there. The *Psociety* theater is empty. Each *personae* has gone home, tries to fit into the dreams.

Partial integrations are possible during sleep, causing elaborate automatic behaviors. Somnambulism. Biographical memory not connected, no memory remains. When we speak of an alternate state of consciousness, it can only be compared to habitual consciousness by reaching a state of integration close to it. These states can then experience their differences in content and keep a memorial trace. Whereas it is difficult between partial consciousness and global consciousness. Gradual transitions are possible. The cortex generates closed-circuit dreams during sleep. The return to integration upon awakening is sometimes slow. The transition between dream and 'reality' is then a dreamlike haze that slowly dissipates and leaves evanescent memories.

Stratification explains both the blurred boundaries and the fullness of awakened consciousness. Its strength and extent come from the billions of stimuli constantly arriving from the body. Consciousness is indeed a psychic energy born from this frantic agitation. The synthesis of signals in merged representations, by successive levels, erases pointillism. Attention can only find its way back if its retrocontrol can be directed there. This is the case up to a point in the sensory-motor pyramid. We can identify the location of a mosquito bite, but not an individual sensory or motor neuron.

Retrocontrol is not a control. Consciousness directly manipulates only its representations at the top of the hierarchy. The action on the lower levels is indirect. When consciousness thinks it is acting on unconscious levers, it only represents itself thus. It cannot communicate directly with the lower levels. They don't use the same code. You have the explanation that it is difficult to learn Bayesian mathematics when the workings of the mental

cogs are Bayesian. Consciousness does not *experience* this code. It is forced to *conceptualize* it. The pattern that you form of your mind as you read *Stratium* is… a conceptual aggregate. Representation perched in the true pyramid that is your physical *Stratium*.

The higher the conceptual stack, the more difficult it is for consciousness to send its retrocontrol deep into it. The effect exists but it is impossible for consciousness to feel because of the independence of the levels.

Stratium now meets one of our major prerequisites. It explains the intermediate states between awakened 'full' consciousness and partial or alternative consciousnesses, depending on the integrated mental functions, depending on the conceptual depth involved in the duration of a thought. Let the basement neurons stop activating and the depth of the concept changes. When we close our eyes the scene may be held in short term memory but its 'reality' has collapsed. Thoughts can thus be extended or narrowed in terms of meaning. Their owner has little means of judging, since *she is* these thoughts. She can nevertheless self-represent her mind, draw comparisons with others. Extended thoughts in terms of complexity have obvious advantages but are more expensive and slower (maintaining a large integrating network). Narrowed thinking is efficient and quick if it is well constructed. Our reflexes and habits are as essential as our deep thinking.

An excellent guide to understanding the conscious mood is *emotion*. Special impression in our thoughts. Very different from logical, precise and punctilious reflection, or from the chain of ideas, zigzagging but clear, delimited framework. Emotion is a color, an *atmosphere*, the gas illuminated by the thread of the concept. We can go back fairly accurately to the cause of a feeling, but the emotion itself is cloudy, physical as well as psychic. It encompasses bodily perceptions unrelated to its cause. A theory of mind must explain the qualitative difference between the dry thread of descriptive thought and its kaleidoscopic colors modulated by emotion. Is the skull a computer or a nightclub with a wild atmosphere? The most abstract thoughts trigger orgasms when the *Inventor* makes them, while they are disheartening blandness to an *Observer* learning them from a

notebook. Whether thoughts come together on their own or are forced to come together transforms the feeling.

Emotions are inseparable from conscious integration. We experience them, but it is very difficult to isolate this sensation from other conscious contents. Difficult to divide it into its parts as we know how to do easily with a logical thought. The history of an emotion is unclear. It is not only related to events but also to mood. Window on the body and its physiological adventures. Attempting a taxonomy of emotions seems reductive. Paul Ekman classifies them in 6 categories, happiness sadness fear anger surprise disgust. Plutchik makes complex emotions into basic mixtures of emotions: love = joy + acceptance, guilt = joy + fear. Mathematics flirting with ridicule? All this seems to be disconnected from the range of multiple flavors associating each event with a unique emotion.

Let's go back to the perspective of *Stratium*. Emotion arises from neural networks like any other content of consciousness. Those dedicated to emotion are much less layered than those for more detailed information concepts. They are archaic groups. You don't need a complex hierarchy to synthesize a sentimental coloring. Emotion is a raw representation, quickly communicated to consciousness. Our mood changes a few milliseconds before we have conceptualized the reasons for it. Sometimes the delay is much longer. Emotional discomfort already installed in consciousness, while the recognition of its origin has not been successful. It can take root in the body at a level inaccessible to consciousness.

The fact that emotion is a function with little hierarchy does not prevent it from being hyperconnected. Metaphorically, *Stratium* is a huge interior atrium whose floors are connected by walkways. The facade dedicated to emotions has few levels, but from these an equally large number of gateways springs to the other sections. Emotion is richly integrated into the mental structure.

What happens in conscious fusion when sophisticated concepts are combined with simpler ones? Take the representation of a work of art. It incorporates evocations, technical criteria, an opinion on the author, and raw emotion. What overall result? The experience fits perfectly with this

two-component yet smooth mixture: a visual image with its traceable relationships, all surrounded by a soft or lively, warm or icy sentimental lighting. As we strengthen or relax the sharpness of our attention, the impression shifts from analytical to fusional.

You have understood, with the example of emotion, how to match qualia with their mental content *in terms of organizational height*. Coarse, ill-defined content indicates a modest number of processing stages. Precise content, rich in a multitude of identifiable parameters indicates a dizzying height of the conceptual stack. Another observation: the fullness of a sensation is a different notion. It does not correspond to the height of the stack but to the number of gateways to other mental areas.

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Examples of practical applications

Deciphering face identification: Le Chang and Tsao crack the code for face identification in macaques, concluding that the 'grandmother neuron' hypothesis is wrong. Interpretation error. The decryption involves 200 neurons at the base of the macaque's *Stratium*, recruits many more for a multi-criteria association, then shrinks at the top onto a single neuron, symbol of the macaque's grandmother.

Maturation of the psyche: The intrauterine « I » is a globality with the world. Forced separation at birth, followed by a natural effort to reclaim the world by representing it. Maturity is granting the consciousness of others genuine independence rather than equivalence, which is always an effort of appropriation.

Why the domination of Homo sapiens? Homo is characterized by an astonishing diversification of individuals without splitting the species. Brain less programmed at birth. Ancestral parturients who saved their premature babies?

Addictions, from imperative to controlled envy: An impulse accesses the commands of behavior all the more easily as it is insensitive to the hierarchy of retro-control. The reflex loop is brief. Consciousness is alerted to the desire that is being executed. It can't stop anything. To inhibit a drive

is to integrate it more into the complexity of representations, to raise it in the *Stratium*, to put it in competition with other desires, to give birth to them.

Pain: Diseases migrate easily from the biological to the psychological level of the *Stratium*. The therapist must know the level to intervene. A chronic pain, identitary, can not be treated with analgesics or sedatives, but with a rehabitation of the psychic society (*Psociety*) by attractive tasks.

Here are some problems at the intersection of the disciplines of the brain. Some have received an official explanation, others have not. I have deliberately chosen very different subjects to show the versatility of *Stratium* as a common thread. Neuroscience: decryption of facial identification. Developmental psychology: maturation of the psyche. Anthropology: why the domination of Homo sapiens (rather than another animal). Psychotherapy: addictions. Medicine: chronic pain.

The decryption of face identification

Thunderous success story for neuroscience in 2017: Le Chang and Tsao publish *The Code for Facial Identity in the Primate Brain*[5], remarkable study on the identification of faces by the macaque. The retina transforms a face in the visual field into a high resolution dot matrix. Each neuron involved in decryption is sensitive to variations in one of 50 viewing angles. It does this independently of the others, as if each neuron were placed on the wall of a sphere surrounding the face and contemplating it from its particular position.

Inventive work, clear demonstration. Yet the researchers' merit is marred by an additional, more misleading conclusion: « This code disavows the established assumption that single cells encode specific facial identities ». Le Chang and Tsao declare the 'grandmother neuron' hypothesis false (also cited as 'Jennifer Aniston's neuron'). Previous experience had shown that stimulation of a single neuron can induce the evocation of a known person at the guinea pig.

[5] http://dx.doi.org/10.1016/j.cell.2017.05.011

Le Chang and Tsao studied general face recognition, not grandmother's macaque identification. What happens to the output of the 200 or so neurons engaged in facial recognition? The level targeted by the study is the basis of macaque's *Stratium* (explaining why so few neurons are involved). As you climb the levels, a host of additional neurons entangle their own criteria with the morphology codified at the base. Enlargement of the number of neurons involved. Then the synthesis operated by the symbolization potentially narrows the vertex information on a single neuron.

Graph theory applied to neural networks. The output of a neural group is made up of the state of its vertices. The vertices participate in the change of state of the upper group. Gateways involve groups that have not been stimulated by the retina. At the top of this globular pyramid, the excitement is concentrated on certain vertices of the highest neural graphs. A few hundred neurons only, as for the base. The number of memorable faces is not unlimited. The symbolic value of these activations at the top is much greater than that of the neurons at the base. A multitude of recognition criteria are integrated into it. The small number of symbolic neurons ensures accurate identification of the person within the conscious network.

With a complex way of thinking (neural patterns as a self-organized hierarchy) Le Chang and Tsao would not have come to this conclusion. A good interpretation should say why the alternatives are wrong, not just state them so. In this case, *Stratium* declares that the concepts facial code and 'grandmother neuron', far from being contradictory, are perfectly complementary.

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Maturation of the infantile psyche

The fetus reproduces a phylogenetic history during its development, which continues in the infant in the construction of its conceptual edifice. It goes through archaic forms of social relations, then 'civilizes' these primitive reactions by weaving more complex layers of consciousness. We are all born in the state of *Groumpf!* Long task to get out ...

The first step in self-awareness is to lose the sense of being *everything*. 'Self' is in 'something'. The intrauterine « I » is a wholeness with the mother.

Individuation does not come from growing but from being in relation. The primitive « I » has difficulty separating context (maternal heartbeats, metabolic changes) from its own essence. The early stages of the embryo are just clusters of cells among others. The first nervous stimuli differentiate regions, but not yet an interior and an exterior. Birth marks a major break. The world is imposed. It is no longer an extension of the body. « I » am starting a forced separation.

What is her reaction? « I » am trying to re-aggregate to myself what has separated from it. I build representations to reclaim it for myself. It's hard to see anything or anyone as entirely independent, alien. It's scary. My curiosity, my desire to learn, is a natural effort to keep the universe a part of me. My parents belong to me because I represent them. *Persona* endowed with characters, reactions in such circumstances, satisfying desires. I fabricate these *persona* with my nascent elements of sensitivity and abilities.

Childhood is a slow transition from *an inability to know* to *active blindness*. Inability to know that the world itself is inaccessible. Active blindness to the same, to protect my insurance. It is not a refusal to know but a refusal of ignorance. Accepting to know begins with accepting my ignorance ? No. I have an explanation for everything. Even what I don't know is explained by the *mystery* status. Waiting for more precise. Nothing is out of reach. I went from "an infant with absolute pretension but without means" to "a child chasing the absolute with more means", but still blind to the fundamental separation between me and reality per se.

As a young adult I am seized with the desire to travel. I feel my representations are strong enough to extend them. Further improve my control over the world. Visit and bring back the experiences, the opinions, which reappropriate the mysteries to me. I am beginning to really, laboriously experience that a multitude of different rather than equivalent Me(s) exist. Multiverse of minds that definitely makes the hope of keeping the world within oneself utopian. The initiatory journey only ends with realizing the absolute impossibility of merging into someone else's consciousness. Previously, I tend to convince myself that I know people "better and better", that I am able to merge with them. Fragile illusion. What I share with them are words, concepts, more or less similar bricks of

our minds. They establish relative proximity. Emotions, raw and whole, are the easiest to merge. But I still don't have the slightest access to how other people *experience* their consciousness.

It is by becoming aware of this ultimate barrier that it no longer becomes an obstacle. To neglect it is to want to assimilate the other to me. Do not respect her individuation. Fusion is not vampirism. It is by maintaining the juxtaposition that the weld to the other becomes complete.

Quantum analogy: The location of a particle is only a probability until it is measured. Observation materializes it. It is the same with consciousness. Locate the location of other people's consciousness by measuring her words, opinions, concepts. Her 'me' is impossible to pinpoint until such a sighting. It is still only a space of potentiality. I cannot mix my consciousness with another. The feeling of being merged comes from the similarity of our representations, but I can only experience my own consciousness. The only space where representation and experience are confused. The only genuine objectivity.

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Why the domination of Homo sapiens?

We have investigated a lot of the specific functions of the Homo kind. But have we gone back to the root of these amazing skills? Should we look for the rise of Homo sapiens in its prehensile hands, its tools, language or cooperation? Or should we look further down, especially how it has diversified? Amazing diversification of individuals within the species without breaking it down. Society maintains the common genetic pool.

Developing language would be of little use if people all thought the same thing, reproduced the same behaviors. Language is a translator. Words multiply when thinking diversifies. Is cooperation more of a cardinal factor? Many species are more cooperative than humans. Beehives spreading an ultimately undiversified species.

Humans are the only ones to give birth to very poorly completed offspring. The infant chimpanzee is smarter than the human infant. More wired originally but less likely to learn. Human offspring start off unprepared for life. Years of protection, training and supervision are needed to make her

independent. On her virgin brain, the environment creates more diverse patterns than the genetic code. Self-organized and unscheduled hierarchy. The rise of Homo sapiens stems from her vast field of thought, which is then reflected in its languages and customs.

Which starter was able to launch his preeminence? Perhaps ancestral parturients, instead of throwing away their premature babies, surrounded them with care. Their descendants are born more immature than those of other primates. Less programmed brains, more likely to shift from and take control of their environment?

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Addictions: from the imperative to the controlled

Regardless of self-control, we have cravings that override conscious acquiescence more easily than others. What is the neurological and psychological reason for this?

Take the very simple intention called 'reflex'. Sensory stimuli directly trigger motor action. Very few neurological stages are involved. Only those of the coordination of the motor fibers depending on the sensory site. The stimulus, despite its minimal sophistication, acquires the status of intention.

It's not always that conqueror. As it passes through many levels of *Stratium*, is assessed by a series of checks, it sometimes fades without triggering a single gesture, or even a vague thought. It did not access conscious space. The reflex loop has opened and not necessarily closed with an act.

Conversely, some actions are not necessarily consecutive to a sensory stimulus. Cortical neurons are the site of intrinsic activity. Groups are easily awakened to, or watch for, the slightest stimulus, like reward circuits. The neural tasks which are connected to them are favored.

A stimulus, whatever its origin, is all the easier to fine tune as it is integrated into complex representations. Each adds its own feedback, extends the stimulus circuit. A reflex becomes an act consciously approved on elaborate criteria.

The very type of imperative envy is bodily need. Powerful impulse, reaching in a straight line into conscious space, little integrated in the meantime. The characteristic of the bodily drive is that it is as powerful as it is fused. It is not defined, decomposable and manipulable like an abstract idea would be. This is a directly working bulk intention. Mobilize your conscious inhibition, it won't last long! Reflex only slowed down. It will act anyway if the stimulus keeps its intensity. The role of consciousness is not to prevent impulses but to think about ways to avoid their unwanted effects. It is a function that appeared *above* the primary bodily needs, which would be a little lonely if it sought to replace them.

In short, the more a desire is structured by a significant height of *Stratium*, the more it can be reoriented, delayed, sublimated, removed. Consciousness puts it in competition with other desires. Their presence makes the former less directly active. While an impulse connected without intermediary to the consciousness and to the motor centers clearly takes the controls of behavior. Physical addictions are thus much more difficult to extinguish than psychological ones. The former are self-fulfilling, directly creating their right to exist in conscious space. The addiction is acting. Psychological addictions are more diverse and easier to compete with others.

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Pain

The applications of *Stratium* to medicine are endless. Classically, diseases are separated into two main categories: biological and psychological. All in fact participate in both, some centered on intermediate levels. Correct identification of the dysfunctional stage is essential for the therapist.

Take the example of pain, considered too exclusively a symptom. Therapeutic procedures aim to make it disappear or at least reduce it. *Stratium* shows that pain is an *identity* in the psyche. Conflictual in the healthy psyche, it becomes *existential* in the chronically painful. The patient is no longer a spectator of the outbreak or the disappearance of his suffering, she *is* her pain, in her mental intimacy. Mental pain-*fame* inevitably changes the personality. The changes are neurological. The *Observer* is able to see it, but this self-observation has very limited powers when pain has become identity, has taken hold of *Psociety* and dominates it,

pushing aside all other necessities. The pain persists and gets worse because *there is nothing else to do but be painful*.

Any period of misunderstood or poorly controlled pain changes the personality. Sometimes irreversibly. Waiting for the next episode. Increased anxiety. Generalization of the wait-and-see attitude to other behaviors. Despite these obvious disturbances, medicine is primarily interested in the long-term effects of therapeutics, deciding that the short-term effects on pain are not worthy of attention. Maybe acceptable if the body was just a vehicle. But it is inhabited…

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Stratium versus other theories of consciousness

Are the concepts at the service of « I » or « I » at the service of the concepts? Opposition existentialism / behaviorism, becoming useless with the double look.
Stratium is a representationalist theory, by nature compatible with the epistemic approach of the philosophers.
The concept 'qualia' is spoiled by its connotation "a phenomenon impossible to relate to physical processes". A qualia is proven as constitutive fusion.
Integrated information IIT (Tononi): measure 'Phi', index of consciousness related to the amount of integrated information of the brain. Make the connection with the inanimate. But gives a high index to complex non-conscious entities. It lacks the qualitative hierarchy of *Stratium*.
Adaptive Resonance ART (Grossberg): Neural learning model that links neurological and psychological processes. Very documented. Correlative model which does not cross the obstacle of the 'hard problem', unlike *Stratium* and its surimposition.
Global Workspace GWT (Dehaene): Founds consciousness on a specific pre-frontal cortex / hippocampus circuit. Integrate the biography into the consciousness. But reserve the quality of being conscious for brains endowed with such a circuit. *Stratium* makes consciousness independent of the container.
Hierarchical mechanistic mind HMM (Bacock): makes entropy minimization of free energy a universal principle even in neural organization. Corrects

defects in the IIT. Ontological model closest to *Stratium*. But still does not explain the phenomenon of consciousness.

The realism of *Stratium* is to show how everyone can establish their own theory of consciousness and behave according to this model. Separation of the conceptual plan and the processes. Relative independence since the plan can reverse-control processes and increase its veracity.
Neglecting the information hierarchy brings a lot of reductive interpretations to genetic studies.
The 20th century marked the rise of personality theories. The twenty-first is that of their flattening under the steamroller of neuroscience. Replaced by the mediocre 'Big Five', a simple model of temperament.
The theater in which to place your inner *persona* has disappeared. Isn't it the greatest drama, if a reductive plan replaces it in our minds? Aren't we already AIs made by neuroscience?

The mind is its own creator, while its ingredients do not belong to it.

We are at a time when science is readily seen as a guillotine. Which begs the question: are the concepts at the service of 'I', or 'I' at the service of the concepts? Impossible to answer without resorting to a postulate. If you believe in a principle of consciousness superior to its physical support, representations must dominate it. Phenomenological and existentialist stronghold. If you believe in the primacy of sensory impulses, it is the representations that shape the psychic face. Behaviorist stronghold. *Stratium* makes this opposition unnecessary. Representations do form the heart of our personality, but in such an organization they no longer have anything in common with their initial level of information. They have become intentions.

How does *Stratium* behave in the face of existing theories? The upward look is that of neuroscience. Same ontology. The divergences appear with the materialist theories of consciousness, precisely because they are only materialistic. Amputated downward look. A specific theory of the downward look is *representationalism* in philosophy. Same flaw, in the other direction: weakness of the ontological look. The disagreements between these approaches come from a unique source: the absence of a meta-

principle connecting the upward and downward looks, condemning them to remain contradictory.

Under the upward look, the most interesting theories are Integrated Information, and the Hierarchical Mechanistic Mind. I will also confront *Stratium* to: adaptive resonance, global workspace, multi-modal user interface, attention scheme. Quantum consciousness, which is very fashionable, is of no interest and will be discussed later in this book.

Representationalism

1) *Standard branch* (first-order representationalism FOR), a mental state is a conscious phenomenon through the intentionality of mental representation. This seeks to exist as such and nothing else. The properties of the phenomenon are not those of the experience but of what is represented in the experience.

Pros: The transparency argument. Different elements of representation can pass through a single conscious experience. These can then be the subject of ontological modeling. Opening towards the reductionist treatment of consciousness by neuroscience.

Cons: Does not take into account elements of a different nature (mood, abstraction, bodily sensation) or contradictory within the representation. Example: you are looking at an optical illusion. 2 lines seem to you to be divergent when measuring they are parallel. The visual impression accommodates two contradictory things: divergent lines for sight, parallel for reason. How can they be part of the same representation?

2) *Higher Order Representationalism* (HOR), criticizes the lack of explanation by FOR of the mental state experienced as lived. For HOR you need a representation of the representation, which is the higher order. Principle of transitivity: the transfer from one representative space to another allows you to experience the sensation of watching yourself think.

Pros: The idea of a higher representation opens the way to the hierarchy of information and the richness of conscious impressions, an idea fully exploited by *Stratium*.

Cons: only two levels, this is too restrictive a view to explain the wide range of conscious states. Self-observation is far from constant. We must invent 'empty' higher order states. Not convincing.

3) *Self-Representation* of consciousness (SRC), a mental representation contains its own ability to represent itself. FOR and HOR are unified. I spare you the quarrels and theoretical branches resulting from these clashes. The distinction between SRC and standard representationalism becomes blurred. In fact, SRC is called representational theory in the contemporary sense.

Stratium vs Representationalism: *Stratium* is inherently a representationalist theory. But it does not make the representation an image without thickness, a sort of mental photocopy of the corresponding neurological states. It structures mental representation as a material entity, using the more general theory of reality that I set out in the next chapters. So it is possible to escape eliminativism, which philosophies fight for good reasons.

Before leaving philosophy for the neurosciences, let us briefly mention the *qualia*. This term refers to conscious phenomena experienced in the first person. To experience a scent, a color, an emotion, a mixture of it all. The reputation of the term 'qualia' has been tarnished by its use as an anti-theory of consciousness. Some wanted, with it, to make consciousness inexplicable, to put it forever beyond our comprehension. 'Qualia' is the part of the phenomenon that cannot be related to physical processes.

This idea is fundamentally distorted by a sanctuary of the 'I'. Consider the classic question: "What is to see red?", or "What is it like to feel fear?". No response in correlated neural states. But the reasoning is vitiated by the presence, in ambush, of the homunculus, the 'I' who sees the red, who feels the fear. A believer of qualia does not understand that it is the red that experiences itself, the fear that desires to enter into existence, within conscious integration. The fact that there is a conscious content *Observer*, a mental task dedicated to this assessment, does not make it a soul or any other intangible process that would witness the experience of red or fear. Fortunately, the bluff surrounding the notion of qualia has become

unpopular in the field of philosophy. *Stratium* denounces the problem by saying, « Our individual consciousness is the only thing we can truly experience. Everything else is represented there. »

Integrated Information Theory **IIT (Tononi, Koch)**

Uses the principles of Shannon's information theory to measure the amount of information integrated into the brain. The measure called 'Phi' (Φ) serves as an index of consciousness.

Pros: Roots consciousness in general systems theory, connects with the inanimate.

Cons: Some systems with very high Φ absolutely do not meet the definition of a conscious entity. No link is made between informative integration and experiencing[6]. Shannon's theory cannot be applied to the brain as it is. It is not qualitative. It concerns a defined set of states linked by fixed probabilities. But the brain is constantly generating new information.

Stratium vs IIT : *Stratium* takes up the notion of integrated information but with a qualitative hierarchy, which makes any general quantitative measurement of consciousness illusory. Consciousness expands by integrating parameters into this hierarchy. But we cannot add objects, emotions, abstractions. *Stratium* explains that primitive animals and even plants seem to us to be endowed with consciousness, because they have a significant decision-making hierarchy (sometimes purely biochemical, without any neuron). While the integrations of much larger volumes of data (digital A.I., virtual networks, companies) have a weak hierarchy and do not appear conscious. Shannon's theory applies to a unit-network, but not to the whole brain.

Adaptive resonance ART (Grossberg)

Neural learning model that links neurological (learning, attention, resonance and synchronization) and psychological (visual, auditory, feeling, knowledge) processes. The correlations were then extended to

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[6] For a detailed review of IIT : Why I Am Not An Integrated Information Theorist https://www.scottaaronson.com/blog/?p=1799

consciousness. The principle of resonance / persistence of activation of neural networks explains the maintenance and succession of mental microstates.

Pros: models the antagonism between plasticity / instability and rigidity / stability in neural processes; has benefited from detailed development for most brain functions. Most documented official thesis.

Cons: does not explain why some of the resonant neural units participate in consciousness and the others not; in particular does not account for the constant conscious content and the inaccessibility of some others. Do not cross the obstacle of the 'hard problem'; simple correlations are established between the resonance of the patterns and the conscious impressions.

Stratium vs ART: *Stratium* also uses the principle of the persistence of neural excitations as a physical support for mental microstates. However, it makes the delay between synaptic stimuli a capital point of the conceptual code. It is not a question of afterglow or resonance but of re-excitations defining the celebrity of the patterns concerned. The principle of prioritization at the heart of *Stratium* fills the shortcomings of ART. Resonance, as a physical phenomenon, is not sufficient to explain the formation of a conscious impression; this comes from the structural integration of information.

Global Workspace GWT (Baas, Dehaene)

Bases consciousness on a specific neural circuit including the pre-frontal cortex and its connected areas, in particular the hippocampus. Information relevant to consciousness is massively disseminated to this network. The relevance of a representation is that it is 'expected' by the conscious network.

Pros: finely links the different conscious states to the activity of the networks concerned; incorporates the notion of biography, the inclusion of the hippocampus (long-term memory) bringing a temporal dimension to consciousness.

Cons: reserves the quality of being conscious for brains endowed with such a circuit. It is taken away from most living things, whom we have not

interviewed but who probably have conscious experience. Confusion between the conscious process and its contents. Does not make the connection with the unconscious neurological structure, remains obscure on the way in which this one participates in the conscious impressions. Finally, the reprocessing of information by a separate neurological assembly is costly in terms of resources and unlikely in the evolutionary plan.

Stratium vs GWT: Our theory fully adheres to the concept of integrating space for consciousness, but in a very different way: a small number of neurons are involved, instead of entire and specific areas of the brain. The pre-frontal cortex adds evolved functions (capacities for abstraction, self-representation, language) but the integrating space itself is not an evolved function. It is the pinnacle of all neurological architecture, at least in animals with a central nervous system. The brain has evolved through the addition of functional layers. The current top space is just the latest version, enriched with pre-frontal skills and not created by them. Separating the phenomenon of 'consciousness' from its contents, *Stratium* attributes it to any neurological device, to the tiniest brain. It can explain it for organisms without neurons, since the definition of the phenomenon is based on self-organization.

Perception by multi-modal user interface PMUI (Hoffman)

denies that the role of perceptions is to approximate the objective world. They simplify and reformat them for a purely utilitarian purpose for the user. This scene is the user's reality. Hoffman undoubtedly wronged his PMUI by associating it with conscious realism (CR). In this more controversial part of the theory, it is no longer reality that builds consciousness but consciousness that builds reality. Sanctuarized spirit.

Pros: Shows the mind is suspended in a reality of its own. CR skillfully reverses the mind / matter problem: it's about figuring out how the user constructs their interface, which we do best.

Cons: RC poses insurmountable difficulties. How do different consciousnesses manage to create the same objects? Why do physical theories lead to discoveries that no consciousness has imagined? CR is

contradictory with the argumentation of PMUI: PMUI supports the evolutionary thesis while CR throws it into oblivion. Conscious intentions are parachuted out of nowhere.

Stratium vs PMUI: *Stratium* sees perception in a similar way: utilitarian. Most satisfactory hypothesis for evolutionary theory. However, Hoffman neglects an essential part of the utilitarian foundations: the need to reconcile the world and our fellows. The mind is not just individualistic. The collective is pushing for a stage that garners general approval. So much the better if the world itself complies with it. PMUI asks a wise question: What in the world is compliant? Unlike competing theories, *Stratium* can respond, by being included in a more general theory of reality. Perception records the level of reality to which it belongs. It models the system in which the organism participates. Vital necessities are met through this model. The definition of 'vital' evolves with the environment. It becomes virtual satisfaction in a society ensuring bodily needs. Each thus creates its reality.

Diagram of attention DAT (Graziano)

makes the difference between paying attention and 'being warned of'. Attention is a mechanistic process (neural processing of information) while consciousness is a model of attention constructed by the brain, persuaded of its own existence and insisting not to make it a mere illusion.

Pros: Explains that there is nothing behind conscious impressions, no access to the neural machinery.

Cons: many contradictions. Why would this pattern be conscious and others not? What is its evolutionary interest if the mechanistic process is sufficient? No connection to the neural machinery. Does not account for the varying limits of consciousness, which is moving more or less towards its unconscious foundations: the circuits are not clearly independent.

Stratium vs DAT: By abandoning the idea of making the unconscious into a single system, our theory escapes the contradictions of DAT. The unconscious is also a series of self-representing layers of information.

Hierarchical mechanistic mind HMM (Bacock)

inspired by the notions of emergence and complexity. As emergence remains uncoded in the physical sciences, HMM makes entropy a universal principle (minimization of free energy) even in neural organization.

Still confidential, HMM is the closest to *Stratium*. Best ontological theory with IIT. But both are pure upward looks, not addressing the phenomenon of consciousness.

Shortcomings common to all these theories: no phylogenetic or embryological rooting. Lack of practical applications. Ask them if a fetus or an animal is conscious? Include a theory of personality? What therapeutic recommendations to act on depression, existential difficulties, learning concerns? Among the burning questions of the day, do they predict whether an AI can be conscious, and the necessary conditions? Finally, the most obvious deficiency, none of these theories explains how information as foreign to each other as images, smells, abstractions, emotions, categories, memories, etc., can relate and be aggregated together to form the conscious impressions. Horizontal visions. They put the pieces of a puzzle together but do not merge their patterns and colors into a single impression.

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The realism of *Stratium*

What goes through your mind when you read *Stratium*? I am transferring into your consciousness a pattern of mental functioning, a layered image but not implanted as a layering in your mind. This would require that I independently apply each concept level in your corresponding level. You would then be deeply convinced of its veracity as the owner of its entire composition. Work patiently attached to school teachers. Check the levels the student has, adding more. Increase the depth of understanding.

I don't know what levels you have. To adopt *Stratium*, other unconventional levels are needed. Task of the next chapters of *Surimposium*. It is in the end that the full meaning of the theory will be reconstructed in your head and mine. Only then, after this feedback on the foundations of the concepts, will you be able to experience the consistency of this stratification in its subconscious extension.

Note that with this process, any theory can do. Suppose you are a follower of another model, for example that of Freud. The feedback from your psychoanalytic readings influences the lower levels to be consistent with this system of thought. Freudian theory becomes identity. At first you are just interested. Only your *Observer* is seduced. Then you are convinced. Psychoanalysis is becoming a celebrity in your *Psociety*. The longer this preeminence lasts the more difficult it becomes to change your mind. Your unconscious structure has adapted to the theory. It permeates your personality. But sometimes a tiny irritating thorn, a fact that doesn't find its place, turns everything upside down.

Stratium sets itself apart by welcoming the very wide variety of personal theories of reality. The way you view your own mind is an important part of its construction. Several compete sometimes in the same person. It is intrinsic to the term 'polyconsciousness'. Its validity is experienced in a set of common phenomena: the ability to lie, small voices, words that one would like to catch up on, contradictions, assumed or not. Personality 'facets' that yet we experience fused together. It is the analytical *Observer*, by refining the representation of the self, who sees it differently. Stormy and vociferous assembly, impossible to unite for long, dominated by the loudest and most famous voice in the moment. Sometimes it does not seem to belong to us. Instinct from the depths of time. Or infantile reflex, emerging at the controls. Or mimicry, an easy solution but which does not entirely satisfy us.

A complete theory of consciousness must explain this plurality, which recomposes us without leaving us chaotic. We are, at the very least, *multi-conscious*.

There are many adages related to polyconsciousness. "A man seeks mother, wife and mistress in a woman". Example of *persona* count. Persona are symbolic and unrealistic characters. No actor clearly individualizes itself in our inner theater. They are high-level conceptual clusters, neural patterns that do not differ physically from others, except in their high hierarchy. Persona are the link between the psyche and neurology. They may eventually be integrated into a therapeutic project.

The absence of a scientific model of the personality creates a lot of difficulties for psychiatrists. There is a strong temptation to descend the basis of mental diagnosis on the only levels modeled by science, genetics and neurobiology. Particularly reductionist approach given the complexity of the mind.

The role of the brain is not to provide metabolism. It coordinates other organs and behavior. It adapts them to an anthology of dissimilar situations. To the jolts created by other fanciful living beings. The conceptual pyramid has become more complex. Multitude of levels of information interspersed between genetics and conscious decisions. The reduction in gene behavior is a crude statistic in humans. At best, the studies relate to fairly modest over-risks, when we would like unassailable judgments. Make a prediction of moral qualities starting from the purine bases? When we have no model between them? The neglected depth of information is matched only by the delusions of researchers. Yet these shortcuts still fill textbooks and monthly magazines.

Ironically, the most obvious relationship between genome and behavior is inapplicable. A major genetic peculiarity! An entire chromosome is replaced by another. A Y takes the place of an X in males. Does it statistically cause psychiatric disorders? Certainly, since 90% of the incarcerated population is male. But it would be awkward to make unfortunate Y a danger to the species. So here we prefer to blame culture.

Because the Y chromosome is very widespread. Almost half of the popularity accommodates the defect. Miraculously, a significant number of carriers appear to be able to control its effects and remain allowed to roam free. Evil tongues say that their aggressiveness also allows them to control scientific publications ;-)

Blithely overlapping from gene to criminal act while neglecting the complexity of intermediary psychic organizations allows above all to pass on personal convictions, often partisan on the innate or the acquired. Bankruptcy of eliminativism. Prediction entrusted to the micromechanism. Researcher focused on her level of information. The 10 categories of

personality disorders of the DSM hesitate between biological and clinical determinants, by not knowing the path between the two. But it exists. Do not let psychiatry get locked in its basics.

Do we have, as with consciousness, official models of personality to compare to *Stratium*? Not really. The 5-dimensional model (Big Five) is based on traits of temperament. Positioned at the foot of *Stratium* pyramid. It brings personality criteria such as length, width and height are criteria for an object. A very brief description. The *Psociety* wants to be a more elaborate scene. Each of us can, in this interior theater, interview our identity persona.

In the book *Stratium*, of which this chapter follows, I reviewed the classic theories of personality. They have multiplied in the last century, from Freud to Minsky's mental micro-robots. *Stratium* accommodates most of these approaches. It goes so far as to make Buddhist and Hindu philosophies compatible, which differ in their visions of the person. The Buddhist *skandhas* separating the individual into 5 aggregates (body, sensation, perception, volition, consciousness) oppose the Hindu concept of one human essence (*ātman*). The *skandhas* are found in *Stratium* hierarchy, while *ātman* emphasizes the fusion achieved on each floor and especially in the conscious space. The contradiction disappears.

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Synthesis

The simplicity of our mind lies in its ability to resolve conflicts,
and its duplicity, to maintain them.

Consciousness is both a *structural* and a *holistic* notion. It is the workspace formed by the superstructure of the stratified organization of neurons, feedback on it. The size of this space is determined by the number of neural groups simultaneously connected, these groups themselves overseeing specific mental functions. Essential regulation is provided by activating neural nuclei, which during awake accentuate the intrinsic stimulation of the conscious superstructure.

The *contents of consciousness* constitute the richness of the phenomena experienced by 'I'. They explain the variety of feelings and aspects instantly taken by 'I', its perpetual dynamic. Confluence of representations provided by mental functions, range from crude (raw bodily sensations) to sophisticated (abstractions). This assembly is not chaotic. It is structured in *Psociety* (elements of personality or *persona*).

'I' is the fusion of the contents of consciousness. When these contents harmonize easily, 'I' is assured and *surfs* on its personal reality. It does not matter that some content is erroneous or even aberrant. The doubts of 'I' come from conflicting representations. The extension of content is therefore potentially an embarrassment in finding this conscious homogeneity and its assurance. Balance to be sought between the intrusion of problematic content and existing insurance. The *thickness* of 'I' is reinforced by the number of content that is ultimately successfully aggregated.
Conscious fusion is thus opacified to its intrinsic conflicts. It ultimately feeds on its self-representation. Self unified temporally, including in particular a *realized* future, around a personal work.

Biography is the mental librarian which, at every important event, recalls the stories on which to build. Temperament traits organize books in the library into persona. Coherent and independent behavior profiles selected by the context. Personality is the meeting of persona, readers of the library. Their speech forms the thread of thought. Character is a somewhat reductive classification of personality, based on social reactions. 'Character', 'temperament', are descriptions and not acting representations. But the separation is not waterproof. Being told repeatedly that you have a certain 'character trait' and making it your own transforms a description into an identity representation. Constant bidirectionality.

Instincts are the most archaic section of the personality library. They root the other contents in the necessities of the body. Rough and powerful. First to launch a response to vital threats and needs. Thus they readily emerge at the controls of behavior, even before other mental functions have been able to retro-act. Deadlines are critical. Acting puts an end to the confrontation of alternatives. The force of instinct inhibits feedback. The relative independence of physical and mental necessities is preserved.

The *Observer* is the conscious function specializing in the evaluation of feedback. It develops representations of the Self, in the environment, in society, of society in the midst of the world, of the languages used.

An *act* is an ascending decision, starting at the bottom of *Stratium*. It climbs the body's information levels, instincts, *persona*, *Observer*. Structural memory and biography contribute to the choices throughout this ascent. The act may already be in progress (motor effectors solicited) but feedback can operate on each stage and modulate the way of acting.

The experienced consciousness phenomenon comes from the *surimposed* conceptual pyramid that supports it. The surimposition of levels is physically the persistence of excited neural patterns with their reentry. Consciousness is not only generated by this information but also the feedbacks. The phenomenon also has a temporal substance that we will detail over time in the chapter 'Metalanguage'.

What neuroscientific references for *Stratium*? Most of the studies fit easily within its framework, with interpretations to be reconsidered. Some directly support the theory.
Recent example: the integration of functional brain activity from adolescence to adulthood[7]. The BOLD signal fRMI technique has been used to test the connectivity of neural networks in patients aged 8 to 46 years. The local connectivity of young brains transforms into larger and functionally distinct networks as age advances. *The stratification takes place*. The higher levels, based on wider integration, are the evolution of conscious space. 'I' am more integrated, start to observe myself. How high will it climb?

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7 The Integration of Functional Brain Activity from Adolescence to Adulthood, Prantik Kundu, Brenda E. Benson, Dana Rosen, Sophia Frangou, Ellen Leibenluft, Wen-Ming Luh,
Peter A. Bandettini, Daniel S. Pine, and Monique Ernst
Journal of Neuroscience 4 April 2018, 38 (14) 3559-3570; DOI: https://doi.org/10.1523/JNEUROSCI.1864-17.2018

Interlude

Let's summarize what we have learned with *Stratium*: the mind is a stratification, both physically with hierarchical neural groups, and virtually with concepts organizing with increasing complexity. Through this conceptual pyramid we contemplate the world. We say it real or virtual, with their dedicated poles. But it all happens in the mind. It is about his *relationship* with the real and the virtual. *It is important to differentiate virtual representations of virtuality from the mental processes that make them*. For example the process may be Bayesian and be unable to represent what a Bayesian process is.

The transition is of particular interest to us. How does a process manage to model its own functioning? In the horizontal way of thinking, it is impossible to say why one represents the other, except in a cowardly '=' sign. The transition becomes understandable with vertical thinking and its *surimposed* levels of information. Forming an 'idea' (awakening a representation) is not taking some kind of photographic snapshot of the subject, which would be caught in a mysterious universe called imagination. It is to complete the organization of an assembly of concepts describing the subject in its different aspects. Consistent synthesis with related subjects. Here no reference is made to 'reason'. An idea may seem ridiculous to all but one who finds it coherent. It is in principle a valid solution in this singular mind. How else would it stay there?

Our relationship with the world is the coming together of two self-organized pyramids, that of the structure of reality and that forming our representation of this reality, including ourselves. Where does the quality of a representation come from? From its bases. It's not always apparent. Sometimes we think right for the wrong reasons. Ouch! Making a mistake would then be less serious than coming across the truth straight away, as any teacher knows (we learn best from our mistakes). The quality of a representation is judged, *Stratium* says, separately with each organized stage of data, and not just with its conscious integration.

In the next chapters I will show that material reality is structured the same. It doesn't make mistakes, but something very close: *approximations*. Already the source of an intention in matter? We will first check that our mental bases coincide. To bring the real and virtual pyramids closer together, our starting points must not be too far apart.

Language is in a way the distribution system of our mental architecture. Its elements connect the levels. Words derive from others. At the base are the notions of identity and difference, order, categorization. The information is sorted. But then, how to bring them together? How to build a meaning? The mind is thus a succession of alternations between classifications and syntheses.

Difficult to define the primary concepts. They are the origin of all the others. The words match but can't be explained. Without any other means, we take the flowery language of the top to describe the base. Circularity? Fortunately, consciousness has a wide variety of codes. It can be multilingual, create several logics, add mathematical frameworks. Expanding the languages of the top allows you to better center the words of the base. Widening perspective. This is how strange artistic creations improve our understanding of the fundamentals of the world. Poetry, music, imaginary tales, the phantasmagoric reality of paintings and sculptures, these works help to better identify reality in the midst of a multitude of distorted, unsuspected virtualities.

Ceaseless back and forth between the base and the top of *Stratium*, between the data of our perceptions and our image of the world. Mental materialization of a reality specific to each. How do we share them? The resemblance of the images brings minds together, so sometimes that they believe they have arrived in the real world. No. *All humans journey through reality per se like dreamers seeking to awaken*. Scientists congratulate themselves on being the most aware, but ultimately *they dream of being awake*.

*

3
Foundation
Conceptuality

False synonyms

The terms of the language conceal the double look. Targeting a single thing, they sometimes belong to the Real Pole, sometimes to the Spirit Pole. Language is a conceptual pyramid dissimilar from mind to mind.

Some additional preparations (optional if semantics are not of interest to you): Many synonyms translate an invisible dichotomy about a single concept: its property is sometimes attributed to reality and sometimes to its observer. Examples :

The thinking process uses *information* translated into language by terms. At the base we find terms that do not require definition, root terms: *element, set*. Indecomposable foundation of thought. To capture the elements, we anchor *properties* (belonging to reality) or *characteristics* (it is the observer who characterizes). Properties allow *relationships* to be established (reality), and relationships are categorized into *rules* (observer). The resemblance between rules leads to the most general *principle*. When the relationship between two elements consistently matches the same rule, it is an *axiom*. An axiom is therefore an assertion that is self-evident, does not *require* demonstration (observer), *cannot* be demonstrated (reality). In particular, an axiom is independent of the other axioms; it cannot be deduced from them. A *postulate* makes arbitrary use of one or more independent axioms. It is no more demonstrable than an axiom but admits more of its character of authoritarian construction (observer).

Thanks to characteristics and axioms, indecomposable elements can now be defined by *definitions*. From these elements associated together naturally follow *propositions*, or first deductions. By deepening the process of deduction we arrive at the *theorem*. *Lemmas* are interspersed along the way, partial results leading to the general theorem. Finally the whole process, axioms definitions propositions lemmas and theorems, is called a *theory*. If the process does not arrive at a solid final theorem, it is called a *conjecture*.

Other terms take place in the process. Some are clearly attributed to the observer: *corollary* (immediate deduction of a proposition, without involving additional real elements), *hypothesis* (thought experiment including new elements in the observer; reality does not make assumptions). While others are given as properties of reality: *fact* (things as they appear), *law* (reality always follows the same course in the same context). Some terms are ambivalent. Unfortunately this is the case with *proof*: it is sometimes attributed to reality (which confirms a theory by submitting to its proofs), sometimes only to the observer (a proof is possible within a system based on postulates, without necessarily corresponding to something founded in reality).

The distinctions are poorly drawn between the *observer* vs. *real* affiliations, between what forms a solid coherence *of thought* vs. *of reality*, and finally what attempts to make the link between the two. Example: a proof has a priori all the solidity required in the way of thinking that created it; while it is never secured in connection with the inaccessible essence of reality. Yet it is generally the opposite that is asserted: a proof is given as solid by its link with reality while it is fragile in thought.

In the end, the language pyramid dedicated to reflection can look like a mess very different from one individual to another. You will forgive me if you still find anarchy in mine, despite this short attempt to map it out. The main thing is that you have the impression that you are dealing with a pyramid, a structure whose foundations are lost in your unconscious, in its implantation during your learning. Consciousness only uses the upper floors daily. *It is* these upper floors, we saw it in the previous chapter. To gain access to its own cogs, it is obliged to establish models, as for an external mechanism. The difference is that it establishes direct, unconscious but real feedback over them.

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Individuation, identity

Identity is based on individuation, the separation between element and whole.
Notions-roots in our way of conceiving, impossible to define other than by themselves.
How does the mind separate? 3 classic theories: identity serving only to establish difference, identity as a pure form of the thing, identity at the confluence of similar and different.
Let us bring these theories together in an identity slider, positioned between 'I am' and 'To be part of'.

Identity is impacted by the presence of other individuals. 'Identical', for elements taken in isolation, is no longer true when they are together. *We are no longer the same in front of our fellow*.
The 'I am / To be part of' setting defines an *importance* of individual identity within the whole.
Importance is a characteristic of individuation. *The whole has no importance* since there is nothing outside of it to make comparisons (at its level of reality). The whole takes on importance only when it itself becomes an element.
Importance measure: 'Major' and 'minor' are the extremities of an ongoing assessment of the element between 'more individualistic' and 'more collectivist'.

To be perfectly 'identical' is impossible. This would abolish any separation between the individuations concerned. 'Identical' is a convention of similarity between elements excluding their spatial location.
Contextual similarity, allowed by the restriction of the observation criteria.
Even for the fundamental elements of reality, therefore, it must be assumed that saying them identical is a convention.
Indeed, if reality were ultimately reduced to identical fundamental elements, the only principle allowing these elements to be individualized would be an impregnable spatial framework (imprescriptible locality), a postulate called into question by quantum theory.
To renounce this postulate implies the possibility of an individuation present in several places (not locality), and of several individuations surimposed in the same place.

What about identity in the time dimension? Are successive states of an element always 'the same' element?
Carnap defines *genidentity* to merge these states into a single identity.
But the issues raised are acute: identity is based on permanence rather than change. The temporal dimension is opposed to the spatial in the definition of identity.
Our slider solves these problems. The classic 'element / whole' dualism slips towards a progressive 'individualist / totality' conflict.
The identity is the positioning of the element on this slider.

The real offers *regularities* and the mind attributes *properties*.
The property is an individualizing stable benchmark. It reduces the identity of the thing to this reference point, without it being necessary to know it in full.
The counterpart is that the thing is always more than the sum of its properties.
The substance of the thing can be defined as all of its structure and properties, including what we do not yet know about.
Surimposition: neologism adopted in this book to describe the experience added to the substance of an entity by the entanglement of an additional organization, which does not make the previous ones disappear.

Quantity: strength of a relational criterion common to things (which share the same level of reality by their properties).
Depending on whether the criterion is continuous or discontinuous, the quantity is called *magnitude* or *multitude*.
Quality: the set of properties of a particular thing. It is the union of these properties in the thing and not their sharing that matters.
While the quantitative concerns a level of reality, the qualitative integrates them all.
Quantity and quality cannot be reduced to one another.
The qualitative is hidden in quantitative models, in the form of *units* following numbers.

We said earlier that ‘element’ and ‘whole’ need no definition. They seem impossible to define other than by themselves. Precious clue. We are with them very close to the fundamental principle of reality, at least to the limits of our perception of it. Neither analysis nor imagination can descend

further; they find themselves forced to use these two terms to derive the others, even the most fundamental: continuous / discontinuous, symmetry / asymmetry, order / chaos, God / creation… all these notions are based on a *separation*. Everything is fragmented. Fortunately. The whole without divisions would be analogous to nothing, since in the inability to accommodate differences (how would the nothing differ?).

But how do we separate? The upward approach is blocked here, since we cannot formulate a level of reality from which the element / set couple would arise. There remains the downward approach: how does our mind create separation? Problem of identity and difference. What do the classics say? They propose 3 theories:

1) Identity as a servant of difference: a practical way of successfully separating different things, without the content of identity being fundamentally important.
2) Identity as the pure form of the thing, without reference to anything else.
3) Identity constituted by the recognition of the similar and the different between two things.

Can you guess how it is possible to combine these three visions into one? The first favors difference (reference to the collective), the second favors own identity (reference to individuality), the third favors the link. None are complete. The first neglects the existence of identity benchmarks, real attractors erasing differences. The second is mistaken in believing that identity can be defined on the only structure belonging to the thing. Every order refers to its alternatives, therefore to something else. Finally the third forgets that identities become transparent in the relationship, and that we must keep the reference so as not to truncate the essence of the phenomenon.

This is why I suggest that you give up the classic approach and define 'element' and 'whole' jointly, in the form of a ruler between two poles, on one side 'I am', on the other ‘being part'. That is, anything that we can evoke can be described by a position on the ruler between the theoretical perfect individuation (I am) and the theoretical perfect dilution of individuation (being part).

This ruler is a tool that can really claim universality for our discernment. To discern is to individualize something within the pseudo-random whole. This tool, I will call it the *T <> D setting* from now on. T for soliTary (the 'I am' pole), D for soliDary (the 'being part' pole). This starting point being established, we can move forward on the notions of individuality, identity, collectivity.

In a system all the elements cooperate to organize themselves. Yet do they ever have equivalent roles? There is frequent confusion in the analysis of complexity between the identity of items taken in isolation and their identity within the whole. Placed within a set, the elements are no longer identical. They are differentiated by the composition of their individual interactions, by their position, by the history of their interactions, by specific intrinsic characteristics that appear only as a whole. Often identity concerns only one level of observation, and the limits of the instruments that observe define an arbitrary alike.

When the roles of the elements are different within the group, we are tempted to prioritize them into 'major' and 'minor'. *Power*, omnipresent in what surrounds us, primarily in our human societies. We easily translate the connotation of importance to any organization, even those of the inanimate. Seen through *Surimposium*, importance is an anthropogenic tattoo on individualism. Even when we attribute importance to the 'The Whole' it is to give importance to its individuality as a 'notion of the Whole'. For the Whole in truth is not important since it is 'everything'. Importance only makes sense when there is an independent element, allowing comparison. It is judged at a different level from the whole constituted. It is not a characteristic of it on its own level, where by definition nothing is outside of the Whole.

Importance is a weighing of the individualization of an element within the whole, according to specific criteria. The terms 'major' and 'minor' basically mean 'more individualistic' and 'more collectivist'. The scale is continuous from one to another; we prefer to use 'major' and 'minor' for extremes, but this appreciation is subjective.

In a system, the organization of the elements reveals the differences, separates those who will influence the system more by their own characteristics and those who do it less, who "undergo" the system (if we tattoo the anthropic idea of power). Elements that are identical at the outset acquire different influences. But were they ever really, "identical"?

In a system where all the elements appear the same, an individual characterization can be reduced to specific spatial coordinates. This characterization appears so basic, a simple declaration of existence, that it does not seem to justify the attribution of a particular importance to each element over the others. They are only ‘independent’ in location. Yet we do not intimately know the origin of the dimensions. The true birth of an element's identity as individuation in dimensional space is beyond our reach. It is a deeply ingrained habit in our minds to think of two atoms as ‘strictly identical’ obliterating their separation (the ‘two’). They are indeed two independent individuals by location. No two entities are ever similar, integrating this data. Worse, the postulate of individual existence based on personal coordinates fades to the level of elementary fields; it is still valid for fields associated with matter, false for force-transmitting fields, which can be added in the same place.

In this state of mind, the immeasurable masses of all interchangeable robot particles become a society of tiny individuals whose ‘personality’ is based on a specific location, associated with its particular relationships within the whole. The mental paradigm shift is remarkable. On the one hand, making the particles indistinguishable prompts us to validate a statistical reality: no matter the individual states, it is the state of the whole that must be visualized. On the other hand, granting individuality to particles encourages validation of a unique, deterministic reality. Each individual retains their own particular destiny and influences the rest. We will see that the two paradigms each have their interest. Although they seem contradictory, they coexist in science and its effort to describe reality. Unsurprisingly they clash there. But that will hardly bother us: we are going to make conflict our only transcendent principle.

I will repeat myself, because this notion of individuality is very important for the rest of our discussion: Similarity is always contextual. Even when

two elements appear absolutely identical in all possible and imaginable observable properties, they are still two separate individualities, that is, endowed with different locations in space. The spatial coordinates are thus treated separately, endowed with a unique status, setting up an abstract and invisible background on which the similarity of the elements is declared. Is this specific status justified, knowing that space-time is no longer seen as the ultimate canvas of reality? Are two entangled quantons a single element endowed with double spatial properties or two existences linked by a still unknown thread? Our resources do not allow a definitive answer. The notion of an individual element becomes purely contextual. But then we lose all possibility of actually founding an individuation. Which begs the blunt question: why would there be anything other than a single element as reality? Or if you are a mystic: how did reality manage to separate itself from God?

Let us pragmatically avoid immeasurable questions. Let us stick to our principle of contextual identity, which already has important consequences: that the quantons respond strictly to the same mathematical equations, in their collective organization, does not make it a proof of structural similarity. We have no proof that these quantons are pure information, which would be faithfully transposed into the equations. On the contrary, never has an element of reality been able to be completely reduced to any equation, outside a specific context in which we observe it. As the context evolves, as the instruments are refined, the equations change or find themselves cloistered within the confines of the previous context alone. Reality slipping away from its links, it is difficult to confuse it with them.

Absolute similarity does not exist. Forgetting that this is a contextual statement risks skewing our thinking at higher levels of organization. For example, when we think of the molecules of a gas as ‘identical’, by convention. Each has specific coordinates, let's keep that in mind. Saying ‘element’ automatically brings up the notion of individuality, and therefore of difference.

We have just pointed out the special status of the spatial location, placed out of play to allow the principle of similars to be introduced. And what about the time? Although it has become a dimension equivalent to the

others within general relativity, it has an inverted status in the principle of individuation: two elements are identical but independent by their coordinates in 3 dimensions, while they are 'one single' element in two different states by their temporal coordinates. Oddity showing that it is necessary to radically recast the notion of similarity. Either we transpose to space the way we conceptualize time, and then all the individualized building blocks of the universe become one element, in an immeasurable number of different states. Seductive holism for followers of a Big Whole. Either we transpose the way we conceptualize space to time, and each temporal iteration of an element becomes an independence, similar to its past and future iterations by its common (or trackable) spatial location.

This leads to radically divergent paths to the definition of the universe. Countless facets of a unique essence. Or on the contrary, immeasurable fragmentation, which dissolves the notion of destiny for an individuality, replacing it with a simple temporal filiation of independent elements. In both cases our individual personality sadly seems to evaporate and we have to look for another context to re-aggregate it. How to do ?

The classics do not help us much. The majority of philosophers (and of humanity) still consider the identity of a thing to be defined only by the exclusive occupation of a spatial location. That it changes, that it moves, is obvious in no way threatening its identity. Unfortunately this leads to intractable questions. Something can change so profoundly that nothing of the original elements remains, and yet at no point has a clear identity leak occurred (Theseus' boat, the human body, whose cells are almost renewed fully every 7 years). This leads to defining identity in the relationships maintained within the thing rather than in its elements. But then would a computer simulation of these relationships be enough to duplicate the identity of the thing? Something seems to be missing. Terrifying dead end.

The theory of relativity, which makes time an analogous dimension to space, has not yet been incorporated into the current definition of identity. Some have tried it. Carnap defines 'genidentity'[8] by adding this temporal

[8] The term 'genidentity' is from Kurt Lewin (1922) and has been taken up by Carnap, Reichenbach, and others in versions modified by their personal works.

dimension to the spatial ones. The location is added with the sequence of states of the thing. The thing seen as genidentity consists of its past, its present and its future. The disadvantage of this amalgamation is not negligible: spatial identity is based on similarity and temporal on change. Two contradictory axes to define an identity?

Identity is based on permanence. Can't attribute one to chaos. What is the duration of the stability of the thing that gives rise to talk of genidentity? From what degree of transformation do we lose it? As easy as it is to base the identity on the similarity, to integrate the change is a challenge.

Perhaps certain fundamental notions should remain symbolic. How else to escape the unbearable pressures of the whole, the infinites, as well as the loneliness of unity? Are these principles in essence real or just tools for our minds? The first option provides no solution while the second is pragmatic. Fundamental notions do not occupy more neural space and do not stay there longer than other representations forming the ego dynamic. A little existentialism keeps away symbols so powerful that they risk freezing our mental paste; a little reductionism gives it shape when it gets too chaotic.

Symbolically, the definition of individual identity is dealt with with those of the inside / outside, the center and the limit. The center can be seen as the collectivization of the individual place (without reference to dimensions other than those of the individual). The center is synonymous with a benchmark, or attractor. It is not necessarily the same 'distance' from any point on the boundary. Rather, the center is the top of the wave of likelihood of being within the individual. The limit, on the contrary, is the trough between this wave and that of being probably outside the individual. We can find a more precise definition of it in relation to the dimensions / properties of the individual, but it does not necessarily need a more precise definition, since it actually belongs to the outside as well as to the inside.

To define the identity we started from the classic dualistic 'elements / whole' vision. It slipped insidiously towards an 'individualist attractor / totality' conflict, measured by our new tool, the T <> D ruler. This is not without consequences for the theory set out in this *Surimposium*.

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Property

Properties are *the individuation of a thing seen from what represents*. While they are inconsistent for what is organized in the thing.

For example, the properties of an atom are invisible to the particles that form it. While the atom has properties for what represents it as a relational entity, whether it is another atom or a physicist. If it is a human consciousness, it is seen by others by its relational properties, while it is experienced as what is organized to form it, a set of stimuli coming from the body and the environment.

Identifying individuality by a general principle is difficult because there are many ways to look for a difference. Multiple aspects which are its properties. The mind is confronted with things (philosophical *objects*). It grasps them by their properties through the tools which are already given to it. The mind accommodates senses, concepts, innate codifications and social mimicry.

Defining a property is therefore epistemic. The Spirit pole looks at the Real. It is, for example, the observation that detects the magnetism of an object. Property is defined as attraction or repulsion and seems exclusive to certain materials. Secondarily the mind tries to explain property. It takes the ontological path. The Real pole constructs a representation of magnetism and anti-magnetism: in the first case the spins of the atoms are aligned, in the second case the adjacent spins are in opposite directions, canceling their effects.

A host of intermediate states of the object are overlooked by the Spirit pole, by magnetic / non-magnetic binarism. They are less characterized, more ephemeral. The notion of property is nested in that of benchmark. A benchmark is a stable, lasting or recurring regularity. Notion inseparable from temporality. In the downward / epistemic direction, a 'property' is an enduring individualistic benchmark within the whole. It allows you to reduce the identity of the thing to that benchmark, without looking at the thing more closely, at least according to the particular clock of the system.

While the essence of property is ontological. It is produced by the thing. The meeting of identical properties determines the similarity of things. On this criterion, the Spirit pole traditionally attributes a substance to them. While the Real pole, which has become structuralist, sees properties as information, proposed by smaller structures. Things made no longer of substance but only of information.

However, the sum of the properties is not enough to identify the thing. Sometimes they are shared by structurally different things, especially the properties they show as a group. Phenomenon called *multiple realization*. We are forced to take into account 'what achieves'. Perhaps it is only other information, but it is not possible to go back to its origin, to present the information of the thing in its completeness, if we thus wanted to replace the notion of substance.

Moreover, the identity of the thing does not freeze when we gather its information. Reducing the identity of a thing to its properties therefore causes it to lose two parts, a *structural* part and a *temporal* part. *A thing is always more than the sum of its properties*. Very powerful brake for those who wish to hide the substance for the benefit of information.

In the event that properties and structures are similar between two things, say two protons, what is left to separate their identities? Notice first that we do not know the ultimate foundation of the proton structure. It gets lost in the quantum ‘vacuum’. No certainty, then, that the resemblance of the protons does not come from a phenomenon of multiple realization on a scale that we cannot see.

Secondly, we have seen that our sense of things, natural or scientific, ultimately focuses the specificity of the thing in its location. It can't share it with anything else. Arbitrarily, it is a question of spatial location, not spatiotemporal. The temporal iterations of a spatially identified thing remain the ‘same’ thing.

Alternatives are possible. In a theory considering the location as a simple property, which remains to be constructed, several locations of an identical structure would be considered as the same thing (entangled particles). Or

on the contrary in a theory considering time as a dimension ontologically similar to space, the different temporal iterations of a thing would be considered as different things, adjacent for the property 'proper time'specific to each thing.

Since we cannot definitively define the substance of a thing, we make its properties a level of information. However the thing is not this simple level. It is the level where we look at it together with all those who structure it. We are looking at a pyramid, the base of which is indistinct, and the top provisional. Are we sure we can see this summit? Humans could be part of a larger entity that we are no more capable of perceiving than cells perceive in the body. This would be the case if we were in a simulation.

It doesn't matter whether the properties of one thing are shared by other things, the fact that we can isolate it defines its own identity, epistemically. The thing is unique. It is then possible to redefine substance as the whole structure of the thing that allows us to individualize it, no matter whether it is a pyramid of information or ultimately an unknown indivisible substance. The concept of substance includes what we do not yet know about the thing.

This position is essential before addressing the issue of emergence in the next chapter. Emergence is the eruption of a property that is completely unpredictable and independent of the elements that constitute it. The same property can appear for sets of structurally different elements (multiple realization, universality of the property). Is this a property that is really independent of the ontology of the elements or not? By viewing each element as a pyramid of information, the controversy disappears. It is no longer lawful to regard any element as ultimately fundamental. All are entangled pyramids of levels possessing relative independence. *Identical levels can meet on different floors of different things*. The theoretical work still to be done is to codify the sequences of these stages, using the current empirical approach, while seeking possible transcendent principles.

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Surimposition and *overimpression*

'Surimposition' and 'overimpression' are fundamental terms for this book. They indicate the simultaneity of the existence of an entity, as an assembly of quantum, atomic, molecular, cellular, organic, mental information… To say 'human being' is equivalent to surimposing these levels of information. All are included in the existence of a 'human being'. The difference between surimposition and overimpression is that between the two looks. 'Surimposition' is the upward term, that of ontological constitution. 'Overimpression' is the downward term, for the experience of being all of these levels of information.

These terms are inspired by 'superimposition'. The most famous use of it concerns the status of a quantum particle. It is described by 'superimposed states'. The existence of a single quanton is equivalent to a large number of simultaneous states. Merge of independent states in the calculation. '*Surimposition*' relates to the entanglement of information *of a different nature*. This neologism avoids confusion with the quantum superimposition which entangles information of the same nature. It also stands out from the overlay of layers in an image. The notion of experiencing something extra as an added real essence level is to be understood in 'overimpression'.

These terms will be further substantiated as the book progresses. We will see that they are based on perfectly materialistic principles about the structure of reality and the mind, which do not reduce the mind in any way.

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Quantity et quality

The properties led us to the concept of level of information. They also introduce the *quantification* of regularities in things sharing the same property. Quantity is the strength of this common relational criterion. Depending on whether the property is seen as continuous or discontinuous, the quantity is called *magnitude* or *multitude*. To quantify the magnitude uses 'greater than', 'less than', 'equal to'. Quantifying the multitude uses the numbers.

Quality is an independent concept. It is the set of properties of a thing. Quality is not about the fact that these properties are shared but on the

contrary united in the same thing. Quality differs from ‘substance’ in that the combination of properties doesn't do the *whole* thing. This association is attached to the conceptual level that looks. There is still some unknown. Quality is a concept, belonging to the mind, while substance is the essence of the real.

Qualitative is the overimpression of quantitative levels of information (those that are known). Sometimes a formal model does not yet exist to finalize this entanglement. However, each level is involved in the quality of the entity formed. This is how we reconstructed in *Stratium* chapter the notion of ‘qualia’.

Levels of information can have similar *quantitative dimensions*. For example many properties are based on distance. The models of these levels can be interchangeable. Other dimensions are not similar. The spin is not interchangeable with a spatial dimension.

Finally you know of course the false friend of ‘quality’ in common parlance, which refers to the *excellence* of a thing. An even more specific ‘quality’ of the Spirit pole since each of its iterations under our skulls gives a competitive quality to each thing.

Quantity and quality cannot be reduced to one another. Does anyone attempt to define a quality by quantities attributed to a set of specific elements? For example by defining the color red as the wavelengths of photons between 625 and 670nm? This is a reductionist correlation, not an equivalence. It takes an observer of the photons to declare them red.

Consider a more difficult example, where quality results from a thermodynamic equilibrium. Here, you no longer need an observer. The evolution of the system occurs naturally towards the most probable states. Its final quality is directly linked to the really large number of elements, therefore to a quantitative datum. Quality defined by quantity?

It is easy to reverse this reductionist discourse. The quantities are applicable only because the items are similar. The quantitative discourse hides the prior attribution of a uniform quality to all constituents. A few

elements of different quality would suffice to prevent thermodynamic equilibrium and destroy its quantitative definition.

An important point in this example is that the presence of a human observer is not necessary to speak of quality. The elements define it among themselves, through their mutual recognition. A system determines its quality through intrinsic self-observation.

The need for qualitative is reflected in models when quantification is followed by unity. *°K* for a temperature quantity, *km* for spatial quantities, etc. Other models only use quantities, without unity, because they are intrinsic to a level of reality or to descriptive language itself. The radius of the trigonometric circle is 1, without the need for a unit of length.

The qualitative is thus hidden in the apparently purely quantitative mathematical models. Sometimes it is superfluous. The bit was created as a *numerical qualitative* unit, while the 0/1 difference is the most basic of information quantifications and does not need it. Probably this is the consequence of the arrival of digital after analogue. It seemed necessary to distinguish it from hertz, degrees and other volts by endowing it with its own unity.

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Interaction

The reality is an *unfolding* before being a place.
The interaction, or quantum of unfolding, is a mysterious interval framed by the initial and final states.
Even by reducing the interval, splitting it in turn, there is always an incomprehensible jump from one micro-state to another.
Is discontinuity specific to our descriptive models or is it in the essence of interaction elements?
The individuation of an element is really robust only according to its *interactive function* and not on conventional characteristics such as its spatial and temporal situation.

The bond is an area of equilibrium between spatio-temporal coordinates of the elements.
It defines a stable system within the limits of this equilibrium zone. In terms of information, it is a new surimposed entity to its constituents. Elements *plus* the bond.
Either the elements have equivalent bonds (homogeneous system), some have a particular influence (system with attractors).
Duplication is the multiplication of identical elements because the context encourages their constituents to join in a similar way.
Replication occurs when *an element becomes the context*. The presence of this replicator encourages components similar to assemble the same way.
I use the term '*celebrity*' to designate the power of attractors, whether material or conceptual.

'Complicated' concerns the difficulty of the human mind to integrate information. Opposite = 'easy'.
'Complex' concerns the evolution of reality within multiple possibilities. Opposite = 'simple' (restricted possibilities).
'Complicated' is subjective, 'complex' has a mathematical translation.
'Existence' is a by-product of 'interaction'. In the dominant structuralist vision, the existence of something is revealed by being related to something else.

Interaction is arguably the most general term in science. It brings together radically different phenomena, inexplicable to each other. What can we find in common about an interaction between elementary fields and between human beings? They take place on incredibly alien time scales and complexity. Staggering but invisible intervals, hidden behind the facade of things as substances. Our perception of the organizational dimension is crude: visible / invisible, alive / inert, etc. Other intervals are instantly perceptible with precision: those of spatial dimensions. The *distance*. Our dominant sense is vision. It offers a huge amount of data to process. Our perception is full of it. Telescopes blew up its wingspan. The amount of *coordinates* is such that it obliterates non-spatial information. Shape and movement of an object are of interest before its structure. The Whole, in the classical mode of knowledge, is an *expanse* before it is an order. Yet *it was order that created the expanse*.

Laws are enthroned in three dimensions, could conquer up to ten or more, still in geometry, thanks to string theory. Objects of reality are spatially defined with breathtaking precision. However, reality is an *unfolding* before it is a place. The space we know did not exist at its origin. That the quanta of unfolding is systematically reduced to an 'interaction' is an unacceptable shortcut. This makes it a quantity never defined in a proper name, only by its beginning and its end, initial and resulting conditions. Framing an interval of nothingness, an instant of nothing. Instant? Time has been integrated into the three spatial dimensions without really knowing what differentiates it from them. We do not know what to do with it, beyond the theories of body movement, or how to replace it, within these theories, or why some ignore it completely.

Vertical thinking, which considers self-organized reality, is a mandatory dimension for our observations. It is the only one that can self-appreciate, including the organization of our conceptual pyramid. *Horizontal* thinking, based on distances, sees the limits of systems, juxtaposes them to each other. But it is vertical thinking that brings the hierarchical dimension, coordinating our conceptual elevation to the structure of reality. However, the interaction in this particular dimension is poorly understood in science. No mathematical model describes its entire course. All relate to specific sections; none *go through* it. Equations apply at any point in three-dimensional space, none do in the hierarchical dimension. Yet if reality is an organization before being an expanse, is it not this organizational dimension that is fundamental? Isn't it about it that an equation could claim to be universal?

Interaction is what we find right after individuation, going back to the foundations of what appears to us to exist. The exchange, the change, which implies a state 'before' and 'after', that is to say a succession (let's avoid the protean term of 'time' for the moment). Faced with two different states, we ask the question again: what brings them together to make the same thing? Certainly the states in question are representations that we construct in order to perceive them. Whether the instrument used is sight, language, imagination, abstraction or an electron microscope, the given image is never the essence of what is represented. The question seems impenetrable: has the essence of this thing changed or not? Are the two

states ‘before’ and ‘after’ two different essences or the same, observed in two different ways?

Let us give our favor to the first hypothesis: the essence of the thing changes. This choice will be justified later. Notice now that our representation, as a mold of the essence of the thing, is always divisible, dispersible. We have never found the slightest trace, other than in beliefs and hypotheses, of a monolithic essence, of a soul of things, animate or inanimate. Let us therefore postulate to have, with the states 'before' and 'after', two different structures corresponding to two separate essences, which despite the change we continue to call the same 'thing'.

This is a cardinal point in the conception of the world, because nothing is static, nothing is independent of interactions. What appears to be inert, isolated, is a stable interacting system, the appearance of which does not change at a certain level of observation, but is in fact a series of interactions looping in on itself. The change comes back to the same. Everything, however, is dynamic, that is, it is a succession of states. When this succession is short, on our scale, we see a particularly permanent thing. A rock is an icon of stability because its atoms do not mutate and are connected to each other by strong bonds. Yet every tiny fraction of a second, the elemental fields of this rock engage in a ballet as frantic as that of oxygen and nitrogen molecules in a hurricane. The rock has gone through countless conditions and we haven't seen it move. Stability is a matter of scale. The ‘same’ is a matter of the scale of the interactions examined. If a cosmic observer looked at our universe between its birth and its end, and the time between these two singularities is very small for her, perhaps she would say that our universe is a 'virtual' particle, whereas to us it seems imbued with eternity.

What we consider to be the same thing is thus a potential infinity of different things, the only point of which is to be issued from the previous one by the grace of an interaction. This dissolves the Theseus' boat dilemma: the Athenians preserved this boat by replacing the worn planks, so the boat was still resplendent centuries later, with no original plank remaining. Was the boat still the 'same', or had it become a whole different boat? Whether the identity of a thing implies a material identity is a false

problem: at no level is matter a fixed substance. Atoms are exchanged for electrons. The elementary fields have an arbitrary identity, strongly influenced by a point observation. One thing only 'stays the same' depending on the paradigm used to observe it, and the length of time it is observed. Identity is subjective to the very depths of matter.

To say that a state of a thing is from the previous one, we use *location*, have we seen. States are the same thing in that they occupy the same place, or are in a shifted position due to *interaction*. Either the interaction is traceable (shock, attraction, repulsion…) or it is not and spatial displacement is defined as an intrinsic property of the thing, its *angular momentum*. Shortcut ? At a more foundational level of reality changing spatial coordinates could be an interaction like any other. Reductionism tells us that properties are the fused aspect of micro-mechanisms. Why would it be any different with angular momentum? We are looking for conceptual unification. By reducing the definition of an interaction to its most basic meaning of state change, we satisfy this need.

At the moment we do not know whether the essence of a thing is purely information. However, it is clear that we define a ‘same’ thing only from the information we receive from its states. It is in the processing of this information that we attribute an identity to the thing. We own more of this identity than the thing itself. The human mind is a sort of ID card dispenser for things.

The situation is different when the thing is virtual, in a way that we might deem unjustified: after all, isn't the virtual thing also an assembly of information? The difference to the virtual is that we feel like we have complete ownership of the identity of this information. We are the creators. Whereas the real thing has its own essence which is contingent on the representation plastered over it. The real thing is ‘dressed’ by our ID card; it is not entirely reduced to that.

But is it so different for the virtual thing? Would it be created ex-nihilo by our mind? No. It is the apex of a conceptual organization that has its roots much lower than abstraction. With *Stratium*, we saw the continuity between this conceptual organization and neural interactions. The real thing is not

much different: it too, at the level where we observe it, is the apex of an organization whose primordial roots, if they exist, are not apparent to us. What we seem to lose in the identity of the virtual thing, versus the real thing, is spatial embedding. The virtual has no clear coordinates in space; its transformations do not seem to be linked to a movement. We can thus classically say that real and virtual are united in the fundamental principle of succession (or dimension of their own time), and opposed in the principle of spatial localization (the dimensions of space only apply to real things) .

At second glance this separation is not so clear. At least concerning the virtual which accesses a certain form of existence because it arises in our mind: these mental states, whatever the level of reality we want to grant them, are backed by perfectly specific neural configurations of each of them. A virtual thing such as an abstraction within our mind has many spatial characteristics. The movement is that of synaptic networks. Obviously it is less easy to describe than for real things, due to its level of complexity. An abstraction-forming diagram contains a tremendous amount of information, from the states of its neural constituents to the particle level. The most important thing to note is that this existence has a temporal dimension, essential to add to the spatial dimension. An abstraction only exists through a number of synchronized neural interactions. It is not definable in the instant of molecular interaction, let alone particulate. Things have a definite existence in their own time, viewed at a certain level of organization.

An idea, an abstraction, follows another after an interaction, a series of states, just like the real thing. Why do we individualize *different* ideas when a material thing is considered *the same* despite its changes? Certainly the transformation of the idea seems more radical; the real thing keeps the same look. But is this really unexpected, given that the degrees of organization in the mind reach a complexity and diversity far superior to matter? One idea has so many 'parents' that it would be surprising if the next looked like a twin. It almost does, sometimes: We have all experienced a repetitive, nagging thought on a feverish and sickly night, in a constricted state of consciousness, causing anemia of ideation.

Our search for the foundations of existence is beginning to strengthen. Until then, we had a problem of the primacy of principles: is spatial location such a fundamental principle of the individuality of things as the succession of interactions (which we colloquially call *time*)? We were tempted to answer yes; we even wanted to impose a spatial location to define the identity of one thing, before it could interact with another. We can in a thought experiment imagine a world existing spatially without the slightest movement, and 'waiting' for the metronome of time to kick in. While it seems difficult to imagine the opposite, interactions between elements devoid of spatial individualization, *which would all be in the same place*, which by our classical definition makes them the same thing.

Two observations disrupt this classic vision:
On the one hand, quantum experiments allow the hypothesis that the same thing is in different places, simultaneously. Individuation by spatial location is called into question. On the other hand, the same conceptual organization can be supported by different things, sometimes very different; the 1 + 1 = 2 operation can be performed in a human mind or in silicon circuits. A strictly identical transformation concerns things of clearly different essence, pairing them with a certain level of observation.

These observations are incomprehensible in the classical view of things initially possessing a spatial identity and 'animated' by time. On the other hand, they become easy to describe if the interaction is the fundamental principle, that the individuation of an element is not defined by its spatial coordinates but by its interactive function, and that the spatial dimensions result from a choice of organization among other possibilities (which explains their arbitrary number of 3 when there is only one 'time').

The fact that interaction is the fundamental principle of individuation also makes it possible to give an identity to a host of processes which only take shape when they have reached a certain stage of their development, i.e. a sufficient interval of accumulated interactions. There is an interactive size, or informational size, which is the basis of identity. Spatial dimensions are, in this context, only a sub-category of the characteristics of the identified entity. A virtual concept truly becomes a 'real' entity, because it is given the

interval of neural interactions necessary for its implementation. Therefore it can have causal effects, like any real entity. It can induce physical action.

This thesis, which we will detail, encompasses physicalism and emergentism, without denying their respective claims. Physicalism is correct when it describes processes in terms of properties intrinsically attached to spatial dimensions. Emergentism is correct in showing that the interactive intervals grow up to self-organization thresholds defining new entities, endowed with specific properties at this level of organization.

The so-called top-down causality is possible because it *succeeds* the bottom-up causality, following the creation of the newly organized entity. These are not concurrent causalities (which would undermine causal formalism) but surimposed, invisible to each other and nevertheless inseparable. Top-down causality changes the relationships between the constituent elements of the entity, in a way that is not written into the initial conditions. There is a seal between these causalities. Another way to put it is that the context is not passive but active. There is constantly a whole added to the elements, formed at the very least from their association. *The association is a third acolyte*.

The stability of the existence of the entity depends on how these two causalities gravitate towards each other, that of the elements and that of the whole. Either the equilibrium is convergent and limited variations of the two causalities keep an entity with stable characteristics. Either the balance is divergent and the organization immediately gives way and resumes the course of the alternatives.

There is therefore also an interaction in the organizational dimension, at the origin of a 'permanent' entity, in the sense that the organized processes come full circle. The stable spatial form of a material object is a subcategory of this principle: the spatial movement of its components follows a loop that fixes its morphological aspect.

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Linking, duplication, replication

Interactions radically change in nature, from one system to another, within an assembly of molecules or thinking beings. Even more than the

appearance of an element, it is its interactive capabilities that focus our representation. You can grab a solid with your fingers, a liquid escapes them. The most remarkable interactive properties make us classify objects by categories. We do the same for their structure, defining levels of organization according to the properties of their constituents. A cell has little interest in the representation of a living being except in its relations with other cells. The more amazing the properties of the elements, the more we tend to assign them a particular level. It is thus tempting to define major organizational crossings from the cardinal properties of matter: covalent bond founding chemistry, electrostatic bonds founding biochemistry (water and macromolecules), molecular replication founding biology, membrane lipid envelope founding cellular studies, molecular sequencing founding genetics, etc.

Among the multitude of these interactive modes, we can guess a hierarchy proper to the interaction itself. The simple bond is the spatial stabilization of the elements. It appears as soon as the spatial location becomes part of reality. It is the foundation of all higher level interaction. Even virtual. When I think of a distant galaxy, it is not with this galaxy that my mind interacts but with its representation that it hosts, a proximal image. It can associate this image with other neurologically neighboring ones, and reflect on 'galaxies' as a whole, when the distances between real galaxies make this kind of interaction impossible.

The simple link is more exactly an *area of equilibrium* between the spatial coordinates of the elements of the system, a portion of space independent of the rest, a ‘whole’ relating to the elements of the system. Inside, the elements retain their individuality. Two possible cases:
1) Either each element interacts with the set in an identical way to the others, that is to say that the set made up of the elements is homogeneous (‘state of lower energy’ or maximum entropy in thermodynamics).
2) Either the elements are not identical in their relationship to the 'whole' and the patterns they establish in their personal interactions are different. Some gain a special place with respect to others. They are *attractors*. When one or more attractors have created a state where each element of the system remains in its equilibrium zone, we have a stable heterogeneity, of which the homogeneity of the first case is only a particular iteration (case

where all the solutions are identical). In either case, the attainment of equilibrium characterizes a higher level individuation: it is a whole possessing a spatial definition and a stable internal constitution.

Duplication is the multiplication of identical elements because the context encourages their constituents to associate in a similar way. The elements seem to independently 'choose' identical single bonds.

Replication is a special iteration of duplication. The elements mimic the structure of one or more of them, in their presence only. The general context always exerts its influence; one or more *replicators* are superimposed on it. An element becomes context. Individualism takes precedence over the collective context. The link, symmetrical when it is simple, takes on a radically asymmetrical character. The identity of one element is erased in front of that of the other.

Replication starts at the stage of organic molecules. It can be seen as the foundation of life. It is found on all the upper levels, without erasing the simple links. A bacterium duplicates itself, including molecules that do not have self-replicating activity. Replication begins with the reproduction of spatial characteristics, then concerns the specific properties of each stage. Even to a complex organism such as a human being: capable of reproduction and seeking to duplicate its cultural memes in its offspring. The phenomenon of replication is very general.

The term 'replication attractor' may be preferred to 'replicator' because the fidelity of replication is inconsistent. Two amino acids of the same type are identical (within the limits already seen), while an animal is only resembling its parents.

Linking duplication and replication seem to be principles transcending the organization of reality. An essential step in our search for a general theory of self-organization. In the midst of the profusion of amazing and particular properties of systems, we can systematically extract the principle of simple spatial connection. What makes the popularity of reductionism: if one flattens the pyramid of organization of reality in a horizontal vision, only one fundamental principle remains: the spatio-temporal link between the

elements. Whereas the vertical view shows that the connection by location is transcendental rather than fundamental. This bond has not yet acquired spatial properties at a basic level of matter. Elementary fields have locations in Hilbert spaces, before organizing into locations in the usual three dimensions.

Let's not go too fast. A future chapter will develop this subject. What interests us primarily here is whether the classical principles of duplication and replication can be amalgamated together, so as to have a single transcendental principle for the rest of our theory.

Indeed the notion of duplication is already present in the single link. It takes an identity that is partly common to the elements in order to establish a link. When we talk about a link between two elements that are *different* by their location, we must also say *identical* by some of their other properties. This first level of duplication present within the system is attributable to the context: it is the similarity of the equilibrium states found independently by the elements, under the influence of the same context. We could say that there is *a duplication of context in the elements*. It all came down to individuals.

In replication, it is an element that imposes its form on others. However, perfect replication is an extreme case, the other extreme being the absence of any perfect similarity between elements (human beings for example). Between these extremes lies a wide variety of intermediate situations, between the dominant influence of an individual and that of the collective context. The transcendental principle becomes the tuning between individual and collective influence, rather than one of its particular values. We thus find our rule T<>D, 'soliTary vs soliDary', a principle which accompanies us throughout this book. We will use the term 'celebrity' for the influence value of an element within the collective.

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Simple and complex

'Complex' is not '*complicated*'. 'Complicated' is for the human mind. This is a conceptual hierarchy that more or less easily grasps new information to integrate it into the stack. The real opposite of complicated, in this context, is not simple but 'easy'. 'Complicated' indicates the absence of the mental

routines underlying the performance of an operation. When faced with a complicated equation, a stupid calculator gets by without problem, with a speed that the best of mathematicians cannot hope to approach. Note that the 'complicated/easy' is not based on the height of the conceptual stack but on its specialization. The presence of a particular stage makes the analyst, human or mechanical, effective: that dedicated to the mathematical paradigm underlying the operation. An equation is never complicated for the level that realizes it. It is its constitutive essence. It is ultimately 'easy' from that point of view. The complicated begins with the need to involve several 'easy(s)' in a paradigm that does not yet exist. Once this work has been done, the 'complicated' becomes a new mathematical entity and returns to the status of 'easy'. And so on as we build our concept stack.

'Complex' addresses general reality, the relationships between its discontinuities. 'Simple' concerns a small number of possibilities, 'complex' a great diversity. What makes reality difficult to predict is that the evolution of the simple (low number of elements at the start) can be complex, and the evolution of the complex (large number of elements at the start) is sometimes simple. Regardless of how we define individualized elements, complexity incorporates two variables: the number of elements and the number of parameters (or dimensions) relating to them.

Since reality responds to equations and suggests complexity to us, it is not surprising that this finds a mathematical translation. Let us quickly take the example of chaos, a common appearance of complexity: A linear system (which initially includes all of its variables) in a finite number of dimensions is never chaotic; it is simple. A non-linear system (its results become its variables) is chaotic; it can show phenomena of order called attractors; for discontinuous dynamics the attractors appear whatever the number of dimensions of the system; for continuous dynamics they appear from 3 dimensions.

The complexity of the possible follows a mathematical determination. This has nothing to do with the mathematical *difficulty* of the 'complicated', this pain for a mental structure to appropriate the language of mathematics. Because while mathematics rules even physical neural interactions,

neurons construct a whole different language between them, better suited to the symbolization of an ever-changing environment.

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Existence

Maybe we should have started with it, right? Well no. Existence does not interest us much as a notion because it is the most radical of the obvious. Especially since we are going to merge real and virtual in the same space. To scrutinize 'existence' we would need a term on the same level, something like 'non-existence'. But no, 'non-existent' has no absolute meaning; it always refers to an existing thing. The structuralist view makes 'existence' a by-product of 'interaction'. The existence of something is only proven because it enters into a relationship with something else. It is not possible to demonstrate the reality of a substance independently of an interaction. Everything that exists is a permanence of information associated with it. Defining the existence of the thing involves in practice interactive postulates about it: two different things cannot exist in the same place; two different things but succeeding in the same place from moment to moment are considered to exist of the same thing.

We only perceive something through the relationships we establish with it. Either we are immediately equipped with the necessary means (the senses), or we build the instruments capable of establishing these relationships and translating them for our senses. So we never access the existing essence of the thing, only its properties, part of its information likely to relate to other things of the same type, including our instruments inscribed in the same level of reality.

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Representation, abstraction, error

Express oneself is showing one's individuality. *Representing* is taking control of a foreign expression. An *appearance* involves a context and is no longer just constitution. *To self-represent* is already shifting from its constitution.
The truth is attached to the symbolism of a representation. It is best known by small diversified errors nearby.

Platonic Dualism ("There is a world of ideals") weakens knowledge. It decreases the power of ideals by evacuating them out of reality, in a space that we can not know anything.
Locate the ideal in the conceptual pyramid of our mental processes reinstate its power in reality.
The presence of the brain is not indispensable. *The parallel between ideal and intention* is examined in the example of a tree that looks for water.

Feel and represent are two incompatible manners. Feel: be the constitution of the thing. Represent: symbolize the thing to make it an element of something wider.
The conceptual stratification of the mind gives it relative flexibility: a local paradigm change upsets the adjacent levels without threatening the entire building.
The downward approach shows the 'how'. The upward approach shows the 'why'.

Eliminativism wants to obscure the paradigms of representation for the benefit of micromechanisms. Self-blindness. It is particularly dangerous in neuroscience: abandonment of free will, colonization of upper representations by neural functionality.
Differentiate the methodological reductionism of the eliminatory. Methodological: respects the complex dimension and explores it. Eliminatory: flattened the complexity and occult the downward look, made the term 'reducing' pejorative.
Neologism possible for the good reductionism (methodological): 'redusemiotism' (look behind the appearance of things without harming the reality of these symptoms).

In modeling, the encryption of the observed properties improves quantitative accuracy, but it is their hierarchy that makes the *quality* of the representation.
Quality can not be reduced to a quantity. Additional information plan. The application of blurred logic to the example of a pile of sand reveals a quality *incrementally*. Quality surimpose over quantity.
The qualitative is symbolization of the quantitative.

The difference between *simple* and *acting* representation appears by considering them in their hierarchy of organization.

All are actually acting according to the direction of the look: be constitutive either corrective of a constitution.

Express and represent

To express oneself is to show its ontology, its own structure, towards which it tends to evolve. Reality expresses itself, as does the spirit. The two expressions are inaccessible to each other. Spirit is its expression, and owns only it.

To represent is to take control of a foreign expression. It is to immediately modify it, at least to subjugate it in part to its own personal expression. The foreign essence is already lost. If nothing in the mind allows the relationship, it is able to fabricate more appropriate expressions, a new language, intermediate between the alien reality and its own structure.

What relationship does a performance have with its subject? What is the role of error?
In the representation, two efforts are mixed: symbolization and fidelity to its model. To symbolize is to define the center of the model, to merge it around a central concept that erases the multiplicity of its composition. Fidelity: respect for the structural rules of the group represented. It is never complete, since the representation extinguishes other potential solutions for organizing the system; it operates a reduction. It cannot be too approximate, otherwise the feedback control no longer finds its target; the representation carries the voice of micro-mechanisms.

Strict fidelity impossible, but close enough, how does the representation find the appropriate compromise? Here's where the error comes in. The notion of error is related to that of noise, which we will see later. It makes it possible to identify the faithful representation without being able to reach it, by exploring all its neighbors. The mistake should not be a big one: by leaving big holes in its net, what it is trying to pin down is no longer there. It must not be absent, otherwise the truth, too quickly discovered, risks being taken for a mistake. The (symbolic) truth is at best surrounded by small, diverse errors nearby.

This principle is particularly universal. In physics when we are looking for the position of an unknown value, neither large measurement errors (which lead astray) nor exact measurement (accuracy that we cannot recognize) give the best certainty; there are several similar measures. In psychology when a person tries to assert herself, neither a serious behavioral error (which radicalizes) nor the ideal attitude (the ideal not belonging to her) gives her the best assurance; several small conduct mistakes are better.

It is also an evolutionary argument for the theory of personality presented in the previous chapter: *persona*, those complex and contrasting representations, the fusion of which forms the dynamic of the 'I', allow a human being to test a large number of ways to interact. *Persona* propose small (sometimes big!) behavioral errors, which frame the merged consciousness on the path to mastery of its environment. Updating and enriching this nursery of explorers is the daily work of our different intelligences.

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Realism and abstraction

Let us keep at bay the idea that abstract things, or properties, would stand in a space independent of reality, that they could exist without any kind of presence and location in our reality. This old Platonic heritage is still alive in both scientific and phenomenological circles. Dualistic separation between the universe of substances and that of ideals. Does such a dichotomy bring greater coherence to our vision of the world? By placing ideals out of reach, in a place that we cannot know anything about, is it not rather a loss of power? Abstractions are indeed representations, acquiring a real existence only if there is a conceptual edifice to form them. Competent processes are not exclusive to the human mind. This book will show that all levels of reality are capable of self-representation. When the designer is the human mind, mental representations are rooted like others in self-organized reality, in this case a set of synaptic weights.

Virtual abstractions are solutions, either *realized*, and we classify them as 'proven real', or *imagined* and as concepts they also exist, at a higher level of self-organized reality (*Diversium*), that of neural processes, which we call 'thinking'. The ideals nestle there, perfectly embedded in these upper stages

of *Diversium*, no more independent of reality than a magnetic field is independent of the solenoid that generates it.

The ideals have not disappeared. On the contrary, they have never had such a strong presence in reality. They are totally intuitioned[9] in consciousness, as merged concepts. Now consciousness, that part of *Diversium* which designates the higher organization of the mind, is rigorously connected to the rest of reality, as explained in the previous chapter. Dualism diminished the power of ideals by evacuating them to a non-existential continuum. They are making a strong comeback in reality. The philosopher can finally extend an ideal to a materialist, make her touch it, share it between identical planes of consciousness. The whole difficulty is the construction of these on common bases. The ideal is sometimes as unifying in one as it is conflicting in the other…

Here is a demonstrative example of the relationship between realism and abstraction, which has two additional interests: it shows the possibility of virtual self-representation without the presence of a brain (would Plato have granted access to the world of ideals to plants? ?), as well as the importance of the representative level in the genesis of the intention:

Our subject is a tree. Its representation of the best way to grow[10] is to look for three essential factors: light, water and nutrients in the earth. Let's watch one of its branches grow thinning and take up space with new leaves. The representation of the tree is effective. It is even able to improve it by shrinking the less well-located branches so that the sap runs in the better-lit ones.

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[9] in the philosophical sense of intuition: the reality of what consciousness experiences.

[10] Some will be rightly surprised that a tree can 'represent' something without a brain. It is precious to show us how a performance is born even before the organ dedicated to it. You can replace « the tree » with « the conjunction of requirements for light, water and nutrients which creates and sustains the existence of the tree ». You can guess the gradual transition between simple organization and intention… in the same place.

Let's take a look at one of its old, low branches, which has become inefficient because it is overlooked by younger ones. Now it turns out that this tree is on land that you have just acquired. You camp there on weekends. The low branch is ideally placed for hanging a hose and taking a shower. A pallet under your feet and here is your rustic bathroom ready. Thanks to your ablutions, the tree benefits from a regular supply of water, even in the midst of summer drought. Its survival and further growth are favored.

If the tree designed a representation to take this into account, what would it do? It would hurry to reinforce its low limb, so that it wouldn't give way under the weight of the hose, towels, and whatever accessories you might be tempted to hang on it. But the tree is incapable of such a complex representation. The branch, receiving little light, eventually dies and breaks. Disappointed, you invest in a nice outdoor shower and connect the feeder hose further away from the tree and its thirsty roots. It stops growing so fast. Its representations do not tell why. If it could form the idea of a higher power, would it say the gods have forsaken it? The fate of the tree is turned upside down by the lack of a sufficiently complex representation of its environment.

A representation is thus something fundamentally anchored in reality. There is no such thing as a 'world of abstractions' separate from the 'physical world'. Whatever their differences, they are entangled in the same continuum. The reality of the tree exists, but does not include the most effective intention. Other representations direct it, a priority search for light for the branches, search for water for the roots. The reality of the tree is a competition between fragments of intention, and it lacks an organ like the brain to organize them together. Virtuality is, in the tree, as crude as its ability to codify information. The levels of the virtual and the material are perfectly correlated. Again, there is no need to exile the virtual in a 'world of ideals'.

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How does the human mind represent?

The brain admires itself. It is that marvelous organ that allows the continued virtual stacking of conceptual self-organization levels, through fine adjustments of the same physical medium. *Stratium* chapter presented

the appearance of each additional stage as a virtual upheaval, almost invisible in neural processes. Some synaptic connections and variations and a new symbolic information appeared, fusion of sub-concepts. *Local* 'Theory of Everything', specific to this level. There is no contradiction in terms; the whole thing is generally determined by the concealment of what is not itself, rather than by its completeness. This is why each of our minds has its Theory of Everything, of a *selective* Everything, as we will see later. What brain could host all the virtual coherences?

A theory is a conceptual pyramid, that is, a structure of organized information, corresponding to a segment of *Diversium*. By corresponding, mean *molding*, encircling as closely as possible. Because it is always a representation. Only the relevant level can *experience* the concept applying to it. Representation is by definition foreign to what is merged into the level of organization itself. We could say that human consciousness no longer has direct access to the 'stupidity' of the essence of an organization level of matter. It cannot experience the simplicity inherent in this level, it does not have the natural perception of it. A statistic is inherently simple; it is to integrate it into our conceptual pyramid which is complicated and requires *intelligence*, that is, a flexible and rich mental hierarchy. Transposing the essential rules of the subject in an understandable language is the real mental challenge.

The most remarkable theories are those which chain reality with the greatest precision. It becomes an obedient thing. This formalization is easier for the elementary levels of the subject, which respect imperative equations. Hence the reputation of physicists: they direct matter with a stick. But then, isn't it ultimately more difficult to manage ordinary family relationships, where so many criteria come into play and where the uncertainties are incalculable. The mother of a family, a specialist in daily chaos?

This is not the dominant idea in science. The successes of fundamental physics gave rise to reductionism. If causality has only one direction then you have to dive deeper and deeper into micromechanisms to know everything about reality. Reductionism caused a flattening of the conceptual pyramid in the scientist of the twentieth century. No need to mold different paradigms into each segment of *Diversium*. Build up the

base and the rest will automatically unwind like thread from the 'causal' spool.

The quantum revolution has thus threatened to impose itself in cascade on the adjacent disciplines: condensed matter physics, chemistry, biology, and even neuroscience, social sciences and economics, of highly complex systems. If reductionism had realized its pretensions, quantum theory would have made all previous sciences obsolete. When everything is based on micro-mechanisms and these change, all paradigms need to be revised! This is not what happened.

Paradigms foreign to the quantum level remain. They have suffered the assaults of horizontal thought, for which this separation is fictitious. In the wake of quantum successes in the microcosm, we have thus seen the flowering of multiple attempts at transposition into materials physics, biology, consciousness, etc. Common flaw: using a distant paradigm narrows the vision more than it brings a new angle. It does not replace existing generalist theory. For example, functional MRI, a technology derived from particle properties, is a revolution in neuroscience: it materializes the function of neural excitation. However, it in no way identifies the codification of information by these neurons. It focuses on the 'how' to the detriment of the 'why'. Psychology, on the other hand, has been dealing with the 'why' for over a century. It would be sterile and damaging to replace it, in personality disorders, by a functional MRI report.

The other scientific disciplines have also resisted these intrusions and only their borders have changed. The paradigms at the heart of these specialties, the everyday tools, have been maintained. They were enriched and not upset, which seems to demonstrate their relative independence. Much of our knowledge is empirical. Of course, they are linked to the knowledge of micromechanisms, but there is a layer of arbitrariness separating them, which makes us carefully replace the term 'explanation' by 'correlation'.

We are thus ready to replace one paradigm by another, within a discipline, but that does not necessarily call into question our whole conceptual edifice. The verticality of our thinking is preserved. If there ever emerges a

metatheory to unify it, it will only be more solid. Let's keep our multi-stage mode of representation. Flatness of mind is its worst stupidity.

Our mind is therefore a dynamic conceptual edifice superimposed on reality. It absorbs new information and rebalances itself to keep its general consistency. A minor discovery readjusts a local paradigm. A major discovery shakes the building more violently and diffuses through its levels. In this sense our mind undergoes transformations parallel to reality itself. Its evolution catches up with that already followed by the existing reality, to model it with a goal to transforming it. Technological applications of a conceptual upheaval.

When we represent something, how do we know if we need an extra level of organization? How do you know whether to climb, or descend, a step in *Diversium*? The most universal clue is this: when *quantity* is not enough, new *quality* is needed. Our representation cannot be satisfied with quantifying the known properties of the subject, it needs to create a qualitative mask, a hierarchy of data. If you are looking to know where a human being lives, the color of their skin gives you a vague idea. You progress by hearing heer native language. The investigation accelerates when she shows her passport. But even more valuable is an electricity bill. This is not about addition but about the hierarchy of data. The amount of information does not matter, it is its *quality* that matters.

The quantity / quality couple is at the root of the disagreement between scientists and philosophers. The first seek to represent the world by ever more tiny and precise quantities. Need for unification. The latter portray it with qualities that are irreducible to one another. Need for diversification.

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Redusemiotism

Originally, reductionism is a method. It is about looking behind the appearance of things. Or, in an almost medical formulation, it is dismissing the symptoms of the organization of reality and looking at what is causing it. A priori this does not imply that these symptoms are an illusion of no importance. They are the level of reality we are dealing with. In medicine, no matter how much you explain to a patient the origin of their pain, all they ask of you is to relieve it. The chemical manipulations that analgesics

will operate have for her a very relative importance. The symptom is *existential*.

Yet a drift from reductionism in the last century has distorted its meaning. Scientists have started to think that since everything is based on micromechanisms, the overlying organizations are of secondary importance. Understand the foundation, you will rebuild the edifice. No explanation elsewhere than in the origin. The meaning of the rest is incidental or even negligible. This is *ontological* reductionism or *eliminativism*.

The difference between methodological reductionism and eliminativism is major. The first recognizes the existence of the complex dimension and explores it. The second denigrates it. It flattens reality by ridding it of an essential dimension. In fact the reductionist detaches herself from her brain and reduces herself to blind micromechanisms. So the term 'reductionism' has incorporated another pejorative one: 'blindness'. Today its reputation has turned sour among eclectic thinkers. Unfortunately ontological reductionism is still very present in scientific circles. I will use the term 'eliminativism' to refer to it. But methodological reductionism deserves another fate. Its relevance is in no way questioned. It is the method allowing to look beyond the symptoms of reality, without threatening the existential character of these appearances. I will gladly rid it of its bad reputation with a neologism: *redusemiotism* (from *redu*ctionism and *semio*logy, sign science).

But I have too many of these neologisms to pass you by. In the following, I will use 'reductionism' for the good version, 'eliminativism' for the bad one.

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How to define the quality of a representation ?

George Box argued in 1976 that all models were wrong. This is to confuse incompleteness with inaccuracy. A model does not claim to be, in the first place, more than a representation of reality. As reality is only accessible through its aspects, its relationships, the model can be perfectly correct for some aspects and obscure others, without this compromising the fidelity of reality to the model.

In representative activity, it is very difficult to move from quantity to quality, that is to say to move from one level of organization to another. This problem is illustrated by the sorite paradox (*soros* = pile, in ancient Greek): from how many grains of accumulated sand do we have a sandpile ?
Let's look at its constitution: a single grain does not constitute a pile. Adding a grain does not make a non-pile, a pile. Deduction: one cannot constitute a pile by the accumulation of grains (denouncing the second premise would implicitly amount to saying that there exists a number n such that: n grains do not form a pile, n+1 grains form a pile).
Let us now look at its dissolution: a pile remains a pile if a grain is removed from it. It can be inferred by induction that a single grain or even the absence of grains always constitutes a pile.

This problem is that of describing a quality by a quantity. It does not help much to say that the difficulty is semantic, that the language is unsuitable in this type of paradox: the language only reflects the need to use terms describing independent properties, which we cannot relate simply by additivity. The paradox is in close connection with the problem of emergence: an element of the underlying level does not show the property / quality of a set of these elements (underlying level). Two elements are not enough to show it either. There is no specific number of items where ownership changes from absent to present. And yet it is evident for the whole.

One way out is *fuzzy logic*. The second premise becomes: Adding a grain does not make a non-pile, a pile (99% true). The more grains you add, the less true the premise becomes. The transition from a non-pile to a pile is gradual. The transformation from one quality to another is *incremental*. This very important paradox shows us how to modify the qualitative by going through the quantitative, and therefore *overimpress* these two modes of description.

Another example is the number of fat cells, and the qualities ‘skinny’ or ‘obese’. No particular number of cells can define these qualities, and yet we attribute them at first glance in a person, without counting. We use

morphological criteria whose quantification is no more efficient than counting cells. There is no specific threshold for moving from ‘skinny’ to ‘standard’ and ‘standard’ to ‘obese’. Yet these words are not just inscriptions at the ends of the Gaussian weight curve. They are influential qualities in many diseases. They describe an additional level of organization that is not codified by the number of fat cells but by sections with fuzzy boundaries: transitional zones that one cannot resist to relate to phase transitions between physical states.

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Where does the difference between simple and active representation come from ?

Take for example a scanned image and a computer virus. Both are assemblages of bits, elementary digital units of information. The image serves only as data to the user it is presented to, while the virus performs a potentially destructive action on the information. One is passive, the other conveys evil intent. What makes the difference in the blend?

The two groups of bits are neatly organized. Both are layered. Image compression, separation and reconstitution of contrast and luminance, form several levels of organization. Likewise, the virus can have different levels of intention to carry out its task, depending on the difficulties encountered. Where then does the property to act reside?

The confusion arises from considering these two entities in isolation within the *Diversium*, instead of seeing their continuity with the above and underlying organizations. The difference lies in these connections.

Let's look at the upward meaning: the image and the virus appear to be the same structures assembled in machine language. Yet the image, even if it meets precise encoding criteria, is for the most part self-generated, autonomous; its filiation comes from the material; it is faithful to it; if the user truncates it, she loses the information, replacing it with her own. The passivity of the image is only apparent. In isolation, at this level of organization, it cannot exercise any intention. But inserted into the pyramid of surimposed information that runs from bright pixels to concepts in the user's mind, it triggers a thought, eventually followed by action. It did not

act, but participated in organizing the action. Isn't this what humans do themselves, most of the time, inserted in their social environment?

The virus does not have this parentage of matter. It is a pure transposition of human intention into the language recognized by the machine. It is a retro-control which bypasses the usual hierarchy by the power of this direct language. Never mind that the effects are potentially devastating. It is the strength of highly organized intentions that they can destroy and rebuild lower levels of organizations without risk until their own material support is involved. Intention acts through a cascade of feedback controls that backtrack through the organized structure of matter, to the targeted level, where it authoritatively replaces the existing solution with another.

The action of the image is upward, not directed. The virus's action is downward, a vehicle of highly organized intent. Looking at the bits alone, you don't see any difference. It is essential to integrate the adjacent levels of representation to establish a correct theory. In fact, all representations are effective when they are considered in their hierarchy. They are either constitutive or corrective of a constitution.

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The origin of the language

Language is a reality structure for representing others.
Do not confuse *physical support* of language and *information structuring*. The essence of the support can be true and the information conveyed false. *True constitution and false representation*.
Paradox are properties of languages, and non-constituent of reality.
Deifying language is building a solipsist world, simulation of real isolated in one's own mind.
Every language is hierarchical. Stratification masked by the abundance of the vocabulary. Object = word. Collection rather than pyramid of words. Some nevertheless derive all the others: order, causality, energy, time, etc.
Humor is straightening up a collapsible language, using words out of their usual hierarchical situation.

Brief history of language: images, sounds, writing, logic, mathematical, systemic.
An unrecognized utility of language is *the mind talking to itself*. It reorganizes itself from its own speech. Self-adjusting its coherence.
Bidirectional relationship between language and the thing represented. The structure of the thing builds the language then the language structure can discover that of the thing, especially for highly coded languages such as mathematics.
Each language has its favorite field. Replace it with another universal more synthesizes the image of reality by masking its richness. The language better understands the real, which made its success, but stay aware of the reduction it operates.

Language is an essence of reality used to describe others. It is important not to confuse *the essence of the physical medium* of language (sounds, characters, neural excitation patterns, electronic oscillations) and the *information structuring* language. The essence is real, true; the information may be false, as a representation of a foreign essence.

The consequences are major for our representation of the world. For example, paradoxes do not exist *in* reality, whatever is observed. The reality *is*. A paradox makes no sense to it. It only makes sense as a conflict or error in the language used. No matter how famous this language is, the appearance of a paradox indicates a flaw. Mathematics is of course concerned. A paradox in mathematics does not indicate a flaw in reality but in the axioms used. Obvious remark for the layman, who is not for the one who makes information the very essence of reality. If she confuses information with the language that manipulates it, she enters a solipsistic world, simulated by her own mind.

Language is a codification of the interaction between the organization of the object and the organization of the mind. The two being hierarchical, the objects of the language (the terms) also respect a stratification. Many possible solutions to this organization, explaining both the common points and the diversity of languages. The stratification is masked by the abundance of vocabulary used by consciousness. Each action, each object commonly encountered, has its own name. Thus more than 90% of the

words of the language seem to be sufficient on their own. These are the differentiated words. (chair, apple, walking, liquid…). They are associated in sentences of the same level of information, can participate in compound words, but are not used to construct higher level concepts. They are even more numerous in oral language, which serves to convey information rather than to restructure it.

Less than 10% of the words are gathered in a particular category: abstractions. A tote whose elements have little in common except to form the architecture of the rest. Taken in isolation, it is difficult to find a real object for them. They *derive* the other words, giving birth to themselves in successive strata. They are the micro-mechanisms common to the overlying words, as the same atoms participate in different molecules.

So 90% of the words have a solid footing in the conscious space. They form a tight representative fabric around reality. But the further down the hierarchy we go, the fewer foundations there are under our terms. To the point where the most basic seem to be suspended above the void. Nothing founds them. We prefer to think of this void as an immanent and eternal origin from which the root notions of thought emerge like diamonds. Common base for all languages, innate or even deified, gift of a Great Builder. As if we were computers originally equipped with a minimum binary language, before implementation of a user interface. Why not ? Scientific exploration of our mental pseudopods does not provide a better explanation, ignoring this void. The underside of language, suspended above the non-existent, is formed of abstractions that have no possible definition. In trying this, we quickly find ourselves re-injecting abstraction itself into the discourse, making it a circular definition. In fact it is not decomposable.

These words are: order, energy, causality, time, identity, everything and nothing…

This will not discourage us from defining them, as you will see, by two methods: recursion and regression to infinity. Recursion is defining the root through what it produces. It is a circular analysis, with the advantage that there is no longer anything outside of it to judge its analytical relevance.

The whole is self-evaluating; but what else could take care of it? Regression to infinity is to divide the definition by itself and then again, and again, to infinity. That is, the definition becomes essence through the accumulation of an infinity of its absences. A sleight of hand? It could not be more common in mathematics, yet little suspect of lacking rigor. For example a line is the accumulation of an infinite number of points which are absence of length. Infinity is full of fish: cast your line there and you will catch any species that does not exist!

What we will not do in this book is idealize language, even when it produces exceptional internal coherence, as in mathematics. This would be giving language the status of law and absolving it of any imperative of proper justification. An equation that is always true in an identical context becomes a "law", that is, a self-justified fragment of divinity. Deification of the tool. The why of this precise mathematical formulation relating to a given aspect of reality is never posed. The servant of this thought turns to the world of appearances, leaning against the thick wall of laws, which blinds her to the world of essences. She excludes herself from reality, although she is the receptacle of appearance, and in return sends back the mathematical formulation. So how could this language be mistaken for the ideal, however faithful it may be? How can one obscure the presence of the appearance receptor, even if she hides her individualism within a conceptually homogeneous group of scientists? We will detail this controversial relationship between mathematics and reality in a moment.

Let us return to our stratification of language. In classical horizontal thought, there is indeed a hierarchy of terms; however the whole is seen as a vast global system where each term can interact with and modify another. In vertical vision, the interactions are specific to each level of terminology. But the compositions are similar; the construction of the sentences is the same. These many analogies allow the terms of different strata to interact together, sometimes in a coherent way sometimes in a totally incongruous way. The principle of multiple realization exists within language itself.

Humor finds its use here. It straightens out language that has fallen flat. It takes it out of the purely horizontal view to show the mind the need to correctly prioritize the elements of language, to separate coherence from

inconsistency. Laughter is the doorbell warning that we have crossed the border.

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From screams to mathematics

Like any biological or mental organization, the stratification of language has a history. Its embryology is that of its utilitarianism. The primitive ancestor had to deal with a changing environment versus imperative impulses: to feed, to reproduce, and already, to cooperate in society. Need to communicate. The most efficient transmission is visual. It uses excellent retinal definition for brightness and color in the environment. The evolution of this reactive matrix identifies movement. The vision carries far: it is possible to see an object, mobile or not, at a distance where the other senses do not give any information. Beginning of sign language, facial expressions, attitudes. Sometimes the vision is failing, or too slow. An obstacle can prevent vision. Or the changes don't get to consciousness fast enough for consciousness to catch the message in time. Imagine that you are on the hunt with a companion. A predator is heading towards her, without her knowledge. She's not looking in your direction. How are you going to alarm her? Waving your arms or shouting?

The ancestor understood very early on the interest of sounds, which carry less far than the gaze (useful for communicating only near) but cross visual obstacles. Her language used poorly differentiated words: cries, grunts, whistles, the specificity of which was assisted by body language (already a glimpse of the synergy of languages). The extent of this vocabulary quickly showing its limits, the modulation of sounds diversified it considerably. We are able to finely discriminate sound frequencies. Adding the 'attack' 'duration' 'modulation' parameters already produces a large number of phonemes. By combining them in the form of syllables in words, the potential diversity of these reaches a height greater than all the human brain needs. Probable explanation that our ancestors then fleshed out their dialects, but not sought more complex modes of communication.

The next major step in the history of language is writing. It brings two additional uses to language, giving it considerable power. The first seems obvious: the persistence of concepts recovered by language. An idea survives a human life, the brain that conceived it. The new generation

doesn't have to learn everything again. It adds up its new conceptual advances. Writing is what made modern humans. In its absence, we would have remained scattered tribes, individuals with the same intelligence capacities as today, but less advanced. Because brain processes haven't changed for a long time. What has changed is the conceptual organization adopted collectively through the learnings. Oral transmission between generations could never have preserved the complexity of this building. Historical periods when hands no longer opened books did not bring significant advances in knowledge.

The second use of writing, as powerful as it is less recognized, is that *the brain can talk to itself*, through the vector of reading interposed. Remember that most of the ideational process calls for short-term memory, called working memory. It's impossible to maintain a long succession without losing the beginning. Thought drifts at random, sees benchmarks in the form of small reminiscences that prevent us from completely losing track. Awakened thought is not designed for lasting self-observation; it prioritizes the constant influx of environmental signals. Evolutionarily, it was better. Spontaneously, thought processes reorganize rather during sleep. Smart schedule: This is the time when sensory information can be safely cut off, if the necessary security measures have been taken. We analyze at day and we change at night. A productive alternation.

The limit of nocturnal reorganization is that it does not concern conscious integration, dissolved during sleep. The inner workings of our different mental functions modify their balances, not their association. They thus retain an essential independence. Also, because the conscious organization has not changed, we wake up feeling like we are *the same person*. And luckily our bedmate confirms it to us…. if it is indeed the one prescribed by habit.

I have defined personality as a *Psociety*, an assemblage of high level concepts, the fusion of which produces what we experience as consciousness. A further echelon of the mind is self-awareness. Self-observation, the practice of which is stimulated by the action of talking to one another. To communicate with oneself is to separate an *Observer* from one's *Psociety*. The attempt is still timid in the child, who hardly needs to

self-observe, at the risk of drawing an unfavorable judgment. The little child does not spontaneously write down her thoughts. She learns to do this with schoolwork, an assessment which also reveals the possibility of self-assessment. The *Observer* is born thus. This ability brings considerable personality diversification, evident in adults. Adult *Psociety* is not just an assemblage of concepts but a self-assessed and influenced whole according to a wide variety of social influences.

Writing has made people less alike. It blew up individualism. From now on, human beings could observe themselves in their behavior, contemplate their social consciousness (*panconsciousness*) and escape the imperatives laid down by it. The tyrants were right in burning the books. But they didn't really understand *why* the books produced protesters. The explanation does not stop with the transmission of revolutionary concepts. After all, they are just as well transmitted orally. The book allows you to assimilate a concept without any external influence. The brain talks to itself. From simple mimicry, the concept becomes identity, *persona*. It takes root in society because the work of autarchic reorganization, during reading, gives it a depth, a connection with the rest of the conceptual assembly, which simple mimicry never has.

I have delivered a harsh critique of social media in other books because it has the opposite effect of writing: it makes people look alike, or *categorizable*. The networked mind becomes a concept sponge. It loses the autarky and individuation brought about by self-observation. The inner *Observer* itself becomes uniform. The loss of diversity caused by these networks is camouflaged by the gigantic numbers reached by our populations. Terrifying prospect for humanity to which the Orwellian "1984" is a pretty tale.

We have left the embryology of language but are not done with its growth. A major organizational step is the recognition of logic. Often placed in a historical succession with writing, it is not, however, of the same order. The effects of writing are temporal. Persistence of language. Logic concerns the organization of languages, which is a pyramid structure. With *Stratium* you are now used to pyramids. The codes used by our neural networks have a hierarchical structure. Is it any surprise that the languages we use to

transcribe them have an identical structure? I will not detail that of oral languages. Many works have been concerned with their common origins. The most interesting point, however, is that the common roots appear even when the users of these languages were isolated. They therefore originate in environmental reality. The specificities of the users have created over their diversity.

Logic is inherent in the organization of languages. Because inherent in the functioning of the mind. The ancestor was doing logic without knowing it. The major step we are talking about is the recognition of logic as a way of structuring languages, with the possibility of working and codifying the tool itself to improve it. In this way, logic becomes a technique for evaluating languages and the ways of thinking they cover. Beginning of difficulties for beliefs. Beginning of the conflict of reason with mysticisms then the great religions. Once recognized, logic cannot disappear, especially with the extension of human communications and the confrontation of languages. Their multiplicity and the permutations they offer in the sentences make up such a diversity of concepts that we need a way to sort them out. Judging their effectiveness, bringing together minds around the most functional ones, structuring the way of thinking. Everyday language is criticized for its laxity, its lack of definition. Philosophy seizes on logic to explore the foundations of language, to find the root concepts. The downward view delves into languages as well as matter: where do concepts come from and how are they related?

Logic created its particular words, numbers and shapes, to develop a new group of languages called mathematics. Major stage in the growth of languages. Its effectiveness is remarkable in describing the micro-mechanisms of reality, to the point that some identify reality with mathematics. Subject that we will discuss later. A brake on this claim is already that *some* mathematics only identifies with reality. Why these?

Certainty: the relationship between mathematics and reality is two-way. 'Modeling the real' -> 'specific mathematics', and 'new mathematical objects' -> 'new models of the real'. Mathematics has developed in the downward view, in the understanding of an equation-friendly foundation.

They are precise and rigorous, but do not replace logic as a technique for the general evaluation of languages.

Mathematical thought has established itself as a conqueror among scientists because of its successes in matter. The further one descends into the understanding of reality, the more its competitors are completely extinguished. It was not originally intended for the humanities, nor to eliminate other ways of thinking. Two centuries ago, the human mind was still isolated from matter by dualism. Religions and philosophies disputed it. Things have changed with reductionism and the success of mathematics on matter. Unfortunately with a less relevant additional reduction: that of ways of thinking. The equations have not been shown to be so effective in human relationships. Scientists did not begin to communicate with their children using mathematical symbols. Need for a language adapted to the other direction of the structure of reality.

Systemics is a major new step in the organization of languages. Birth of upward thinking. The reductionists having drilled very deeply into the foundations of matter, how can we install an elevator to raise our vision? We will see the history of systems in more detail in the next chapter. I would like to insist here on the fact that these two directions of language are at the same time concurrent and absolutely complementary:

The downward view criticizes languages for blurring the real mechanisms of reality. The upward vision commends them for this. How to understand their complexity otherwise? The authentic reality of the mechanisms is inaccessible to us. It is imperative to throw a blanket over it, which molds it as tightly as possible. The interface between the two is called chance. Systemic is the formalization of chance. To see fuzzy reality is also to be able to condense it into a functional fusion, that is to say to allow decisions. This is in fact, we find out, that the mind does. The mind does quite well in an uncertain world because it willfully blinds itself at random. It crystallizes the blur.

We have placed mathematics at the base of our pyramid of representations of reality. However, they are not the ancestor of languages. The universality attributed to them is recent and excessive. Mathematics is in fact a

collection of languages without a conductive thread to which the whole of reality would conform. The perfection of a body of equations does not exist within a well-defined system, that is, a construction of the mind. The rigor of the models increases as the levels of *Diversium* are lowered. Is it reality itself which conforms to language or language which loses its discrimination? It is the human brain that professes this language; however, it departs from the phenomena for which it was selected as a powerful tool.

Pragmatism shows us that each language has its privileged field of action. Replace it with another more reductive seeking to universalize knowledge, but impoverishes its qualitative richness all the more. Let us encourage the synergy of languages, which is not a juxtaposition or an armistice: each is subjected to the counter-power of the others. Let's multiply the observation belvederes. This is useful for any popularizer, and the researcher herself when she wants to explain her work to a large audience. She translates her mathematics into verbal language. She verifies that even surprisingly they have a coherence for the usual paradigms of consciousness, which is a place of integration more exhaustive than the particle fields. An effective language structure is a set where the languages themselves dialogue correctly. Several independent visions surround reality and reveal all its natures, united in a single mind.

It is not just an opportunity but a necessity. Having the right language for each organizational layer is imperative to building solid vertical thinking. Language must respond to this fundamental property of interactions on which we will constantly insist: bidirectionality. Outrageously privileging a language corsets thought, extinguishes its different modes for the benefit of the only one who is translated by this channel. Thinking shrinks by the use of single language. It flattens out, because all systems are supposed to obey it, in a horizontal universe. I myself could be the target of this criticism, since I give pride of place to structuralism. But I also urge one to withdraw from the structure, to blind oneself to it voluntarily, to experience the fusion, because this independence from the ubiquitous relationships in reality is intimately part of its organization.

It is possible, if the assumptions of this book are correct, that the need for vertical thinking is still deeper. Let us deflower for a moment this essential

message of *Surimposium*: the essence of each level of reality is brought back to the layer of order it constructs. Fusion of a fragmentation, whose regression without visible limit dispels the very notion of definition. World of appearances surimposed on the world of essences. Mimicry of our *Stratium*, our mind, to the 'matter' section of *Diversium*. The concepts themselves are the subject of this unrestricted regression, which dissolves the problem of epistemological obstacle.

But let's not cut corners. We still have essential foundations to see, and we are not done with the math. I would like to point out that the previous speech in no way seeks to dispute the value of this discipline. Its central place is proven. Candidate for the title of language of languages? To explore. So far the metaphysical considerations heard on mathematics are aesthetic in nature. The effectiveness of equations stops at metamathematics. I don't want to desecrate an identity language. It is constitutive of the Real pole. But in the absence of a universal language, one must know how to get out of the preferential language. Mathematicians are no exception. What matters to us here is not to replace the mind with one of its languages, however important it may be at the heart of each person's identity.

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Order

The order is one of the problematic concepts-roots, defining only by themselves.
How to get out of circularity by breaking the order using itself? Define an incompressible, insecable unit of information?
The order is born in the unit facing the totality.
Does *the disorder* exist or is it a temporary blindness, between two phases of order?
The disorder is not the opposite of the order. It is the lack of information necessary to characterize the order of a state in appearance disordered.
Orders each with their formalism, try to match. They evolve from each other on a scale between accuracy / certainty and likeness / uncertainty.

Round trip. Here is one of our heads to tail between 'mind telling reality' and 'reality structuring mind'. Having defined the modes of knowledge changes the nature of the essence of things. What the mind can grasp is the *order* of things. Distinct regularities of a 'bottomless' context. What is this order that reality presents to our minds ontologically? On what is the structuralist thinking that has colonized all knowledge based?

Do we have a satisfactory definition for terms as basic as *regularity*, *structure*? Classically, a structure is defined by the organization of the elements of a system; but the 'elements' are already visualized in a structure: circular definition. Likewise, a regularity is defined by the conformation of a system to a rule, proportions, a balance, a model… examples which hardly shed light on an equally circular notion. Regularity and structure are pleonasms of order. Order is the conformity to a rule and a rule is a manifestation of order. The mind is strangled in trying to identify the most elementary of its basic postulates, even more fundamental than causation. It can't even ask itself the question « Why is there one order rather than none? », because 'none' is not a reference. It is only a supposed absence, never complete. Random is too complex an order for our mind to calculate or too brief for notice. Nothingness is an order still invisible to our instruments. Order *is the entirety of what is accessible to us*, reality as well as virtuality, because our mind can only see order. Impossible to get out of it. "An intelligible relation between things", the dictionary says, but things are already provided with an order, and intelligibility is the property of a multi-ordered entity: human. When she thinks she is leaving the order, she has only just changed it.

The order is in our eye and presented to it. It is relationship, both in its nature and in its perception. What tracks it is a particular order that we call mental. Order to read and order reader. To the proper nature of these two orders is added the relation order. The order-relation arises from a concordance between to-read and reader. Everyone is subject to change in this relationship. The reader-mind constructs a better representation of the subject to be read, from its existing order. It can retroactively modify the order of the subject, thanks to the bidirectionality of the order-relation. The information represented by these orders is therefore perpetually subject to change, and simultaneously is always information. Order never goes away,

only its aspects change. In that sense, it is a very honorable candidate to be the essence of reality.

The circularity of order makes it a particularly suffocating notion to our minds. The role of mind, in fact, is to leave the notion and represent it, with the help of others which are available. So the mind takes power over a notion, instead of just experiencing it as an essence, which is a dead end for its organization.

What *Surimposium* will do, to get out of such suffocation, is to break the order with itself. It is possible to section it. By separating it into constituents, and assembling them into different varieties of order, we create diversification. Order creates resemblance but also difference. Organizational platforms intertwine, overlap, and exponentially accentuate the diversity of the whole. Chaos, if it exists, is being created. It is at the end of the order's maturation process, not the beginning.

Is it possible to find a principle even more basic than order? Indeed, if we make it the essence of reality, problems arise. Why is there not a single order, but a multitude? What is it that generates this diversity? We have to look lower.

This lower level exists. Order is defined there, semantically, by the relationships between independent elements. Are we really out of circularity, since we are taking up the notion of ‘elements’? These can only be abstracted from order by being considered indivisible, unordered. Do we have something that matches for sure? No. Problem of knowing whether there is an ultimately unbreakable substance of reality or whether there is only information. One way out is to take as indivisible elements the elementary units of information, such as the sequence of real numbers. They can establish countless relationships with each other, but are credited with an existence of their own as a real entity.

There is no need to define a minimum quantity of these elements, for example to speak of a system with at least two elements. It is more universal to define on the one hand the unit, or the individuality, and on the other hand the whole, which can be formed of any number of identical

elements, or of different entities, which we summarize then under the term of 'context' or 'environment'. Here we have the beginning of the principle discussed at length in this book: the opposition inherent in each element as an individuality and part of a whole. SoliTary versus soliDary. T<>D conflict.

No order is eternal, in the meaning of 'without beginning and without end'. However, the time scale differences between elementary units of information mean that some systems behave as having no beginning or end for others. This is how they acquire ‘element’ status for these other systems. They seem immutable there.

There is not one order, but a host of possible formalisms. So much so that one is entitled to assume that the disorder is a temporary state, the summit still under construction of an already organized edifice. History shows us that most disorders, chaos and random phenomena, were simply waiting for the discovery of their formalism. Each mind has its preferences in terms of formalization, so we are tempted to define order as being the instantiation of the formalism we know how to manipulate, rather than a property of the system being studied.

Information, our next topic, doesn't exactly mean order. It is a *measure of order* (or disorder) based on a particular formalism. Formalism distances us ‘formally’ from the essence of the ordered thing. It concerns the *representation* of essence. The essence can only be experienced by the thing. When philosophy speaks of *intuitioning* the thing, it is the mind that tries to substitute itself for the thing, in order to experience itself identically. This is of course impossible, but an approximation is possible, which we will detail later. In short, it is about merging as many levels of information about the thing as possible into a proprietary intuition. This makes it possible to give a variable depth to the intuition, corresponding quite well to its ambivalence, to this impression which is both photographic and volumic.

To say a system ‘disordered’ covers at least two possible situations: 1) The system is ordered but we do not have the formalism to know it. 2) The system is ordered but does not communicate information. These two

explanations being able to account for all the disorders, do there remain with certainty situations of authentic disorder? Can we define it other than by restricting our observation criteria?

The analysis that we could make of it is only valid at the present moment. Allowing the 'time' dimension to intervene complicates matters enormously. The system is very likely to see its order increase or decrease, to go through phases of apparent disorder, or to be suspended between two orders. Unpredictable dynamics. A chaotic or random state should thus be considered by default as a non-sequencing of reality by the mind, and not a 'basal' or 'resting' state. The disorder is not really one; it is an order not counted by the formalism used in the framework described. Order is a principle, while disorder is not, even though it can be quantified. The term ‘principle’ already includes that of order, so ‘disorder’ is absent; but our mind needs a principle to grasp a thing; ‘disorder’ can only be understood by that of absence. The principle of order knows a multitude of formalisms, disorder none. There is no algorithm to produce the disorder. Quantum mechanics is not random. To demonstrate the existence of disorder, it would be necessary to find a portion of reality that is totally independent, autonomous, and devoid of order. This sort of thing is inherently inaccessible to us.

Formalized and unformalized order (disorder) are entangled in a continual dynamic. The disorder can be seen as a transition between two orders, or the reverse: the order transition between two disorders. Nevertheless I will be a bad anarchist and assume that, overall, this sequence is a search for order, for different reasons: it has a direction; my mind is not tied to growing disorder; but above all it is a sequence, therefore an implicit order. A postulate which retains an anthropogenic background, of course. But I’m not trying to make the observer (and the reader!) disappear, just to clarify their place.

This observer, we summon it by speaking of formalization. New switch. The Spirit pole looks at the Real. As the orders each fall under a particular formalism, they need to relate to each other to correspond. Their concordance is never initially maximal. There is a whole scale of intermediaries between perfect match, or *correctness*, and partial match, or

likeness. Two other basic names refer to them: accuracy is *certainty*; the resemblance is *uncertainty*. Let's see how our minds deal with this concordance scale.

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Certainty and uncertainty

Impossible a priori to found the certain and the uncertain in the world. They must be founded in our mind. Certain / uncertain is the elementary clamp of the mind to apprehend the world.
Uncertainty is broken by tools, emotion to logic, making choices.
The only certain place is what is proven. The rest is represented. *The representation is the formatting of uncertainty*.
The more the mind moves away from what is proven, the greater the uncertainty, the more complex representations need to manipulate the world, bring it back to certainty.
The complexity comes only from this remoteness. It is founded in the mind. The world, self-proven, remains simple for itself.

The world is uncertain. Who does this statement come from? Is it the world that evolves as uncertainty, or our minds that do not know it well enough to predict it? Humility suggests the second answer, and assurance the first. In either case, it is the characteristics of our minds that provide the answer. The world says nothing. It limits itself to encouraging us: its image becomes clearer when our model approaches it, or becomes blurred when the model is false. Of its real appearance we know nothing. An unbearable uncertainty. To which the mind must be blinded. Otherwise what would it be for?

In a perfectly *predictable* world no questions would have mattered and our sniffer minds would not have taken place, we may believe. Does this imply that the world, for sure, is not deterministic? No. The functioning of our minds could be deterministic, and their production not. A larger virtual world would be born within our minds, within which would hide the deterministic universe, difficult to discover among its countless possible versions.

In a perfectly *unpredictable* world no question would have been answered and our minds could not have organized, we may believe. Does this imply that the world, for sure, is not completely uncertain? No. If the world is this virtual space containing all the possibilities, then it contains that of our minds, and these can find around them patterns similar to theirs. The mind would be a machine for selecting possibilities and would build its reality around itself on its own.

It is therefore impossible to found the certain or the uncertain in the world itself. Is it correct to base them in our minds? There is no other place. However, they do not take root in it uniformly. The most banal of discussions with a fellow human shows that certainty and uncertainty are implanted in her in a very personal way, different from mine. Strangely enough, one certain thing for me seems uncertain to her (is she blind?), and one uncertain thing for me seems certain to her (where does she get this power from?).

If we are to cooperate together, such gaps are sources of conflict. It becomes imperative to put our certainties and uncertainties together, to turn things into 'rather certain' and 'rather uncertain'. Quite a strange consensus, fundamentally, since in fact there is nothing left but uncertainty. The certainties have disappeared in the affair and some of us are greatly moved. Who can we trust? How to decide?

Uncertainty is not at the service of action and we are not consciously equipped to deal with it out of hand. Consciousness is designed to merge possibilities and choose, and if we have made the wrong choice we are eliminated from the race. This is how evolution created and organized the species. Originally it is as a whole species that we deal with uncertainty, not as individuals. Individual errors within the species compensate for each other, frame the best choice, and progress continues for Homo sapiens as the society of its members. Today we integrate the process into an individual mind. At birth we are very determined, equipped only with instinctive certainties, quite noisy even. Then we learn to recognize the uncertainties. To immediately cover them with a new conceptual layer, which takes place as 'certain' makeup. At least for those who have an obvious ease to manufacture it. The others, afraid of the uncertainty, go

back to their previous concepts. When failure is repeated, anxiety increases; the mind is more and more reluctant to move forward. We call it 'personal failure', and the most common symptom is school failure. Two outcomes: letting anguish invade one's mind, and taking action becomes difficult; or reject uncertainty and stick to simplified certainties. In both cases the maturation of the mind is severely hampered.

Even difficult to manage, let us establish that *uncertainty is the engine of organization of the mind*. Whether it is *in* the world or not, its effects are evident on the development of our conceptual edifice. We find in the human personality two tendencies that follow one another as we mature: 1) Not being equipped at the outset to deal with uncertainty causes our consciousness to blind itself to action. 2) Consciously adding an interest in uncertainty causes us to end up declaring our ignorance in order to keep progressing.

Uncertainty is above all a *tool* of the mind, making it possible to construct representations of the world and to improve them in order to better manipulate it. But we are not supposed to be in the know, otherwise the process tends to block: the representations are presented without deciding between themselves. None reach the fame enough to be active. The acting status is enabled by the 'I', this opaque fusion which aggregates each new representation into identity and defines its degree of compatibility.

The world is certain (maybe), but we can only act on it with uncertainty. It is in fact very improbable to immediately grasp the *certain* act. And we would be unable to find out.

Here is the essential place of uncertainty. To seek it out in the world appears sterile, since it is to develop a concept of an uncertain world and not to experience the essence of the world. The useful inquiry is to understand how our mind deal with uncertainty. In it, certainties are signposts marking out the vast uncertainty in which the world appears to us. The further these indicators move away from the known heart of the world (identity), the more they turn into 'stop' signs (beliefs). The mind is that dynamic organizing process that moves signs, replaces 'stops' with arrows, and looks carefully at what they indicate. Thus progresses the

world map that is our mind. The proposal of this book is simple: add arrows up and down, move through the floors of a pyramid representation and no longer just on the surface of a puzzle.

The conflict between certainty and uncertainty is perpetual. When we think about getting rid of it by mathematically modeling uncertainty, we are only giving back a little advantage to a certainty that seemed to be losing the battle, when strict determinism lost its luster. What is mathematical modeling if not to restore a matrix of certainty around uncertainty? What is probability if not a leash around the neck of uncertainty? After a few experimental pull-ups, we again know roughly how far it is…

The major principle founding this book reappears here: the T<>D conflict, soliTary vs soliDary. Certainty is individualistic; the individual, before being confronted with another (with an organization equal to itself), is *everything*; with the other, it becomes *element*. Uncertainty is the set of all the elements, all the possibilities; it is the collective; in the individual, it is that individual as part of the whole, added to all the others.

The only certain place is what we are experiencing. *It is the walk of the mind given to itself*, which does not need to be conceptualized. In practice, in human beings, the certain is restricted to the unfolding of conscious processes, the part of it that is felt as a fused and secure being. For the rest, fusion becomes sooner or later impossible (even the body does not always react as consciousness expects it), and it is necessary to move away from it by representations.

Representation is the forceps to manipulate what is not integrated into our conscious fusion. Handle uncertainties. The further the level of organization where the object is considered is from the experienced conscious level, the more uncertain the representation. A familiar congener is still relatively safe, because she shares neighboring mental contents with myself. A foreign congener is less certain. We try to identify her with tags, skin color, race, age, dress code, etc. An animal is much more uncertain still. To believe that we can experience its consciousness is delusional. It is with great confidence that we make it a little more certain by defining it by its repetitive behavioral habits, ancestors of our own.

Let's step back to the top of *Diversium* to see the uncertainty dramatically increase: some are trying to predict how society will evolve, but success is weak. Yet these levels are hosted by our minds. Are they not very close to our conscious sensations? Shouldn't we be able to naturally predict our social developments? No. Because these levels are formed from all of the individual representations. None strictly alike. Their organization forms additional levels that are not directly accessible to our way of experiencing. We cannot experience the health of a nation. It's a representation. The gradual estrangement of these social strata, one after the other, forces us to place them in images and symbols, with increasing approximation. If you venture to make predictions for the species, you must have an accurate representation of all intermediate levels. Due to the complexity reached by society, no one is able to do it anymore. Our 'opinions' are mimetic projections of certainties much closer to our consciousness than the subject itself.

Likewise, down *Diversium*, at the levels of inanimate matter, our representations drift away from experienced paradigms and uncertainty increases, despite the initial successes of determinism. When did this determinism first give up the field of uncertainty management? This was to model the behavior of a gas. Is it a surprise? The gas is close to us by its technological interest, but very distant by its behavior and its level in *Diversium*. Impossible to apply our certainties to it. It had to be framed by statistics. Then it turned out that dealing with uncertainty can greatly improve our understanding of systems closer to us. It has gradually colonized large swathes of technology, from communications to the refinement of production techniques, and beyond the individual mind, in marketing, insurance, investment, all social processes inaccessible to certainties.

In summary, the more the mind moves away from the plane of its individual consciousness, in terms of levels of organization, the more uncertainty increases and the more complex tools must be put in place to make it manipulable, to bring it back a little towards certainty. Reason why moving away from the conscious plane makes it difficult to approach reality, while reality itself, from the point of view of each of its levels, is not

more complicated in one than in the other. The only possible 'complication' arises from the inconstant ease of our own concept stack to stretch itself vertically. To do this, we need to acquire conceptual tools far removed from the core identity, this core formed of intrinsic, instinctive certainties, kindly provided by our ancestors through our genetic heritage.

The most important of these tools is the notion of probability, and its science, statistics. Nevertheless, before tackling it, let's give the floor back to the Real pole, since it provides the framework to be studied, the famous *information*, which has become so popular for the affiliates of the Real pole that some think it is entirely *made up* of information. Let's see this.

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Information

Downward look: The undifferentiated reality becomes reality-information under the eye of the mind and its technological assistants.
Upward look: The reality is self-organized, creating its own information.
The information defined by Shannon is technological, property of the mind and its instruments. Here is a definition independent of what looks:
Information is a stability defining its own existence.
Which does not impose that it is substance but does not prohibit it from recovering one.
Before interaction an information is 'whole'. Fusion without reference to the outside, only to its own structure.
Let's call this totality *informessence* (information-essence).
The informessence can not be measured, only proven (the measure is already an interaction modifying it, it is no longer *totality*).
The presence of something else transforms the information into *individuality*. Part of a new totality. Informessence becomes information-*relationship*. Change of *status*, no nature.
Since the information-relationship is correlated with the similarity between instrument and measurement object, it decreases when this similarity is strong (akin things have fewer information to be transmitted than dissimilar things). Connection with Shannon information.

Informessence and *thing per se* are inaccessible. But communication is possible with a level of information of the thing.

The best possible approximation of the thing per se is then the surimposition of the information levels to the organized summit of the thing.
Excerpt from surimposition, a level becomes simpler information, the one that passes through the communication, represented by the downward look.

The information is artificial when it is not owned by its support, but tattooed by the transmitter. *Informartificial*.
Compared to the surimpression of information that constitutes the issuer in itself, the information devices only reflects one of its levels, isolated. Which defines the difference between communication (only this level occurs) and interaction (the transmitter in itself occurs).
Paradox of the informessence: We define it as a fragment of stability while it constantly mutes, from one state to another. Problem of identity in time, object of convention in the human mind.
Paradox resolution: Information does not change in its ontological definition, self-proclaimed. It changes in the identity attributed by the mind, which amalgamates its states in a period that it chooses.

The data is the part of the information that can mimiced by the vector and the receiver.
'Data' becomes 'information' via the model, ownership of the receiver.
Thus the link between informessence and information received is not neutral, which prevents the receiver from fully accessing information.
The transmission is a temporary organization between levels compatible by their information, among things in itself foreign to each other.
An information can not be fully transmitted. It would make the receiver and the thing a single entity.
The thing per se is therefore alone in being able to integrally proven itself.
The notion of depth of experience is the height of information levels transmitted by the thing.
No ontological difference between information and non-information. Status likely to switch at any time.
Shannon's information (uncertainty measure) is included in our definition. By individualizing within a whole, the information makes the whole less uncertain.
'Meaning' replaces 'information' when the receiver is mental. This is an information modifying a cognitive state.

The intention is born in the infidelity of the representation.
The representation is by nature different from the thing in itself since it gums the diversity of its constituent elements. It operates an *approximation*.
'Proven' the thing means that the informations of the transmitter and the receiver fit.
In the relationship of the mind with one thing, a part of the exchanged informessence is buried in the unconscious conceptual pyramid. Interface / translator for consciousness. This consciousness can not proven like the thing. It feels as a surimpression of its levels of information about the thing.
The infidelity of a representation comes from approximations of its intermediate levels of information. Many are mimetic in learning, with variable success.
But progress also come from infidelities. The 'facts' bring together the minds. Interpretations raise their complexities. Diversity source of superior conceptual organization. Advanced science.
Replace 'faithful' by 'consensual' about representations.
The decision is a totalitarian representation of the information openly assuming that it obscurs uncertainties about them.

"Information" is a notion that has changed dramatically over the past century. Previously it only appeared to the downward look: hieroglyphics, books, coins, clocks… information was synonymous with frozen things, only coming alive in the presence of an awakened mind. Then the upward look took hold. Instead of limiting itself to atoms and other grains in the making of things, it began to see interactions. Changing information, perpetually agitated in fact. It came to see its own mind as subject to such turmoil. Interacting neurons and no longer the soul pulling thoughts from an invisible universe. Then machines did the same. Computers and networks are driven by the flow of information.

Information has gone from being inanimate to the source of all animation. Because a doubling of the look has taken place. Birth and amplification of the ontological look.

Informessence

Behind its mask of substance, the order of things is transfigured by the structuralist view into information. The double look, between the Real and Spirit poles, will assist us in the delicate task of defining information.

The case is indeed difficult. The upward/ontological definition is based on Shannon's theory. Technological attempt, based on the order/disorder relationship. But order is categorization, information already created. Shannon's definition thus fails to break out of circularity. It does not investigate the fundamental origin of the information. Shannon himself never made any claim other than to turn it into a technological formalism. We will come back to his informational entropy in a next chapter.

Quantifying the form does not attribute a quality to it. The upward look is unable to give *meaning* to information. Meaning is the attribution of the downward look. Meaning is built on properties of form. The reduction operated by the downward look is to make it an element, a substance. The downward look is independent information, housed in neural networks, which searches for itself in things. They are autonomous *representations* very different from the *constitutive information* defined by the upward look (which I will call *informessence*).

The redefinition of information which follows is therefore of little interest from an ontological point of view. It has a major interest in *substantial* vision. It allows us to find our usual concept of substance within the structuralist vision which dominates science today. It is not about creating alternative mathematics to manipulate information but to say what information, as a tautology, ignore.

'To give or receive a form' is a classic definition but circular since a 'form' is itself information. 'Demonstration of order' or 'result of a process' are open to criticism for the same reason. We have seen with language that this problem of circularity indicates that we are reaching the foundations of our conceptual organization; there is nothing more elementary to dissect the concept being studied. This is why information is seen by some as the very essence of reality. Indeed, the only point common to all categories of

information is that *they are directly constitutive of their existence*. Does it take a human mind to call them? Or are they independent of it?

Question at length debated. The back and forth between spirit and reality slowed down our investigation; but it becomes profitable. By the downward approach: undifferentiated reality becomes reality-information under the effect of a tool to conceptualize it: the human mind assisted by its instruments. By the upward approach: reality self-organizes, creating its own information. I will show in the next chapter that it does more: it conceptualizes itself, one level of organization after another. The information created by mind and matter come together. The controversy dissolves. The human mind is a conceptualizing tool high up in *Diversium* hierarchy. It increases a depth of information that reality began to create from its original foundations.

Shannon's information is owned by the mind. We want one *independent of what looks*. There it is :

Information is a stability defining its own time of existence.

It is thus entirely definable by itself, whatever the context in which it is found. In fact, information cannot be defined more basically than as quantification: 'one' information. And this even before the context gives it a qualification. It takes a tiny and yet elementary stability to speak of 'one' piece of information. The numbers themselves are names for these insignificant yet imperative fragments to establish the simple principle of 'one' interaction.

Do not ask the question "Stability of what?". By doing so you lose the generality of the definition. Information presented in this way does not have to be substantive. It can be a simple excitation, a Gaussian peak, an attractor, a particular object of a set of information of another nature.

Before being communicated, entering into a relationship, such information is 'everything'. It exists intrinsically, without reference to anything outside, a fusion overcoming the organized edifice of the sub-information that constitutes it. Information, in isolation, is the set of elements that have

worked together to define it. It is a *totality*. Let's call it 'information-essence', or more simply *informessence*.

Communication convulses this status. Suddenly there is something *foreign* to the information. An alternative, another system. Information suddenly becomes an individuality. A new context has arisen, a new whole in the making, if the exchange with strangers succeeds in creating a higher organization. Communication exposes information to change. It can be disguised, become a mimicry of another, or itself colonize the structure of foreign information. A conflict is born. It is *information-relation*, or *confrontation*.

Informessence and *confrontation* are not of a different nature. This is a *status* flip-flop for information. From soliTary status, independent totality, it again becomes soliDary status, part of another whole. It changes position with respect to the T<>D principle.

In the soliTary status, information has a stable autonomy corresponding to our usual notion of substance, of the essence of the thing. In the soliDary status, information is dependent on what is external to it, with the power to reform a new totality in its image, or to disappear in favor of another, or to maintain a persistent conflict.

This notion of status is not just a little story to reconcile with an antique need for substance, which our mind would refuse to give up. It is a notion independent of information, which derives from its very existence. It is necessary, as we will see, for reality to stand 'upright', a verticality which is not a mathematical dimension, which is external to the information itself. A dimension that the theory of a purely informational universe lacks.

'Information-relation', is it synonymous with 'message'? 'Message' conveys the idea of an intention to transmit it, to seek a receiver. There is no such kind of intention in matter. The organization seems blind to it. Objects do not send messages to us. But they communicate. With us and the other objects.

We will see later the definition of a level of reality. Its interface, the passage from one level to another, is at the heart of communication. Information-relation is the link between informessence and meaning. It is the burst of a receiver for the communication that sets the level of reality. Just before, it is still a pure informessence, only constitutive, passive synthesis of this constitution. The surge of a receptor transforms this informessence into one element of a higher level system, two or more elements. The hierarchical jump starts at the instant of contact.

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Informartificial

The connection between the essence of things and information raises many difficult questions, which we must resolve. The first is that there is sometimes no link between the information *communicated* and the essence of its medium, simple *vector*. Data used by our minds can travel on sound waves, electronic streams, printed characters. The information conveyed is similar, while the informativeness of the medium is radically different. Where does communication get its very existence?

The case we have just evoked precisely defines *artificial* information. The information conveyed does not belong to the essence of the medium. It has been tattooed by the human mind, and is understandable only to it, or to the targets for which it intends. The information communicated is meaningless to the medium itself. The difference between informessence and *informartificial* is therefore this: an *informessence* is capable of self-organization; its structure allows it to evolve spontaneously, without perceptible limits. It is an autonomous entity. An *informartificial* is static, or susceptible to evolution within prescribed limits. It is not the property of its structure. This is how it can be reproduced on various structures. An informessence is a level of information *entangled with others*, underlying and overlying in the thing studied. The *informartificial* is this level taken in isolation.

It should be noted, moreover, that an *informartificial* can be part of a level in addition to an informessence without disturbing it in the links, because it is not entangled with the other levels. For example, writing characters in ink on the paper of a book does not change the informativeness of the book. The characters contain an independent informartificial. This could have

been inscribed on another level of informessence of the book, say its molecular structure. White pages, but the message is present. The informartificial is tattooed but does not participate in the essence of the book. It cannot produce any additional organization.

It is important at this point to clarify our terms. What does 'informessence' cover for a thing? What is the difference with its essence? Both are inaccessible to us. To grasp the whole essence of the thing is impossible, for a reason as scientific as it is philosophical: the ultimate foundation of the thing is not known. But we can communicate with an informality of the thing, that is, one of its levels of reality or several entangled. We can also define the best possible approximation of the essence of the thing as follows: it is *the surimposition of the levels of information of the essence up to the top of the organization of the thing*.

The levels of reality of the thing correspond to its manifest regularities, which are both the orders ensuring its stability and the anchoring of our observation. The relationships between these levels are less easy to codify. They are, however, just as 'real' in their participation in the essence of the matter. To isolate one of these levels of reality for study is to immediately cut yourself off from the essence of it, no matter how precise the 'initial conditions' gathered for the study. Non-surimposed informessence, stripped of the underlying levels, is no more than simple information, that which passes through communication.

Let us return to the connection between communication and informessence, which has become less mysterious. Many questions remain. How do two forms of information come into relation and mutually modify each other? Do they always mutate or do they sometimes remain intact, together creating a higher level informessence? If they transform, are they only concerned with their own, or is the whole structure of the thing involved? Would the resulting informessence only be the reorganization of the substrates of the other two, all constitutive information placed in a common pot?

All these eventualities appear possible. For example, when two gases meet, it is indeed their molecules which mix and form a final medium, not

necessarily gaseous; the resulting informessence replaced that of the two gases. When two atoms meet and form a molecule, the atoms retain their individual organization, which reappears if the molecule splits; the informessence of the molecule adds to that of the atoms without disturbing them. When a sperm meets an egg, the formation of the egg leads to a cascade of reactions that permanently changes the egg and the sperm, triggers a duplication of the resulting information from cell to additional cell, in fact opens up like a book the information contained in it. the genetic code for it to unfold.

When an experienced craftsman meets an apprentice, the communication between the two minds profoundly changes them, especially that of the apprentice. The superior concepts of the craft take hold, but also all the underlying structure that is necessary for them to exist. The simple mimicry of a gesture changes the pyramid of mental organization, from the integrative concept of the gesture (including its visual representation) to the effector motor neurons. The surimpression of all these information is transformed. The informessence called 'personality' in the apprentice changes. It remains close to the previous one. Much of its elements remain the same. It changes more profoundly if the craftsman and her apprentice establish a parent relationship and discuss intimate matters.

This example shows a paradoxical aspect of informessence: I defined it as a fragment of stability, but it can constantly mutate, each of its elementary times giving way to a different version. We returned to the problem of defining identity in the time dimension, analyzed previously. Identity is the subject of a convention in the human mind. A fixed identity is assigned to a body, regardless of how it moves or whether all of its cells have changed after a few years. A personality identity is assigned to changing neural networks. Until a certain point.

The paradox of evanescent informessence is resolved as follows: it does not change within the framework of its realistic, ontological definition (informessence is a stability defining its own time of existence); it changes when our mind uses it for the notion of identity, where it amalgamates its successions in a time that it chooses.

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Data, experience, meaning

The easiest aspect of informessence is commonly referred to as ‘data’. Values provided by elements and systems, which are the basis of their intrinsic identity. They can be in direct relation with the receptor or communicated by a vector. They have extrinsic significance only when transformed into something digestible for the receiver. ‘Data’ becomes ‘information’ literally. This is the role of the model, which can be the property of the receiver (mental representation) or of the communication vector (translator). Data is not informessence. It is the part that the vector and the receiver can mimic.

The transition from ‘data’ to ‘information’ assumes the existence of a transformation by a third party, the model, and its owner in ambush: the programmer. This is where the restriction posed by philosophy comes in: the mind cannot access the essence of the real, because the link is not shared equally between the two; it is possessed by the mind, the programmer. The real responds in a Manichean fashion: yes or no, agree or disagree with this model.

Transmission is possible due to the very nature of the data. The level of informessence copied is similar to that of the receiver or vector. Transmission is a temporary organization between compatible levels of foreign information to each other. A succession of stabilities is necessary to transmit variations. This is why we have defined information as elementary stability.

A priori it is not possible to fully transmit the informessence of a thing. This would make the receiver and the thing a single entity. In our conception of identity, at a minimum, the spatio-temporal parameters of the receiver and of the thing must remain different. The thing is therefore the only thing that can fully experience itself. However, we give the property of depth to the experience, for example when we feel more or less invested in an experience felt by someone else. This depth corresponds to the stacking of levels of information transmitted. The more the receiver has a comparable height of these levels, the more it has the possibility to similarly experience the informessence of the transmitter. On the contrary, the more these levels

are reduced by the model or the vector, the less the receiver is able to experience the original informessence.

Let us take a demonstrative example in the world of business. A CEO receives information from her departments, corresponding to 3 different organizational levels: 1) operational data (how tasks are performed in practice); 2) tactical data (how resources should be used); 3) strategic data (the different perspectives that threaten the company within the market). The CEO combines this information to make her decisions. Operational data (good state of satisfaction of workers) can be irreconcilable with strategic data (it is necessary to lay off). If the CEO copied the information levels of her workers, she would experience the same thing and be unable to proceed with the layoffs. But she only copies the "whether or not to have a job in the company" level, aggregates it at the strategic level, and her experience becomes "it is regrettable to fire but it is necessary". Of course, the experiences of the worker and the CEO are very divergent and they become very alien to each other.

In this book, we will use ‘data’ and ‘informessence’ almost as synonyms. It is about the identity of the exhibited thing within the system, which must be taken into account in studying its relationships. ‘Data’ has a more restrictive meaning than ‘informessence’ because it assumes that there is an observer (the mind) to manipulate it, while reality self-organizes its ‘informessences’ to form new ones.

Our definition of information makes it an *individuation*, an identity in the face of non-identity. It oscillates between 1 and 0, from *Whole* to insignificance within the whole. In Shannon's theory, information is what is structured within a ‘noise’ that is not. Selection rather than definition, property of the receiver. Noise is also information (in the structuralist view everything is information), non-contributory to the receiver. The definition we present is more ontological. It makes no difference between information and non-information, both names of informessence. Except for the change of status: non-information is a totality, information is no longer one: it exists *within something else*.

Any non-information can thus become information, without changing its nature. In fact, this is what it does systematically. In the absence of an ultimate knowable Whole (for which no 'other' is possible), no non-information can be maintained. Everything is potential information. This definition singularly brings nothingness to the existing and facilitates the resolution of philosophical as well as physical questions when they are of dualistic inspiration. But that is not the subject of this chapter.

The chosen definition spontaneously amalgamates the different meanings of 'information'. The meaning 'message' is implicit; in individuation there appears a potential relation to what is 'other'. 'Representation' also finds its meaning in the resemblance (interchangeability in the relation) with the information within that which is other. The modes of representation lead us to 'languages'. The categories of 'knowledge' are based on languages. Among the media of knowledge, the most evolved, but not the only one, is 'thought'. We are already here, to describe the information, in a conceptual stratification. Our mind needs several successive layers of organization to take hold of the principle. As we situate mathematics among languages, a priori they are not the foundation of the principle, despite their efficiency. We will discuss the disadvantage of confusing information and mathematics later.

Shannon's information is encompassed by our definition. The individuation placed at the root of 'information' implicitly leads to the separation of identities and therefore behaviors. Information enters into a relationship with 'others' and others with information. It is then easy to include information as a 'measure of uncertainty' in this definition. Certainty, in fact, is the separation of true and non-true, of more and less probable. Information, by individualizing itself within a whole, makes it less uncertain. Absolute uncertainty is what cannot be divided, that is, there is nothing else that can be separated from it to assess it. It is also easy to insert the term 'meaning': everything is information for an individual if an effect on her cognitive state occurs. But generally speaking, 'meaning' is a more reductive term than information because it visualizes only one direction of the relation between the latter and the rest.

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Are the representations accurate?

Information is not synonymous with 'knowledge'. The information is specific to the relationships between the parameters studied. Knowledge is more composite; it is built on top of the information governing the system itself, with representations or cognitions.

How does the mind handle the information communicated? We have previously approached this problem from an evolutionary and utilitarian perspective, summed up in the maxim "small mistakes get it right". As we continue to mature, an adult human eventually attains a level of self-observation that she sees herself as a frequent source of error. She seeks to reduce its consequences. Is there a safe method to achieve this?

The gap between information and representation is frequent. We say 'opinion' for the second. But is fidelity possible? A representation is in fact, as we have seen, a pyramidal conceptual edifice that we associate to the self-organized edifice of the subject providing the information. The apex of this representation, that is, the most elaborate concept manipulated by our consciousness, conforms to the subject only if all intermediate levels are. However, the intermediate representations are approximate. Lower in the hierarchy, they are generally mimicry acquired by our mind during its maturation. We have not *experienced* each of the levels of the subject studied in turn. Our consciousness was still in the state of a building under construction. We have *learned* to add them up, just like the people in charge of our education.

To experience them, you have to be able to blend in with the subject's information at each of its stages, which requires knowing the precise language, mathematically at the base. Only a sophisticated consciousness can do this. We have to differentiate this late power of conceptualization from the precocious faculty in an immature consciousness to coordinate with a subject, without understanding the detail of its underlying organization. A child learns to use a tablet almost instantly, without knowing anything about its inner workings. The more elaborate habits of adults make it difficult for them to appropriate the same functions. The child *experiences* the functions; for adults they are an interface. Very few people, perhaps none, would be able to properly experience all levels of

organization of the tablet, from its quantum properties to its user interface, and thus transform its full essence into a true representation.

To say a faithful representation is all the more perilous as it is impossible to say, for each of its intermediate stages, that the solution learned is the best. The one elected as 'the best' is in fact the most consensual among the thinkers given as 'specialists' of the level analyzed. However, notable progress in knowledge often comes from those who break away from the consensus to rethink the solution differently. It's the infidelities that drive us forward. Not all. The vast majority of them end up deadlocked. Opinions without a future. But it is among this diversity that a better solution emerges. If it concerns a sufficiently foundational level of the organization of reality, our whole conceptual edifice can be upset.

Scientists adopt two opposing attitudes on this subject. To fully understand them, let's take the example of medicine. The doctor may think he is dealing with healthy people, almost always suffering from minor disorders; it is reassuring. Or she may view people as perpetually suspected of having a serious illness; it is worrying. The first attitude is preferable for a hypochondriac; the second is better for a patient who rarely consults.

The scientist in general can estimate science in good health; its disorders are minor; it doesn't need new ideas. Or she may view science as still harboring severe afflictions; any further examination is prudent and desirable; new ideas deserve a break.

They still need to be properly founded. The relativity of time and quantum mechanics have only challenged contemporary mentalities among a tiny part of the population. They are not taught by parents or teachers until high school. Mimicry is an essential part of education; replacing it with new fundamental assumptions is to risk making learning globally inconsistent. Thus the conceptual edifice that we pass on to ourselves is the subject of careful retouching, to avoid capsizing it.

We never have 'faithful' representations, but 'consensual' representations in the socio-cultural environment in which we operate. Trying to convey information rather than an 'opinion' simply means that we present our

interlocutors with a subject less altered by our personal conceptual edifice. This is advantageous for recipients who are gifted at building a relevant final representation, perhaps more relevant than ours. This is penalizing for those who have difficulty constructing the final representation, such as when a student unsuccessfully seeks a solution to a problem and sets herself up for failure. Mimicry remains preferable to an absence of representation.

Transmitting so-called 'factual' information is a way of reducing conflict over its interpretation rather than making it 'objective' information. At what level is the fact treated? If it's sensory perception, chances are good that everyone agrees; humans are endowed with roughly identical meanings. If the fact is told, objectivity is already more suspect; the presentation is more proprietary. If the fact is interpreted, objectivity drops dramatically. However, at no time is there a line between objectivity and subjectivity. Facts drift away from their essence, but become easier to digest.

Low-level (sensory) information is communicated well ("did you see that?"), gives predictable, consensual results at the level where it is injected. Subjective information ("did you know that?") is more conflictual but also of a higher level. It surprises, shocks, provokes rebellion, adoption or incomprehension. An opinion assaults or seduces, but always contains higher conceptual scale information.

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Decision

The decision is the creation of a new global representation, fusional, integrating the underlying information. It is not based on the information of things but on their communication. It itself becomes a new formlessness, absolute during its creation, then capable of confronting others and relativizing itself. The decision is a rival to the essence of the thing described. It is an attempt to make the thing behave differently. This avowed discrepancy is the only thing that differentiates it from a simple representation, because they are of the same nature. A representation is always out of step, without saying it when it cannot determine.

The decision is the totalitarianization of a set of information, more assumed than in a simple representation. It reduces uncertainty about all information, by ignoring approximations about it. Is this reduction of uncertainty an addition of information, which would be surimposed on the previous information? Seen from the building blocks, information is lost (that hidden in the approximations). From the decision, information is gained (the choice of organization). This is important systemically, depending on whether one places oneself within the system or in front of the stacking of levels of reality. The way of calculating the final information content differs.

Subject that we are going to discuss with Shannon's information, defined *within* a system. In this framework, information is defined by the degree of uncertainty about the system (great uncertainty can only be captured by such a great amount of information). Reducing your uncertainty through approximations is therefore a loss of information. But this is only true within the system, not in its relationships with others. By going through an additional organizational plan, the amount of new information created is not predictable.

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Communication

Shannon's information is a theory of communication. It concerns the *message*, says nothing of the transmitter and the receiver.
It measures the uncertainty of the message. Certain message = unique possibility = little information. Uncertain message = multiple possibilities = a lot of information.
The *bit* is the unit specifying the choice between 2 equiprobable alternatives.
The *noise* is random disturbance blurring the message. It increases the uncertainty so the amount of information.
Redundancy protects the noise message by repeating it. It increases the cost in bits.
Two aspects of information are not managed by Shannon's theory:
1) Its *hierarchy*, which gives several levels of meaning to the information of the same message.

2) The *erroneous* information. Power of error, possibly counterpower in the receiver. Organizing pressure on the receiver.
Missing information is not an unknown. It is calculated precisely, like the information. Current starting point in systemic. Probabilities take foot in reality.

The theory of information is a reductionism specific to the downward approach. It defines a level of reality by the homogeneous information which constitutes it, represented by a model algorithm.
Although this reductionism is blind to the stack of hidden levels in disorder, it is the craftsman of this hierarchy, creating the relative independence of levels.

The more likely the message, the less information it provides (Wiener)

An algorithm which would generate a purely random system would take as long to express as the unfolding of the random system itself (Chaitin)

We continue to talk about information. This section deserves to be individualized because it is the only one straddling the Spirit and Real poles. We opened it with a maxim from the father of cybernetics, Norbert Wiener. Opportunity for a brief historical review. It can be difficult for the generations who are now continually immersed in information to experience the way of thinking of our forefathers, a radical dualism between matter and mind. We are surrounded today by robots, intelligent assistants, search engines that smell our tastes. Only a century ago, an automaton driven by stupid gears fascinated, but that it could possess a soul, a *receptacle for intentions*, was pure fantasy. Manipulating information was exclusive property of the human mind. The idea that everything could be interacting information received an official birth certificate in 1943 with the first articles from cyberneticists[11]. Reality becomes fully interpretable in terms of information. All that matters is the logic of the relationships between events. In one of the articles, a Turing machine can be interpreted as an idealized model of the mental function of the brain. The mind has

[11] 'Behavior, purpose and teleology', Rosenbluth, Wiener et Bigelow, and 'A logical calculus of the ideas immanent in the nervous activity', McCulloch et Pitts, 1943

become mechanizable. The dualism is no longer appropriate, neither that of body and mind, nor that between *informessence* and *information-message*, which are confused.

Unfortunately the original cybernetics contained its own reductionism, which subsequently showed its limits. Too horizontal view of the systems. Simple replacement of the flesh by the virtual gears of information. The mind is not a universal Turing machine. To say that it is the assembly and especially the superposition of a multitude of these machines is more correct. Cybernetics is concerned with organization, misses self-organization, that is, the evolution of processes. It was about simulating, not about making the simulation so intelligent that it escaped its creator. The military who funded Wiener's research wouldn't have liked it anyway.

The cybernetic revolution has continued in different directions. John Von Neumann demonstrated the possibility of a universal constructor, a self-replicating 29-state processing machine, that is to say capable, on reception of a signal, of duplicating itself with the signal in more. An intention of perpetuation appeared in the animate. The way information is self-administered has broken down barriers.

Information theory

Information as an abstract quantification tool was defined by Hartley in 1928. Then Shannon created his information theory in 1949 to meet the needs of telecommunications reliability. This work concerns the *information-message*. Formalization of *transmission*. Shannon called it "mathematical theory of information communication". It is not interested in the sender or the receiver, which are by convention equipped with a common repertoire to understand it. The information-message studied consists of regularities within a signal considered to be essentially random. Shannon's theory therefore targets information such as sought by the human mind specifically. It does not cover the message in general, as it appears in the interactions of reality.

In this theory, information is defined by the *number of possibilities* conveyed by the signal. In a somewhat counterintuitive way, it is assimilated to a *measure of uncertainty*. A certain signal contains a unique possibility, so little

information. A random signal contains a large number of possibilities, which is a lot of information. Mathematically, information is low as the logarithm of its probability is high (i = - log p). The unit is the bit. A bit is a signal fragment specifying for the receiver the choice between two equally probable alternatives. The more information the entire signal contains, the more bits it will take to transmit it.

Noise is defined as the random disturbances of the signal interfering with its transmission. We have just seen that randomness increases the amount of information. If we want to reduce this quantity to precise information, the noise is annoying. This definition of noise does not contradict the self-organizing noise found in natural processes, which we will see in the next chapter. As information increases, more possibilities become available to the system, which is an advantage to find the most interesting. In natural processes, there is no such thing as 'good information' defined a priori. We are not in the situation of a human mind having conceived a particular concept and seeking to transmit it faithfully.

Redundancy is a way of preserving specific information from noise. Its repetition decreases the risk of truncating or losing it. Redundancy increases the amount of information. It has an additional cost in terms of bits. On the contrary, seeking economical transmission requires eliminating redundancies, or even eliminating the less significant parts of the specific information to be communicated. Principle of compression. For example, removing vowels from a text does not make it unintelligible. On the contrary, it will read flawlessly and almost as fast.

For our purposes this introduces the very important notion that not all information is of identical significance. Information, even reduced to bits, is not egalitarian. It is composite, hierarchical. It is a fragment of a conceptual stack common to the sender and receiver, some stages of which are more necessary than others. Here we leave the human communication framework of information theory. The transmission of a concept stack is a process involving the whole of reality. This is the way in which two 'similar' entities, that is to say neighbors in degree of organization, can recognize each other as such. The message must contain a reflection of this degree to be readable. The sounds emitted by animals, close to our own, are

incomprehensible to us (or very little) although they also reflect social organizations. A conceptual stack added by our brain takes us considerably away from the crude meaning of these sounds. We are no longer 'similar' entities in language level. Interaction is severely limited by the difference in degree of organization. We can learn this language, but it is impossible to *experience* its meaning the way animals do.

If the information is hierarchical, the redundancy does not have the same value depending on the level of significance of the information to be protected. In a genetic code, certain sequences are more vital than others in ensuring the perpetuation of the organism. A mutation at a critical location destroys it, so these sequences are the best targets to protect by genetic redundancy.

This principle is valid for any organized entity, including communication media. Let's apply it to a book, for example. Let us assume that the message it conveys is primarily addressed to minds with a given level of understanding. Let's say Book A targets students and Book B targets experts. They deal with several conceptual levels. In Book A, the redundancy focuses on elementary concepts, without insisting on the most elaborate, or even obscuring them because they constitute an incomprehensible "noise" for the pupil. Book B details and repeats sophisticated concepts over the pages, quickly moving over the basics that are noise of no interest to experts.

Communication is approached by Shannon from the perspective of trying to convey a *clear* message. However, it has another aspect: throwing a *wrong* message. We can easily guess the consequences for humans, and even for the rest of life. But if life is an arbitrary boundary, what about the mistaken messages from the rest of reality? Can we separate voluntary and involuntary errors elsewhere than in human relationships?

The effect of an unintentional error can be confused with that of noise, since it is the interference of information that generates the errors. Voluntary error is radically different. Sender and receiver have a common language and the information is transmitted with the precise intention of triggering a different reaction than expected. It is no longer a question of infidelity of

the signal in relation to the information transmitted, but of fidelity to expressly truncated information. The concept of *manipulation* is born here. Manipulation is the trigger by the sender of a reaction in the receiver that it would not have spontaneously undertaken. Or the cancellation of an expected reaction in the receiver. The exchange of information is no longer neutral. A *power* from the transmitter to the receiver appears. Power is the message of intention. Intention is the hallmark of individualism: "I spread my intention". Whereas neutral exchanges are collectivist: "We will choose the intention together".

Intention and power are not reduced to error, but we will see in the next chapter that the consequences of this are remarkable, whether voluntary or involuntary. On the one hand, it declares the representation to be false in the receiver, after experimentation. That the receiver in exchange indicates that its individuality sets up a *counter-power* to oppose the intention of the error. On the other hand, error forces us to construct a superior representation. This is to manage the possibility that the information received is inaccurate, or less accurate than expected. Information is no longer directly acting at the receiver level. It is *observed*. These two pressures of error have an *organizing* effect on the receiver.

Let us retain this essential point from Shannon : information and non-information are independent notions; the second is not unknown. The missing information is calculated precisely. This is the number of binary questions you need to ask to determine the information you want, or the shortest algorithm to get there. Order and disorder become interchangeable as the starting point for studying a system. This is how the odds gain a foothold in reality. Note for example that consciousness is a process of spotting irregularities in the midst of our programmed habits. It looks for disorder in the midst of order, which may translate into an order of another nature.

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Intermediate synthesis

How do we relate, at this point, the Shannon information to the one we defined previously, as an elementary quanta of stability defined by its own duration?

Compared to our personal definition, Shannon elaborates further on his definition of information. The *possibilities* are stabilities in the sense of our definition. They are more. They add the notion of statistics, that is to say the adjustment between an eventuality called ‘real’ and the set of possibilities. Shannon's information is already a quantification of the relationship between the oneness and the whole. This is why we lose the notion of substance about information. The step "What constitutes a quantification?" is forgotten. Quantification is a stability defined by its own essence. This is where one cannot obliterate the substance within information. Substance is what does not change. Shannon's definition takes information along the way, being interpreted, and not at its root.

Shannon's formalism works very well in a homogeneous, clearly delimited level of organization. It is a codification of the *language* of reality and not of reality per se. It does not take into account the surimposition of the levels of reality in their relationships. Accuracy on one level may be error on another. Some information cannot exist without others, while the opposite is not true. The qualitative aspect of the information is not managed.

We have to look at information theory for what it is: reductionism. A downward approach tool. It allows a level of reality to be defined by the homogeneous information that constitutes it. The smallest algorithm describing it fully is constitutive of this level of reality. Absolute loyalty. There is perfect identity between the algorithm-model and the informessence of the level. For a follower of a universe made of information, the amalgamation between the two is tempting.

In this downward approach, we do not care about the reason for information in such and such a place. All information is implicitly inserted in the right place in reality, participating in its construction. There is no longer ‘good’ and ‘bad’ information in the sense that one is useful and the other useless, ‘outside of reality’. There is only information that is necessary since it constitutes reality. The only problem to make them relevant: inserting them in the right place in the models so that they become exactly superimposable on reality, ie *be* reality.

The downward approach has an essential interest: it erases the gap between model and essence of reality. It defines a level of reality by its minimum quantification. It is the craftsman of the organizational dimension of reality, by defining there organizational quantas that are these incompressible levels. Such quantas are the best approximation of substance that we can have about the real in a structuralist view.

The other interest of model/essence reductionism is to make the level of reality independent of its neighbors. The model does not need to be concerned with the underlying micro-mechanisms to be declared accurate. It ignores their variations within the limits where it remains faithful as a model. If one speculates that information is reality, the conclusion is astonishing: it means that the real itself operates a reduction by raising its organization from one level to another. The real instructs its abridgment, its synthesis, its schematic approximation, information forming one level in order to surimpose the next. No addition seems to appear, from the point of view of the original level. Information from the upper level does not materialize there. The reduction of the real is not a negation of its own essence, as an underlying level. It doesn't make the information disappear. On the contrary, reality seems to seek its essence. Its information exchanges are not in a static configuration, reduced to closed calculation loops. There appear incompatibilities, persistent conflicts, preventing the attainment of a perfect and eternal order, which would mark the end of all conflict. Organizing is the addition of additional layers of information to stabilize underlying information conflicts, a perpetual escape route to this perhaps unattainable goal.

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Cinematic interlude

Little interlude in our difficult climb to the complexity of information. This illustrates the unusual notion that a message of which the recipient knows the content contains very little information. You spend an evening at the cinema…

In a certain category of popular films, the script makes the characters say exactly what is expected of their social consciousness. Sometimes the episode concerns a significant event in their individual life, such as

marriage. Nevertheless the actors pronounce the agreed words. Solemnity wins out over the desire to make a text more personal and unexpected.

These sentences do not contain any information. Social consciousness being shared by all spectators, each of them knows in advance its content. The scene has the same effect as if everyone had been handed a mirror in which is reflected the same image, the ideal citizen. Encouragement to think that you are that ideal. Programming of the collective in the individual through the media.

The reinforcement is all the more effective when it is based on a strong emotion. Marriage awakens powerful feelings. But above all it is the collectivization of an idea that triggers particularly positive and pleasant emotions. The ego backs down from the whole. To be part of something bigger. Our evolutionary wiring makes us seek this impression. It rewards the societal aspects of our behavior.

The popular film's script contains very little information. It simply refers us to our identity. It checks to see if it's still there. If it's not the right one, we quickly stop the film out of disinterest, because it doesn't add any new information.

The author's film contains foreign information. That of the author, much more individualistic and shifted from our own identity. The film contains an imprecise amount of information because it is difficult to communicate. We stop the film for lack of understanding. The dialogues are 'noise'. Eventually, during a re-viewing, things clear up. Information content is increasing.

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Informational complexity

The 'complex' criterion arises when *communicating*, translating representation.
Its definition varies according to the authors. What is common to complex systems? A conflicting initial state within their environment. Their interactions evolve.

The complexity depends on the resolution with which the system is observed, where its initial state is fixed. Is it then a notion belonging only to the observer?

Mathematical definition of complexity: Kolmogorov algorithmic information content K(s), the shortest algorithm capable of displaying the full message.
Bennett proposed adding the measurement of logic depth P(S): time set by the algorithm to display the message (s) (in elementary steps).
These measures each reflect one of the two contradictory aspects of complexity:
1) K(s) measures the possible compression of the apparent order of a message.
2) B(s) measures the potential order that is not apparent in the message.
B(s) corrects a fault of K(s): For a random message K(s) is maximal (the algorithm is as long as the suite), which assigns it counter-intuitively the highest complexity. On the other hand B(S) is minimal: (algorithm = suite) is a single step of calculation. A random message has a zero logical depth.
The roles of K(s) and B(s) are different. That of K(s) is simple: identify ordered suites within the random. K(s) creates an organization level. Dismemberment of complexity.
That of B(s) is to estimate the total height of the information levels, without specifying the number. Globalization of complexity. Skip on qualitative breaks.
Neither K(s) nor B(s) succeeds in recognizing the levels of information. These are not satisfactory measures of the true complexity of one thing.

The complex is not adding simple, but entanglement. In this sense it is unity like the simple. The complex does not oppose simple, it alternates with it.
The complexity exists only in the representation activity, we find it again owned by the observer.
But the observation is not elective of the human brain. The characteristic pattern of an organization plan *represents* its elements.
The information merged in this representation is the best possible definition of the *essence* of the organization plan.
It exerts a retro-control over its own structure. The extent of this retro-control is the root of the complexity *proven* by it (property of the actual entity).

How to separate information from noise? How to calculate the complexity of information that is not clearly delimited? Classic horizontal vision reduces this complexity while vertical vision can keep it. They are complementary.

Part of one system may contain more information than its entirety.
This surprising result comes from the principle of *symmetry*. The information decreases uncertainty. But the symmetries between the parties can reduce the uncertainty in each of them at the general level of the system.
Which connects the quantification of the information to the resolution of the observer.
The selected choice for information contains an epistemic approximation inherent to the observer.

A binary number is an elementary example of *integrated information*. Isolated, 0 and 1 contain minimum information (1 out of 2). Integrated in a byte they are 1 out of 256.
The integration only makes sense by reference to the whole (the 'byte' container representing all its possible values).
Two bytes associated according to a specific rule form an additional level of information.
Integrated but independent level by the presence of the rule. Different quality.
Quality invisible in the information of the level alone. It only appears by surimposing it to its constituents.

We have seen that complexity has no meaning in the experience of things. Nothing can be experienced complex since experiencing itself is a fusion. The meaning of the complex does not emerge until it is communicated. You have to *represent* it first. In the human observer, the *complication* is a measure of the difficulty of the mind in forming a conceptual stack representative of the thing. It is in the eye of the theorist that we must separate the simple from the complex.

The divergences of theoretical approaches according to the authors make the variety of definitions of complexity for a system. Is it the non-linearity of its evolution, the presence of self-organization, the appearance of

emerging properties, the feedback of the whole on the elements, the heterogeneity of these? Let's review a few choices:

Nonlinearity is a reductionist point of view. It favors an upward sense of organization, postulating that everything starts with micro-mechanisms. Disadvantages: no ultimate foundation identified, and non-linearity does not include the reverse principle, retrocontrol or recursion.
Retrocontrol in isolation does not better define a complex system, for the same reasons.
System heterogeneity is not a necessary condition for complexity. Cf cellular automata. The increase in order is not constant. Very ordered systems, such as a crystal, are not very complex. Emergence and complexity have no well-authenticated kinship; cause or consequence?

In fact, is the question correctly asked? Does it make sense to look for complexity in the intrinsic nature of a system, when its definition is marked out by what observes it? Can the simple and the complex be anything other than extrinsic qualifiers?

Complex systems have in common that they are in an initial unstable state, in conflict within their environment. The conflict is trying to be resolved through organization. Search for a stable solution. However, the organization only ends the conflict or transforms it without making it disappear, because the new groups created discover new conflicts between them. The importance of complexity is thus analogous to the size of a family tree. The more you start it from a very old grandfather, the more complex it becomes. But who chooses where it starts and where it ends? The observer, of course. Reality being entirely a superposition of these conflicts, it is itself a gigantic complexity. The only way to see it as 'simple' is to divide it into interactions so close and homogeneous that they seem banal duplications of each other.

In other words, the simple appears at the small end of the telescope, the complex at the large end. This is the notion of *aggraindizement* of physicists: the definition of observation defines the system. If you look at a photograph through the telescope, you see a cluster of colored grains, lose the 'picture' information. Chaos of unordered dots on this scale, seemingly

'simple' in its low information content. While the identified image with all its details could reveal the tangled relationship between the characters represented. A fixed and yet 'complex' system for the observer investigating this subject.

Would complexity then be purely in the mind of the beholder and foreign to the elements of reality? Let's continue our investigation.

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Algorithmic information content

After Shannon and his information theory, complexity attempted to be given a mathematical definition in the 1960s, with the algorithmic information content of Kolmogorov, Chaitin and Solomonoff. An algorithm is a calculation rule. Applied to a computer, it is a calculation program based on data encoded in series of 1 and 0 (bit). To define the complexity of a given message chain, we look for programs capable of displaying it on the screen (and ending thus). The length of the shortest of these programs is the algorithmic information content of the message-chain, that is, K(s) for a sequence *s*. Another criterion will be taken into account later by Bennett to define the logical depth P(s) of the sequence *s*: this is the time taken by this shortest program to reach the display. The unit of measurement for this time is the elementary calculation step for the machine model used, or an execution step referring to the programming language (C, Basic, Java…).

The complexity according to Kolmogorov shows that the term conceals two contradictory meanings:
1) « I can't remember the sequence because it's too complex. How can I make it easier? ». This is the complex of a seemingly chaotic phenomenon. How much can we reduce this chaos? This is what K(s) measures, the correct gauge for what is specifically called Kolmogorov random complexity.
2) « Maybe the sequence is complex because I can't quite grasp its organization. How do you know if it has one? ». It is the complex of an invisible order. K(s) is a bad measure of this complexity because K(s) is maximal for a random sequence, therefore devoid of apparent order. The logical depth P(s) does better: the minimal program capable of writing a random sequence is as long as the sequence itself. So a single instruction is

enough to display *s*: (program) = s. The display time is minimal, which corresponds well to P(s) = 0, the smallest logical depth.

To summarize: Kolmogorov random complexity describes seemingly chaotic phenomena, and Bennett's organized complexity or logical depth describes systems whose order is difficult to determine. The contradiction contained in the term ‘complexity’ requires it to be defined by a dual approach, a measure of non-organization and a measure of organization. Replacing ‘complexity’ with either ‘arrangement’ or ‘variability’ would be clearer.

Does the arrangement continuously slide from ‘pure randomness’ to ‘maximum organization’? No: for a sequence *s*, the function correctly calculating its random part K(s) is different from that calculating its organized part B(s). The latter has flaws and shows that it is tackling something composite. It seeks to assess overall organizational depth.

In fact, the two methods do not measure the same thing. K(s) looks for sequences *s* that seem completely out of order. They become exponentially numerous with the length *n* of *s*. If *n* is infinite, the probability that *s* is random can be assimilated to 1. This ironically implies that the infinite pseudo-random sequences generated by any algorithm are in reality part of the infinitely small number of ordered sequences!

The task of K(s) is therefore quite simple since it consists in identifying the small number of sequences which are not random… without saying what else they are. Kind of quantification of the statement "I am blind to the essence of *s*". This method raises a number of questions, the main one being this: the beginning and the end of a sequence are arbitrary; what is behind it? There are no absolute beginnings and ends in reality. The most commonplace of intentions, in the mind of a logician, has ascendants and descendants.

As for B(s), what it attempts to measure is an organization that can be limited to a single algorithmic level as well as extended to a multitude of levels. It is not able to define the number. It gets lost in Turing's suspicious notion of a 'universal' machine. The ‘universal’ version is never more than a

function derived from the simple machine, transforming its constants into a variable. Can we not imagine a 'supra-universal' Turing machine, managing the conflicts of the universals between them? And the same then for the supra-universals? Staging without recognized limit. How, from a large number of these stacked levels of organization, could B(s) differentiate an organized result from an authentic random sequence? Which raises the question of the reality of authentic random sequences.

Take for example the series of distances in meters traveled by a human being each day of her life. This is a very long string of numbers, which will appear completely random to most compression algorithms. Perhaps the particularly gifted one might notice that the sequence is a series of numbers between 0 and about 10,000,000 (making the approximation that a man can fly up to about 10,000 km in 24 hours). But how could this algorithm explain the sequence of numbers between them, which are nevertheless very precisely organized by a long list of criteria, from the anatomy of man defining her stride length to the multiple reasons she experiences for to move, through its socio-economic situation for the choice of transport? This incredible list of criteria is hierarchically tiered into systems, each surimposing its information. This stacking has a precise result, the number of meters covered. A number hiding an obvious organization, but no algorithm is able to detect and quantify it. For that, the numbers would have to be separated in the following, and their meaning would have to be *unstacked*. Hierarchical, qualitative quantification, added to sequential quantification.

We thus see that B(s) is an organizational measure limited to a single level of organization. If there is a second one, you should ask it explicitly. There is no algorithm accounting for the vertical dimension of the organization. By vertical dimension I do not mean the course of the system (a simple deduction that can be calculated by the algorithm) but its destiny (the appearance of a higher level of order, of an additional quality). If an algorithm explaining this dimension existed, it would make a sure prediction. However, algorithms only achieve this in artificial situations, by isolating a level of information and carefully limiting its initial conditions. Context chosen for the model and ensuring its success. The reality is different.

K(s) and B(s) are thus measures of variability and not of complexity. Let's explain the difference with an example: you are listening to music played by a solitary flute. The refrains separate more dissimilar sequences of the melody; the piece ends with an improvisation. There is an inconstant variability in this music, which can be quantified correctly by K(s) and B(s). Another composition is played by several instruments. One sets the pace. A second follows a sequence of repetitive notes. A third adds more elaborate chords. A fourth launches into whimsical variations on the same chords. A fifth weaves a solo in which the mood of the soloist shines through. Finally, a last instrumentalist uses a synthesizer to add some industrial noises whose only objective seems to be to break the beautiful harmony of the others. Style. In the end, the whole seems more repetitive than the music of the flute, but the listener finds it a much greater sonic complexity. Less variable but more complex. Neither K(s) nor B(s) can measure this complexity.

K(s) may be a wrong measure in its very conception. It postulates that the studied system can be located anywhere between 'pure random' and 'maximum order'. But all of reality is organized, even when it is a condensation of probabilities. Pure randomness is only possible by postulating an absence of order, which is impossible to demonstrate. It is in fact synonymous with 'incalculable'. Which doesn't make it an absence of order. In other words, by postulating that *s* can be random, K(s) is a measure of incalculability, in other words of blindness. It's useful for navigating complexity, but that's not what we're looking for to define complexity.

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Complexity of reality

We have seen in the subchapter 'Interaction' the terms 'simple' 'complex' and 'complicated' from the point of view of the Spirit pole. What about the Real pole? For it the 'simple' seems to be its propensity to let a short algorithm fully define one of its information levels. While the 'complex' signals several levels of information stacked up, related but not *inferred* from each other. The complex is not just multiple (several); it is *entanglement*. In this sense it is a *unit* like the simple. Complexity separates from simplicity as a complex word separates from a simple word. There is

information overlay. The simple is not the *opposite* of the complex. It was also not *part* of the complex, with the idea that the complex would be the addition of a large number of singles. It is *fusion* of the complex. There is thus an alternation between simple and complex aspects of a thing depending on the level of observation / interaction.

Is fusion only a holistic symbol in the mind of the beholder? Or is it a *realistic* supplement of essence for the entity which thus sees its complexity increased? In other words, does the notion of complexity only belong to the Spirit pole or is it also the property of the Real pole?

Complexity can only exist in the activity of *representation*. Whatever the heterogeneity and the number of criteria organizing a system, it cannot see itself as complex. It experiences itself as simple (in the sense of natural) because *it is* the process. When a person describes herself as 'complex' she means 'complicated'. It is a representation of herself that makes this diagnosis. The part of our consciousness that experiences does not perceive itself as complicated. The ‘complication’ is therefore the difficulty of adapting its representation to a level of organization that is far from it. A person can say 'complicated' the constitution of her own unconscious, to which she does not have direct access, while she will rather say 'simple' to represent and change a poorly executed gesture, because she easily assesses its defects and send direct feedback to improve it.

In explaining the phenomenon of consciousness, in *Stratium* chapter, we showed that representative activity is not elective of the human brain. Each plan of organization of reality contains a characteristic paradigm. Without deciding on the existence of a substance to which this principle would apply, we can say that the information contained in this paradigm is what comes closest to an *essence* for this plane. The essence or paradigm is a fused representation of the interacting elements.

The retrocontrol that this essential paradigm exerts over the underlying levels has varying scope and strength. It is then possible to give a definition of the complexity belonging to the Real pole, based on the control that an entity exercises over its own structure. If this retrocontrol is extensive, direct and powerful, it is seen as ‘simple’, *integrated*. If the control is limited,

its own structure appears to it complex, independent. The point of this definition is that it intuitively corresponds to what the human mind perceives of itself, as a real entity that experiences itself and not just as an observer. This therefore clears the gap between the complexity for the observer and that of the observed system. They can be very different (*observed* vs *experienced* complexities) but respect a common definition.

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Classes and crossings

A difficult question for the systemic is how to delimit the presence of information in the midst of non-information, or 'noise'. For example, you contemplate on a screen a black square on a white background. Let's add random pixels, black or white. The white background is gradually dotted with black dots, while the square is occasionally eaten by a white pixel. At one point, the square will no longer be recognizable. How to determine this instant? What does it represent for the formalism of information theories?

One solution proposed within the framework of Kolmogorov's complexity is to bring together in the same class of objects the original square and the noisy but still recognizable squares. We then apply the complexity calculation to the class and no longer to the only starting object. It works, but we get the impression that reality has been adapted to the conceptual tool rather than the other way around. Save the tool when it obviously loses its power when things are getting difficult? Annoying for a tool of complexity.

Let's suggest a different approach: pixels and square are not part of the same level of information. The square responds to particular rules for the organization of these pixels. They should draw a polygon with 4 sides of the same length and 4 right angles. By blurring these rules, we can include in the same level of information all the images on the screen where more black pixels than white pixels still form a square visible to our eye. This level constitutes the 'noisy square' information space, while the other images form the 'pixelated noise' information space. The two levels are separated by a crossing that is not instantaneous. For a small majority of black pixels on the square plot, the eye will hesitate to say whether the square still exists or not. There is a *poised realm* between the two levels.

Astonishing consequence of this crossing: the complexity suddenly changes from one side to the other. On the 'pixelated noise' side, the complexity is maximum; enough random pixels have been added so that no trace of a square is visible; note the value of each pixel to keep all the information in the image. On the 'noisy square' side it is still useful to record all pixels if it is the pixel point of view information that matters; however, a new information appeared, the ‘square’, much easier to write and common to all the images of the level. At the end of the level the solid black square on a pure white background is the extreme, idealized form, in fact rarely encountered in reality. Reality is generally satisfied with crossing over to create a level.

The appearance of the ‘square’ level is new information that is simpler than that of the ‘pixel’ level. Is it a reduction? Not exactly. The ‘pixel’ information is always present. The ‘square’ information is surimposed on it. Additional order on top of the previous one. In a conceptual pyramid such as the mind, the information ‘pixels’ is not necessary for the information ‘square’, because they are simple representations, independent. But in the structure of reality, yes! The essence of reality is the surimposition of this information.

Information theorists have correctly identified this change in complexity. They easily show that a class of objects can be much simpler (in terms of Kolmogorov complexity) than the objects themselves. Take for example all the possible sequences of 100 digits. Some will have a low complexity (the sequences of the same digit, the sequences of the same two-digit number…) but most include sequences which are not very compressible and have a high complexity. The information for this class of objects can be reduced to a very simple program: generate all possible sequences of 100 digits. The complexity of class information is low, less than that of almost all of its objects, and drastically less than the cumulative complexity of all of its objects.

Some cosmologists have used this idea to say that the universe as a whole can be very simple. The universe is the class of all objects. These can appear complex to us, and the sum of them may contain less information, they believe. Here again, this is to subjugate reality to the conceptual tool. The

error stems from the failure to recognize the layered organization of information. The superior representation, a simpler synthesis of the underlying, does not make this underlying information disappear (except in the cosmologist's unconscious :-) It is surimposed there. Kolmogorov complexity can be applied, as an informational measure, independently in each level. But it cannot calculate the result of their superposition; this information is not of the same nature.

A final problem recognized by information theorists is that the ‘class’ of objects is defined by the intention of the observer. From the start of our example, it's an eye that looks at the pixels. The intention of the eye is to spot the geometric regularities of the black pixels on the screen. It is the one who sees the images entering the 'noisy square' classroom. The intervention of a conceptual a priori in the observer seems to weaken a theory of information that claims to be autonomous. To say that the presence of the observer is common, and that it works anyway, sounds like a pirouette.

I will argue that no, it is not. *Surimposium* comes to the aid of researchers. The conceptual a priori is indeed *in the nature of the real*. Reality observes itself. The organizational crossing linked to the class of objects does exist, even if our mind only models it. This is a conceptual crossing parallel to that operated in the structure of reality. It is therefore perfectly legitimate to attempt these a priori. The only difficulty is then to validate them. And, let's repeat, let's not make the mistake of obliterating the underlying information: class doesn't exist without objects.

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Symmetry

Tools that quantify information work so precisely for physical phenomena that it is tempting to translate them into the mind. Fascinated by the negentropy-order-information equivalence of thermodynamics, Lowenstein wanted to apply it to mental work. He defined a fundamental equation of cognition: $\Delta i = \Delta s + \Delta e$. The information variation within the brain (Δi) equals the sum of the entropy variation inside the system (Δs) plus the entropy variation outside (Δe)[12]. Here is the mind transformed into a piston and steam machine!

[12] Werner Lowenstein, Physics in mind

Information gains and losses are not so easy to calculate, even with Kolmogorov's algorithmic information content. In fact, it is easy to demonstrate that some parts of a system can contain more information than the whole. Take for example the sequence of numbers 1414213562373095… It seems random, and yet it is the result of a simple calculation: 'root of 2'. Its amount of information (defined by the space in memory taken by the smallest algorithm capable of calculating it) is around a hundred bytes. If we consider a part of this sequence, we need to describe it the same algorithm plus the position of the part in the sequence. The amount of information stored is greater.

Examples of this type can be found at all levels of the *Diversium*. Suppose you are put in front of an unknown person; you have to estimate how much information she have, how much knowledge she have. You will submit a list of questions to her. Even a keen observer of her reactions, it is difficult for you to predict her answers. Could having the complete blueprint of her neural patterns do better? It's a black box. All you could do is reproduce the plan in a digital simulation and interrogate it, just like you do with the real person. Since the answers are fabricated inside the black box, collecting all the knowledge of a mind is in theory asking every conceivable question. A gigantic set. By the time you are done the previous answers will have changed. The amount of information held by the person is inexhaustible, incompressible.

In a variation of the experience, you initially have some additional information about the person: family situation, personal history, job, opinion of co-workers, etc. This additional information takes up very little space. Yet, obviously, they make your job a lot easier. The personality pattern they describe allows you to narrow down the possibilities of the answers. Finally the system (the person) + (her personal context) decreases the uncertainty about the behavior, that is to say, it contains less total information than the person considered in isolation.

Likewise, before Darwin, the abundance of life contained indescribable masses of information, the different species having no obvious connection. Thanks to the 'evolution' algorithm, built on the analysis of filiations

between species, the entire animal kingdom now contains less overall information than a group of species whose ins and outcomes we do not know.

This amazing phenomenon, the presence of more information in a part than in the whole of a system, arises from the existence of symmetries. Information decreases uncertainty. However, symmetries between the parts can reduce the uncertainty contained in each at the system level. The information increases or decreases depending on the observation resolution. Thus the notion of quantity of information is attached to a considered system, that is to say an isolated level of reality. It disregards the underlying information (the constitution of the elements) and overlying (the organizations in which the system participates).

The symmetry hidden in the apparently random numbers is what founds the Kolmogorov complexity seen previously. A possibly infinite sequence is compressed in a finite algorithm because the parts of the sequence are infinitely symmetrical. Symmetry can be inconsistent and revealed by a property called a ‘function’. In our first example this was the 'root of a number' function. The function translates a hidden order into a pseudo-random number.

Let’s dwell on what symmetry is. The way it is used in physics is not necessarily the way you have learned. Do you know this puzzle game where you are presented with several angles of view of the same object, and you must find the intruder? All the figures are the symmetries of the same object, except one. The property considered for the object being its shape, it is a question of spatial symmetry. The figures are connected by rotations in space. A series of these transformations makes it possible to return to the initial figure.

Symmetry is therefore the possibility of transforming the appearance of an element and that it is always the same element with respect to the tested property. In other words, it is the bringing together of different individual appearances for one property into a whole. We have here the beginnings of the concept of emergence that we will deepen in the next chapter: an element is an emergence because it is the meeting of several aspects and

that this meeting is information independent of the aspects — if only by the number of combined aspects, which opens the way to a quantification of the order intrinsic to this element.

For example for the property 'spatial form', an ideal sphere has an infinity of symmetries: any tiny rotation from its center does not change its shape. It remains the same sphere. Whereas an ideal cube has a limited number of symmetries. It takes a 90 ° rotation in the plane of one of its faces to find the same cube (3 symmetries in addition to the initial figure)

Each type of property corresponds to a dimension and can give rise to symmetries.

Symmetries are inherent in mathematical structures. They have an immediate equivalence in the organization of the planes of reality. It's an Emmy Noether theorem: each continuous symmetry of the mathematical structure leads to a law of physical conservation. Among the most famous conservations: energy, which corresponds to the symmetry of movement in time (physical laws are the same across the time continuum); the moment of inertia, which corresponds to the symmetry of displacement in space (the laws of motion are the same everywhere in space); the unit electric charge (effect of quantum symmetry).

The symmetry breaks are punctual. Here we have a new aspect of the T<>D conflict, in the time dimension. For each element, there is a 'temporal collective' which is the set of its states respecting the symmetry for a property, and a 'temporal individuation' which is the breaking point of symmetry between the states. The breaking point is the equivalent of a critical point in the evolution of a system. There is a series of symmetrical states before and after the breaking point. Separation between two groups of states corresponding to a real change of identity of the element. A break in symmetry is spatio-temporal. It takes place in the *sequence* of states of the element as well as in the *location* of those states.

Where do these ruptures come from? Are they really spontaneous? Is chance *real*? Or does *unpredictability* alone determine our universe, through non-decidable functions? Any interaction that occurs is calculable, unlike

those that have not yet been observed. No spontaneity therefore. A break in symmetry occurs when the system is forced to make a choice, when the symmetry is no longer tenable, under the effect of a conflict with another physical entity, we usually say « under the effect of specific local conditions ». For example, it is a liquid whose temperature drops. The organizational symmetry of the liquid state is no longer preserved. Which atom will organize with a neighbor first to produce a strong bond? Even if we cool all atoms together with the most perfect uniformity, two of them will 'crack' first, causing loss of symmetry. Why them? Because of minute fluctuations in context or their own structure. We never observe the totality of an element in its complex dimension.

This will be our provisional conclusion on information: as communication it depends on two poles. The observer is just one of those poles. She quantifies information from this point of view alone. When information is ontological, she is only receiver. She does not know the whole transmitter, only that information she chooses to gather about it. This is the reason why her observation resolution changes the amount of information she collects. This changing quantity is not that of the real but that of the model of the observer. The definition adopted for information is inseparable from an approximation inherent in the observer.

This is an essential point for the structuralist view. It is impossible to base a theory of reality entirely on information if it contains an epistemic approximation. Philosophical reluctance is inescapable: we do not have access to the essence of reality because we do not have access to the sender of the information.

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Integrated information

The integration of information begins with the slightest networking — that is, the joining of elements into a whole. The whole/network is an independent entity of the simple set of elements. A collection is not a network. The existence of the network implies that all the elements are in relation.

A binary number is the most basic example of integrated information. The 0 and 1 in isolation carry reduced information. The 0 is 'non-1' and the 1 is

'non-0'. Information is measured as part of the whole formed by 0 and 1, the elementary bits. We see that the whole is omnipresent when it comes to information. It makes no sense outside of this whole/network.

Now let's associate the 0(s) and 1(s) in the number 10101011. The position of each 0 and 1 now carries much more information. Together, the three 0(s) and the five 1(s) are the negation of 255 other possible byte values (8 binary digits).

Let us keep this number 10101011 and place next to 11100010. Let us form a new number with the bits in the odd position of the first and those in the even position of the second: 11101010. This new number is additional information integrated into that of the previous ones. But it breaks away from it for a reason: it comes under a particular rule applied to the two underlying numbers. The information remains integrated but an additional level of complexity has been added to the whole formed by the three numbers.

This level is invisible in the information of the 3rd number taken in isolation. It only appears *surimposed* on the underlying numbers. Surimposition is an emergence that appears in mathematics itself. Provided that these do not neglect the whole formed by the numbers of one level within the others. The depth of information has a meaning… deeper than it seems. It calls for the introduction of a particular formalism. This formalism should make it possible to attribute a quality to the level of information. This quality allows its integration into the complex dimension. Quality is defined by this integration. It includes all the underlying levels.

Entropy can be defined as the inverse of the degree of integration of information. Its increase corresponds to a loss of integration. The elements become more independent of each other. Only nearby interactions matter. A level of reality is coming undone.

Conversely, an increasing integration of information between the elements decreases the entropy of the system and creates a level of reality. Independence relates to the whole and no longer to the individual elements. Displacement of the T <> D mark.

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Probability

The certain (true or false) is rare. The majority of the proposals has a probability between 0 and 1.
If uncertainty is founded in mind, what is the probability applied in the world? Is it really ontological? Is it constitutive or effect of lack of knowledge?
The *Real Pole* provides two kinds of uncertainty:
1) *The known*: the eventualities and their frequencies are knowledgeable. Classic design of probabilities (example throwing a dice).
2) *The unknown*: uncertainty is not perfectly knowable. It can be identified by a distribution of probabilities. Frequentist design (repetition of experiences).
The *Spirit Pole* provides *subjective* probabilities. Experiments are never identical. Judgment of the mind on the uncertainty of an event. *Probability that it is likely*. Bayesian prediction.
These uncertainties founded in the Spirit and Real Poles are radically foreign to each other.
In the mind the uncertainty is a *predictive* coding, a cloud thrown around the essence of the real and which gradually condenses around it.
In the real uncertainty is *inscribed*, the possibilities are surimposed. The reality designates none before a superior organization, within it, gets involved.
The formalization of these two uncertainties by the mind differs fundamentally by their causal sense.
From the Real Pole to Spirit the coding of uncertainty has an upward causality. The model is born from the uncertainty, diversified by reality.
From the Spirit to Real Pole coding has a downward causality. The model is born from the subjective concept. The intention builds its foundation.
It is not dualism but *directions* within a monist relationship between mind and real.

Involving chance is factoring the unknown.
Statistics are not a reliable method for systems where there is chance, but for those where there is none.
Chance disappears in equilibrium systems made of truly large numbers of elements. Individual acts are erased in collective behavior.

Is chance a concept or only a causal concept emptiness?
It appears in the prediction vacuum, indicating that individual acts have taken up importance, which is the case for the majority of systems.
The multiplicity of individual acts puts us in the face of incalculability.
'Unpredictable' is an admission of incapacity. Predict involves measuring. The forecast is based on the theory of measurement. Arbitrary isolation of a system, while reality is a perpetual dynamic. 'Unpredictable' actually recognizes that we have not isolated what needs to be measured in all the necessary ways. The model can not clarify it.
Only pragmatism saves us: what we demand the model is to be close enough to the thing per se so that it conforms to it within the observable limits. To be able to handle it.

The mind uses two approaches to reduce its uncertainty: 1) Let it leave the Real Pole generating the events and calculate their probability. 2) The Spirit Pole 'decides' itself the probability of an event and verifies it a posteriori by its occurrences.
Each approach has its dedicated statistical tool: frequentist and bayesian.
Frequentist statistics gauges a hypothesis about its experimental results. By convention it is considered valid when the probability it is false is less than 5% ($p < 0.05$).
Bayesian statistics starts from an experimental result and tests the likelihood of the various assumptions envisaged. Each result affines these probabilities.
The arbitrary threshold of the frequentist method creates an illusion of border between certain and uncertain, while the Bayesian method assumes its degree of uncertainty, trying to reduce it.
The popularity of the frequentist method in medicine comes from the fact that it reinforces the Spirit Pole (that of the physicians and indirectly of the patients) in its certainties.
'Evidence-based' medicine is in fact a protocol for 'uncertainties reduction'.
Bayesian statistics is natural in mind, the frequentist must be inculcated to it.
So that human behaviors do not form a frequentist Gauss curve. They are a constellation of privileged hypotheses, or 'opinions', representative of various Bayesian advances of our brains.

The certain: a proposition is true or false. 1 or 0. The certain is very rare in reality. Between 1 and 0 lie the vast majority of propositions. In *uncertainty*.

Previously, we gave full ownership of uncertainty to our mind. We do not know if the real has it. Does *chance*, or ontological uncertainty, really exist? The mind can only conclude that the *unknown* is present. Which by definition is inaccessible to it.

Let us thus distinguish 3 categories of uncertainties:
1) 'Known' uncertainty but whose mind leaves the Real pole owner (formalized but irreducible chance with the present capacities of the mind).
2) Uncertainty that the Spirit pole wants to own (to make a prediction).
3) 'Unknown' uncertainty, the possibility of formalization of which is still unknown, perhaps hiding a real ontological uncertainty.

To properly characterize these three uncertainties, let's take an example where they mix. A player rolls a dice. She has already noticed, after many throws, that the die is not perfectly balanced. It stops a bit more often on the '6'. In the player's mind there are three uncertainties: The *known* one is that there is a one in six chance that the '6' will be produced. The *proprietary* is that the known (to everyone) is not quite right. The *unknown* is why, in a particular throw, the '6' comes out rather than some other number.

The 'known' uncertainty responds to the *classical conception* of probability, which is based on a list of known and equally probable possibilities (each elementary outcome has the same chance of appearing). 1 in 6 chance for each side of the dice.

The 'unknown' uncertainty responds to the *frequentist conception* of probability, which uses a statistical method. In a sampling space Ω occurs a set A of events linked by a mapping R to their individual probabilities in [0-1]. R is called the *probability distribution*. R is known by the repetition of the experiments on the different events of A. A is in general infinite and R is a never complete approximation.

The 'proprietary' uncertainty responds to the *subjective conception* of probability. The full set of possible outcomes is not known. The repetition of experiences cannot be done under identical conditions, as in the frequentist framework. This corresponds to the reality experienced by the mind. Each situation is different from the last. From the first occurrence he

must already assess the most certain outcome. It is a probability based on the judgment of the mind rather than the event itself. Likelihood that the event is likely. Bayesian method.

Let us precisely situate the three uncertainties in the dimension Spirit pole <> Real pole: the 'known' and 'unknown' uncertainties belong to the Real pole, but are accessible to the Spirit pole by the classical and frequentist probabilities. Proprietary/subjective uncertainty[13] belongs to the Spirit pole, which seems Bayesian by nature. Our three uncertainties have become two.

It is on the naturally Bayesian mind that logic has grafted classical and frequentist probability, quite recently in the history of knowledge. This still young transplant maintains confusion in most minds. Let's take our Real-Spirit dimension and its two directions, downward and upward, to understand things correctly.

Suppose we give our mind full ownership of uncertainty, and remove it from the real, what then does its mathematical theory, probability, refer to? Are probabilistic equations a pure description of our way of thinking? What relationship do they have with reality in order to coordinate with it?

Let us detail our two uncertainties, which their origin radically separates: the conceptual uncertainty of the Spirit pole, and the superposition of different possible states of the Real pole.

The first is our difficulty in making forecasts. The mind is a predictive coding process. The evidence that it is Bayesian is strong. Is it a coincidence? Or the start of an impressive paradigm shift? The mind hitherto believed that it had found in probability an intimate mechanism of reality; it finds with surprise that it has fallen on its own! It is no longer the brain that responds to a model, but *the model that discovered itself as the origin*. It is therefore not surprising to be able to apply its principles to

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[13] Some also call it 'epistemic', but it should be noted that the three uncertainties are all epistemic, since the Spirit/Real dimension is in the mind. The only non-epistemic uncertainty is that which is caught by the 'unknown' uncertainty in the essence of the real, the only truly ontological uncertainty.

many representations of reality. The Bayes equation does not become any more intrinsic to the real; this makes it more universal *in the structure of our representations*.

In this first type of uncertainty we must include that we have about the past. We are thus able to speak of « probability that things have happened in such a way » for a realized event. The Big Bang is the 'most likely hypothesis' for the birth of the universe. In fact either the event took place, and it is certain, or it did not, and it is also certain that it is. The uncertainty, again, resides only in our mind. Besides, the world 'knows' what it went through, and that knowledge is the essence of what it is today.

The second type of uncertainty, that of the Real, is the difficulty of understanding events *occurring at the same time as us*. Why should we be forced to use probabilities since we observe these events? The problem seems to arise for the quantum level. There is a persistent controversy about this that we will see in a future chapter. Assume for the moment that the particles are in a probabilistic state described by the Schrödinger equation. The correct formulation is that all solutions to the equation exist simultaneously. All the states are superimposed in reality. Inscribed.

An inscription in reality that is not on the same level as the virtual possibilities installed in our brain. These are based on an organization of neural patterns with multiple outcomes. They are sorted *by comparison* with the diagram of reality. In a similar way, quantum relations are based on an organization with multiple solutions, and one of them is chosen *by the confrontation* with elements of the same type (the measuring instrument).

But the difference is important: it does not only concern the level in the *Diversium*, but also the *causal direction*. It is upward/ontological for the quantum solution; the model chosen is born from it, is superior to it. It is downward/epistemic for the mental solution; the chosen model decides the underlying organization (with a more or less successful answer). It reconstructs it to make it consistent with the conceptual stack existing in our mind. Quantum solutions build their superstructures; mental intentions rebuild their foundations. We need to carefully separate these

two processes, one property of the real, the other specifically of our mind (within the real).

This separation does not reintroduce a dualism between spirit and reality. These are directions within a monist relationship between the two. It does not place the mind and reality processes on different continuums. We started with *Stratium* to give them some continuity, which will be consolidated in the next chapter.

Now that we know how the mind deals with uncertainty, let's look at what it claims to have actually fished. Let's look at what it surrounds with uncertainty and what it calls 'chance'.

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Chance (epistemic)

I will voluntarily present two contradictory visions of chance. The first, now, is that of the Spirit pole. But the Real pole has its say, later in the chapter 'Ontology'. Who is right ? It is important that you understand the arguments of both parties.

What is chance? Everything that has been called so is a factor of unknown source, devoid of apparent organization, acting on a system. To take chance into account, we are never sufficiently aware of it, is a tour de force: it is to factor in the unknown. And it seems to work remarkably. The probabilistic equations of quantum mechanics make extremely precise predictions. *Hazard* as a *guiding* principle, a paradox in itself. Could there be a sham behind the notion of chance?

Factorizing the unknown requires really large numbers, so that in a balanced environment the individual behaviors of parts of the system no longer matter. Chance being founded in the ignorance of each of these individual histories, it sees its importance collapsing jointly. Do not imagine chance always lying in wait, and only controlled by the statistical model; it really disappears. At least in equilibrium systems. *Statistics are not a reliable method for systems where there is chance, but for those where there is not*.

To understand what statistics really are, let's take an example that made them successful: the molecular conception of entropy (a subject that we will

detail in the next chapter). Boltzmann's model made it possible to understand the evolution of thermodynamic phenomena through their molecular micro-mechanisms. The model is based on three conditions: gigantic number of particles (and even more pharaminous of possible states), all equally probable states, a majority giving the same macroscopic state at equilibrium. The 2nd condition is false. That the system can visit all its possible states with the same probability is true in statistics, false in practice. In reality, the system visits one specific state after another, in an order specifically determined by the previous one. The fate of the system is a perfectly deterministic sequence of these states, whatever the quantum uncertainties they cover, collapsed at this level. Some states will never be visited. The vast majority of them will never be visited. The statistical model declares 'possible' a state effectively realized in the same way as others which will never be. The point is that it is impossible for us to understand the real process in any other way. But let's not make it the essence of the real process. This is an approximation. The approximation becomes exact with a rigor proportional to the really large numbers involved, where the importance of the individual behavior of the particles collapses. The soliTary disappears facing the soliDary. The collective model is radically imposed over individual initiatives.

Chance is the part of the system that is not integrated into the organization that we detect. This means that it is entirely defined, and limited, by the level of organization observed. It is in the eye of the beholder[14]. What is called chance at one level is an order in the underlying level… which is not yet known but we cannot say that it is not knowable. Chance is that which is not part of organized emergence, which is not necessary to reveal the properties attached to the higher order. Order and chance are therefore closely intertwined with the notion of emergence. Chance is both a dead end for the stacking of levels of organization and the reservoir of alternatives for the order which continues to grow. There is an inexhaustible chain of interactions that will reveal new attractors, new possible orders, each one reflected by specific emerging properties. Each

[14] Psychologists show that what is called 'random' by the layman is not the true translation of chance but what does not correspond to the orders that he usually meets.

emergence is a branch of organization triggered by the unbroken chain of underlying interactions.

Chance is not a concept but an absence. It simulates a (ghostly) presence of the explanation when *there is no* explanation. To show the emptiness hidden in the idea of chance, let's take the example of throwing a dice. Kinetics of the arm, precise moment of release, trajectory and rotation of the die, contact with the surface, braking, all this is in theory perfectly measurable if we had the necessary instruments. The number appearing on the immobilized die does not come from chance but from a strictly determined sequence of events. But the number of criteria involved, in particular our own imperfect control over the locomotor action of the arm, makes it impossible to predict its outcome before the throw. We say 'random' the number that appeared on the die. The hazard only exists in our minds, not in reality. It exists in our mind because the process of it is stuck in the present. The present, *a space of time approximately accompanying the reality which is perceptible to us*. Small space that cannot accommodate detailed knowledge of the past. It is therefore also impossible to compress knowledge of the future into it. The hazard is entirely a fabrication of the present, and we try to escape it by distending this cramped temporal place, by stretching our perception like tentacles towards the past and the future, using probabilities, tools built on regularities accessible from a reality that is not random.

Our common reference to provoked chance is the dice roll, and this one contains no chance. Let's see more modern: random sequences generated by computers. They are also pseudo-random since they are generated by precise electronic interactions. Paradoxically, the longer they are, the easier it becomes to identify their regularities. What do we do in our efforts to find chance? We simply push the emptiness of its idea to a level where it becomes invisible again. It is impossible to know the intimate mechanisms that could demonstrate that this hazard is not one for reality. It becomes that for us again and that is its only interest. Isn't the fallacy of the idea of

chance already included, after all, in the term 'random sequence'? How could chance overcome the obstacle of order contained in the *sequence*[15] ?

Let's take it a step further: Chance can only be defined, ultimately, by encircling a succession that has no apparent order. It is not a spontaneous phenomenon but a construction of the mind. Classification. In an infinite series, can not all the orders and possible hazards be identified? Only the entire sequence, impossible to delimit, could then meet the definition of authentic randomness. Yet we come to the stop of succession: it has an *origin*.

But then if there is no such thing as chance everything should be predictable, are you entitled to protest.
What does predictable mean? It is the ability to predict the final state of a system starting from its initial state. The action of predicting involves above all that of *measuring* the two states. Quantification based on a *theory* of measurement. A major postulate used is that this theory will not have changed between the two points of the measurement. Precarious, because the theory concerns a certain level of organization of the system. This may have changed at a level other than the one studied. A measurement thus always concerns one aspect of the system and never its totality.

Other problems: the notions of elementary unit of space and time do not exist with certainty. What is the size of the measured point, what is the duration of the state? The choices are linked to the measurement technique,

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[15] This paradox was identified by Emile Borel, who called it *the paradox of indefinable chance*. It can only be solved by an infinite hierarchy: the definition of a sequence as random being contradicted by itself, it can only be enacted by a definition from another level declaring it 'random'. But this also contradicts itself and can only be confirmed by a higher level definition. Mathematicians seem to have solved the problem only by the following consensus: from a sufficient stacking of levels of definition in the hierarchy, we can consider that the sequence is truly random. What is tasty is that they thus probably validate the way in which the concept of 'random' is constructed in the human mind. There is no formal mathematical definition of chance. The current benchmark for saying a random sequence is that it has maximum Chaitin-Levin complexity. However, this is still the application to a 'sequence'. And this is a definition in terms of information content, that is, circular to the human mind. It cannot be transposed as it is to reality.

arbitrary. Is the unit measured in practice homogeneous? Does it correspond to an authentic elementary incrementation? How do you go about choosing it in a seemingly continuous dynamic?

Finally, measuring the evolution of a system consists of moving from a point theory of one state to the point theory of another state, both being approximations of a matter in perpetual dynamics. A bit like taking two photos of a family 20 years apart and trying to understand the story between them, or even predict the second from the first. What if the family members stayed together all the time? But no, like any chaotic system, their destinies diverge exponentially as soon as they are no longer all gathered in the photograph.

The example of the statistical model of an equilibrium system, where chance disappears, is only a small part of the story. Real systems are difficult to model because they behave the opposite of those at equilibrium. They are chaotic and their attractors transform microscopic fluctuations into macroscopic changes. The soliTary gains the upper hand over the soliDary. The butterfly sets off a storm, the grain of sand an avalanche.

Microscopic fluctuations are often less than the definition of the measurement. In predictive models, what is measured is a portion of chaos. It is not an exact representation of the interacting elements. Large numbers are the power of the statistical model in an equilibrium system, because chance has escaped it. They become the Achilles heel of the same statistic when chance reappears. Chance not being the cause but lack of sufficient knowledge of the initial conditions. Talking about chance signals that everyone matters and that you have to know how they express themselves. Chance is synonymous with the void of this support. This is also why it empties itself of the prediction.

Let us summarize our difficulties: the unpredictability of an organized system in reality stems from three observations:
1) The exact state of the system at the start can only be known with relative precision (linked to the definition of the instruments and the level at which they operate).

2) Breaks in symmetry can disrupt the system (quantum fluctuation, genetic mutation, etc).
3) The interactions of the elements of the system can be mathematically irreducible, that is, the only way to determine the outcome is to let them unfold.

These three observations are in fact the reflections of a single reason: any system studied in reality is observed only in part. We know neither its characteristics located beyond the reach of measuring instruments (for example in the quantum vacuum) nor its biography. Defining the start of a system is arbitrary. One operates a reduction on its starting elements to make them correspond to the standards of the theory used.

Mathematical irreducibility is not uncommon. It is undoubtedly the rule. Indeed, even if a system obeys clear mathematical rules, it is only at the observed level. There are underlying levels which are *represented* by the equation used, not described on its own. That is, the essence of the system is modeled but not really *constituted*, included in the theory. The fidelity of the model is correlated with the precision of the instruments and the restrictions placed on the level of observation. The assumption that the very essence of the system is mathematical would not change anything. The equations used in practice are approximations of those which would form, in this eventuality, the real.

Let us remember that the Real pole, this representation of reality that our mind manipulates, is only a mask cast over it. Statistical models are a mask. When a probability does occur, what exactly has happened? It was not the essence of reality that bowed to the model; it is the mask that suddenly gains fame in our minds against others. The 'absolute probability of an event occurring' is the satisfaction of the statistical representation in our mind and not the essence of reality which has behaved ontologically so.

What we demand from a model, therefore from our equations, is to be sufficiently close to the essence of the real thing so that it conforms to it within the limits of the observation made of it. We want some aspect of it to change. For example, if I want to transform a few centiliters of water into ice cubes to refresh my drink, I don't care about the disturbances caused at

the level of the bonds between H_2O molecules. What interests me is the heat captured by the ice in the liquid. It is the thermodynamic, not molecular, properties of ice that guide my action. No model completely describes a system. The only complete model is the integral essence of the system. The only realistic model of the universe is itself.

This description of chance may seem appalling to the poet. Heavy chains resting on a turbulent and unpredictable firefly that brightens up reality. Here is an alternative vision for it:

Chance is a diffusion of the real within the virtual. There are many virtual options to organize the real. Ultimately they are reduced to one in the realm of matter. The real is a pulsation within the virtual. At the maximum of the beat, it condenses into a fine organization. When it is released, it blots in the virtuality, summoning the alternatives. The pulsations crown each real entity, but also the emergences in their structures. The universe echoes with organizational noise. But it is true that in a vacuum of space it is calmer. If I were God tired of my small-week creation, this is where I would be lying.

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Statistics

Let's sum up. *Uncertainty* is the state of the Spirit pole before an order it partially understands, coming from the Real pole. The recognized order is commonly referred to as 'information'. But this common designation is *qualitative*: it concerns information *known* to the mind. So much so that the mind receives little new information *quantitatively*. Knowing that the disorder also hides information, the scientist considers this hidden information to be quantitatively more significant. This is why the definition got reversed in Shannon's theory. Information is now the importance of disorder. Quantitative definition more suited to its mathematical manipulation. Opposed to its qualitative meaning in everyday language.

The uncertainty of the Spirit pole makes it incapable of making certain predictions. Conceptual uncertainty extends to *events* that will happen. The mind manages it by the *probability* of something happening. Uncertainty applies to the mind that observes; the probability applies to the event.

To specify the probability of the event and reduce its uncertainty, the mind uses two approaches: 1) either it lets the Real pole make the proposal (by generating the events to give their probability = frequentism); 2) or let the Spirit pole decide (by determining the probability of an event before it occurs = Bayesianism). All this of course takes place within the mind since it is the mind that contains the representation of the Real pole.

The two approaches each have their own dedicated statistical tool: frequentist and Bayesian.

Frequentist statistics gauges a hypothesis on its experimental results. The more these match and accumulate, the more the probability of that particular hypothesis increases. Since Fischer it is considered validated when the probability that it is false is less than 5% (the famous $p < 0.05$). It's a convention. It implies that 5% of the validated hypotheses are false.

Bayesian[16] statistics start from an experimental result and test the probability of the various hypotheses considered. The multiplication of results eventually reinforces certainty about one at the expense of the others, without ever eliminating them completely (any more than frequentist statistics provide absolute certainty to the chosen hypothesis).

Note in passing that we find in these two approaches the opposite directions of thought in its horizontal dimension: deduction and induction. Deduction, from the hypothesis to the corroborative elements, or induction, from the elements to the hypotheses. Let us associate the frequentist method with deductive thought and the Bayesian method with inductive thought.

The frequentist method deserves criticism with an essentially historical basis. This is the most classic method, born at a time when scientists placed undue reliance on their tools. Frequentism does nothing to make uncertainty disappear, yet Fischer's 'little p' trick seemed to succeed. The

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[16] Bayes's name associated with this statistic is an example of Stiegler's Law of Names (a discovery never bears the name of its author). Bayes posed an equation that its triviality did not encourage him to publish. It was Laplace who saw the interest in changing its presentation.

sham was to separate the studies after the little p into 'proof' and 'non-proof'.

This is a huge problem in medicine. It is not only 5% of published studies that are false, but much more, through recruitment bias: negative studies on a given hypothesis are rarely published; this greatly increases the likelihood of a positive study being within 5% of chance-related false positives.

'Evidence-based medicine' has driven the point home. It has created the illusion of 'certain' therapeutic procedures within the 'unproven'. Reassuring for doctors and patients. But a lie from a statistical point of view.

Should we prefer a continuous confidence interval (the certainty is in the middle but we cannot know it) or a significance threshold (the small p, which gives a pseudo-'certainty 'with a probability of error of 5%)? In other words, should we elect a truth even without sufficient certainty (approximation on the benchmark), or keep the truth vague in the decision-making process? Separation between classical logic and fuzzy logic. Each has its own statistic.

The difference between these two statistics should be emphasized all the more because Bayesian is natural to our mind, while frequentist must be instilled in it. It is foreign to it. The specific mental functions are to be built piece by piece. Tedious school learning that puts some students in check when they do Bayesian without realizing it.

Classical probabilities are so foreign to us that many of our collective behaviors are contrary to what frequentist analysis indicates. Even when we announce something as ‘probable’, without being able to define it better, we cannot find anyone around to attribute the same probability to it. It is even generally the opposite. Saying ‘probable’ raises ‘impossible’ and ‘certain’ around you. Consciousness takes a stand. Even the ‘probable’ is a posture, and it does not bring people together. If consciousnesses were frequentist, they would come together, as opinions, at the apex of a Gaussian curve. The more of us there are, the narrower the curve and the

sharper its peak. It doesn't work that way. Each consciousness uses its criteria and builds not a probability but a conviction. And it even affects the scientist, manipulating statistics in the lab, convinced for politics or domestic affairs. Statistical models are not immune to their conscious decision: they are good or bad, seldom themselves 'probable'.

The two statistics are two possible directions for thought, which can be linked to the fundamental principle that accompanies us continually in this book: soliTary <> soliDary conflict. The Spirit pole seeks to assert itself in certainty on which to base its decision, or recognizes the presence of the Real pole and its uncertainties, which blur and weaken its intention.

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In conclusion, 'probability' is a vague term because it covers two very different meanings from the same definition: it designates the modeling of a system whose number of interactions is such that it makes the analysis deterministic impossible.

The strength of probability is evident in single level systems of organization and for really large numbers of elements. In this context, it manages to predict the outcome of the system with almost certainty. While its weakness appears as the complexity of the system increases. The error rate becomes exponential.

Probability has a remarkably deterministic meaning in thermodynamics or quantum mechanics (Schrödinger's probabilistic equation). While the complexity of the human mind makes any prediction about its decisions very fragile. Almost certainty against major uncertainty, these are the two contrasting faces of probability. A hidden criterion separates them: how many levels of reality do we cross in our 'probable'? None and it is strong. Several and it is weakening dramatically.

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Synthesis

The information is synonymous with individuation. Modification of the adjustment between the whole and something that is individualized.

Double look: The information takes two different names that designate the same thing:
1) *Informessence*, or information seen by what forms the individual (upward look).
2) *Meaning*, or representation of individualized information (downward look).
Quality does not appear in the upward look, which quantifies information from common micromechanisms all together.
The quality is on the contrary fundamental for the downward look, which declares non-miscible the information of different meanings.
The meaning, before being in the eye of the observer, is already owned by the thing. It exists in the very thing these two facets, the constitution and self-meaning.
The elements of a system pool their respective self-meanings, then build a superior meaning together.

Information is synonymous with individuation. It characterizes a change in the setting between the whole and something that individualizes itself. Under the double look, information takes two different names (which mean the same thing): 1) *Informessence*, or information seen by what forms individuation (upward look). 2) *Meaning*, or representation of the individualized information (downward look).

This separation of information into two aspects has two major consequences:

First consequence: the notion of quality only appears when looking down. For it, information is not miscible when its qualities differ. It is not possible to add them up, or even compare them. Color information cannot be mixed with odor information. And yet this fusion exists. It is realized in the 'object' mental level where for example 'tomato' is the integration of color and smell. 'Tomato' in turn becomes a different quality. The information attached to 'tomato' is surimposed on that of color and smell, just as that of color and smell is surimposed on that of light wavelength and molecular chemistry. The qualities are clearly independent for the downward look.

While the upward look unhesitatingly mixes up all of this information. Their qualities do not appear to it, since it is, as an origin, common micromechanisms (fundamental forces for the level of understanding to which we have now descended). Information appears to the upward look as a fundamental binary element of reality. There are not many varieties. No qualities.

It is important for you to differentiate upward information or informessence from downward information or qualitative meaning. Scientists and philosophers[17] indiscriminately call them 'information', creating catastrophic confusion. In science the concepts of entropy, energy, communication, are specific to informessence. In philosophy the notions of sensation, of qualia, of what communicates, are specific to meaning. Mutual incomprehension is total if we talk about the same thing without realizing that we are using two opposing looks, neither of which can replace the other.

In the same vein as 'information', 'experience' has a double meaning to dissociate: phenomenon constructed by reality (for the upward look of the scientist) and phenomenon experienced by consciousness (for the downward look of the philosopher).

Second major consequence: meaning, before being the property of an observer, is already the property of the thing itself. There are in the thing itself these two facets, the constitution and the self-representation or *self-meaning*. I will justify this position in the chapter 'Ontological emergence'. What the elements of a system share are their respective self-meanings. Then they build a higher level meaning together. Much higher in this tier is an observer such as the human mind. This one could not establish any meaning without the considerable stacking of intermediate self-meanings. Or it would be necessary to return to a dualistic conception, arising from nothingness, of meaning. Relocate the meaning in the soul? No, let's stay on the monist path.

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[17] When I say 'scientist' and 'philosopher' you have to understand the scientist and the philosopher in each of us. It is perfectly possible to host these two persona in the same mind.

Here we are equipped with a base of refined concepts, to move towards the second foundation, that of the organization of the world. Diving into systems and orbiting a hot star: the concept of *emergence*. It is bathed in asphyxiating controversies. Put on your gas mask now, if the smelly impertinences of this book haven't made you throw it in the trash yet.

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Interlude

Here we are equipped with essential bases to understand reality. First and foremost, *identity*. We commonly define it as the set of specific characteristics of an individual. However, by emphasizing this singularity, we lose sight of the fact that the 'specific' refers to the rest. So we redefined the identity of any entity by setting it between '*I* am' and '*Be* part'. This allows it to be integrated into the dominant structuralist paradigm. Identity is credited with importance, possibly measurable.

A *paradox of identity* has arisen: identity is continuous in the temporal dimension (it is always 'the' thing), but discontinuous in the other dimensions (sequence of structural states). The opposition between continuous and discontinuous is not yet settled, but we have relaxed the paradox with the analogy of center and limit: the center can be seen as the collectivization of the individual place. Outside the limit, we are no longer in the individual. The limit is blurry. The discontinuity between the inside and the outside becomes continuous according to the scale. An example of this difficult concept to grasp is quantum field theory. The elements of matter there become simple excitations of a continuous field. Centers connected to everything. And yet the information describing these fields is quantified. The scale changes the discontinuous continuously and vice versa.

We have dabbled in the definition of *substance*. Properties added to a partially known structure: we do not know the ultimate foundation. Structure is a stack of surimposed organizations, micromechanisms at the base to the top of that individual organization. Important neologism: *surimpression* describes the experience added to the thing by the entanglement of an additional organization to the previous ones. The best example is consciousness, which finds an easy definition in the face of substance: consciousness is the surimpression of levels of mental organization, that is, the hierarchy of codification of data by neural networks.

The same stride allowed us to separate *quantity* and *quality*. 'Quantity' measures the element's relationship to the whole, within an organization

level. ‘Quality’ refers to the uniqueness of the fusion achieved by this level. It gives it its quality of element in another system.

The most important difference in this chapter is between *expressing* and *representing*. It concerns all levels of the organization of reality. Expressing yourself is showing what you are made of, living or non-living. The ontological structure is expressed. Again the example of consciousness: *Experienced* consciousness is the surimpression of all of our mental and physical structure. To represent is to confront this impression with the rest. Other elements participate in the representation of what is experienced. The result is shifted. It is the consciousness that is observed.

These two notions alternate in the construction of reality. We will see that they are not reserved for the mental structure. A system forms a representation; it is multiple. One element is representation; it is unique. It *expresses* itself as a completed, merged representation.

Then we applied the principles of our double look to the ways in which the human mind represents things. Spirit and Real poles evaluate each other. If the mind obscures any of these directions, it is isolating itself or in what it thinks is objective reality. Slip watching the scientist: she identifies with reality, confuses essence and model, to the point that the mind that designed the model disappears from the equations. This negation of one's own mind reaches its climax in eliminatory materialism, resulting in nonsense: for this reductive materialism there is only a causal, ontological direction. It sees intention as an epiphenomenon, an illusion of causation. *But how to classify this materialism itself, if not as human intention*? Ontology does not effectively detect the presence of the spirit. But isn't it enough to experience it? Sometimes we come to deny something because it's too obvious, too constitutive. We do not manage to deviate from it.

If the concepts of Spirit and Real poles lose their meaning as you read, because they are unusual, replace them with ‘the philosopher says’ and ‘the scientist says’. Of course it is me who follows now reductive; most philosophers today have good ontological foundations and scientists have epistemological knowledge. It's a simple memo.

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4
Second foundation
Self-organization

In this chapter we are going to play the accordion. An accordion called ‘emergence’. We will call ‘reductionism’ the act of compressing the accordion to agglutinate slices of reality. It makes the haunting sound of ‘why’?. While ‘emergentism’ is the action of opening the accordion to unfold its edges. It emits the expansive melody of ‘how’?.

We will have to justify these two movements. The notion of emergence is still controversial. After the philosophical bases, this chapter connects us to the scientific bases. Dialogue is kept open between the two. The obstacles to a general theory of reality will gradually appear. This one does not necessarily interest many people. We live in portions of reality, not all of it. We are even led, by our mental specializations, into very narrow sections of reality, which seem vast to us because the resolution of observation has increased and the systems viewed are the size of the universe. But the spatial dimensions are just dimensions among others. It is from our verticality that we will try to contemplate more than the ground beneath our feet.

Let's start by looking at what makes the possibility of an emergence. We have already defined the individuation of an element within the whole, as well as the principle of an interaction. Let us collect all this to study the relationships between elements and the whole in what defines a *system*.

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System

3 levels of interpretation elements / whole: *sum, assembly, unity*,
which define 3 levels of order: coexistence, relational system, fusion in equilibrium.
The unity can base the notion of *substance*. It becomes 'element' of a higher system.

'Interpretation' is no longer exclusive to the mind. 'Unity' is a self-interpretation of the real on its own elements. Fusion = substance.

System: set of elements in relation to an environment. Distinction operated by the system itself.
The system is therefore not closed but delimited by an *operational closure*. Blurred and variable limit depending on the status of the system.
'Element' can be replaced by 'elementary representative volume' (ERV), the system being the meeting of the ERV of similar behavior from the point of view of the whole.
A system is not only an arbitrary segmentation of reality through the mind. The operational closure implies that the elements abstract together from other interactions with reality, called 'negligible'.
The reality builds a superior organization by making an *approximation* in its very essence.

Éléments et tout

There are 3 levels of interpretation of the elements[18] and their whole:
1) The elements as a *sum*. It is about the coexistence of the elements, regardless of the relationships they may form.
2) The elements as an *assembly*. Interactions between elements are taken into account. This interpretation defines the system.
3) The whole in terms of independence, through the specific properties it possesses, and its ability to influence its own elements. This is an interpretation of the whole as a *unit*.

This particular identity is added to the elements and their interactions. It cannot exist without them but can be maintained on a part of them. The system is no longer just a concept. *It takes body*. Essential foundation to define *substance*.

For the first level of classical interpretation, simple coexistence, is no longer valid. There is no longer an ultimate materialist framework in which to install things only differentiated by their spatial coordinates. Material

[18] I'm using 'elements' because we're going to be dealing with systems, but philosophers may substitute the word 'parts' in this subchapter.

elements only exist through their relationships, contemporary physics tells us. Any set of elements is necessarily an assembly.

The whole as a unit *is an iteration* among the possible assemblies. This additional level of interpretation narrows the definition of the whole to a specific form of the assembly of the elements.

These interpretations are selected by our mind to found the Real pole. They correspond to a progression in the capacity of the Real pole to recognize degrees of order:
1) *Coexistence* is the only identification of regularities. The relationships between these regular elements are not understood.
2) A *system* is identified on the regularities of the interactions between elements.
3) A *unity* is identified in the equilibrium found by the system and its resulting properties.

As the unit in turn becomes a regular element, we are dealing with a loop. It is a true *analysis engine of reality*. The mind tries to match its structure to it to make the Real pole coherent. Of course the Real pole *is not* the reality per se. Multiple errors are possible. Each individual has only correct fragments of it and it is impossible to host detailed representations for all of reality. But what interests us here is that *the mode of construction is shared* by mind and reality. The engine is the same: individuation of elements > interactions > stabilization creating a new individuation, material or mental.

If mind and reality use the same process, it gives an entirely new meaning to the term 'interpretation'. It is no longer exclusive in mind. *We are forced to extend it to the real process*. 'Unity' becomes a self-interpretation of the Real on the stability found by the interactions of its own elements. Indeed, the appearance of this new 'unity' with its particular properties belongs to the real. It is not exclusive to our observation.

Stable unity is where the mind genuinely touches the essence of the real. We have said that this essence is inaccessible. This is true of everything, structure, substance, causality, meaning; but the only exception is stability: the

essence of the real shows a persistence, in a way of looking at it that also belongs to the real. This communion is not surprising indeed, if the processes of mind and reality are similar: stability is a characteristic of the process itself and not of what it produces.

We now have a valuable clue to the fundamental nature of reality: *it self-interprets from its fragments of stability*.

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Self-definition of a system

A system is defined as a set of related elements within an environment. This distinction is made by the system itself: the relationships between elements determine the limits of the system. The system is self-constituted (Maturana uses the term *autopoiesis* for living systems). The system limit is called *operational closure*. This concept must replace that of a 'closed' system, which does not exist in reality. Models based on closed systems are approximations allowed by a sufficiently clear operational closure.

Another successful concept is the representative elementary volume (REV): it is the interactive unit representative of the medium considered. The modeling is carried out on the medium divided into a variable number of these REVs, considered to be similar in their behaviors from the point of view of the whole.

Precisions are important: first of all, the real limits are unclear. Let's talk about a transition zone. They are scalable. An element of the environment may be involved for a certain state of the system and not for another. Operational closure is based on an invisible adjustment: some interactions with the environment are considered negligible, that is, not changing the state of the system. So there is a hierarchy of interactions rather than a system/environment dichotomy. Who decides on neglectability? The system itself, again. It truly self-delineates. Which means that *reality neglects some of its interactions in its very constitution*.

Indeed here we do not involve an observer. We are not talking about the model of the system but about its essence, at least the closest representation that we can attach to it. We are not in the process of simplifying this essence by omitting certain elements, keeping only the most significant to make it

calculable. The system is considered in its integral reality. It responds well to an operational closure, in that part of the actual interactions with the environment does not change its condition. This state is therefore a global representation of the constituent elements which neglects the participation of some. *Reality builds its higher organization by making an authentic approximation*.

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Organisation

The organization adds the notion of intent to that of order. It implies a higher intention / a downward look. It *stacks* orders.

Preceding the organization, the ontological principle is *self*-organization, involving an upward look at the bottom of the stack.

The observer *gives birth* to the regularities contained in the elements, to bring up the organization. It is not necessarily a mind, it is enough that it is itself organization influenced by what it looks.

Isolate regularity is also abstract from the rest. Reduce its observation at this level of order. We sequence reality.

But an order is also organization of what underlies it. The difference between order and organization fades.

The interesting distinctions are the height of the pile of orders in an organization, and the alternation between a potential-order and a realized-organization.

An observed thing is not completely passive. Its production of messengers creates a *presence*, superior involvement than the mere existence.

Represent is to *recognize* plus to *form an intention* (exist as representation).

The intention is born in the lag between the representation and the essence of the subject.

View from the subject (Real Pole and upward look), the intention is powerful when it narrowly mimics the structure of the subject. It constrained because it looks like it. It's *understanding*.

View from the Spirit Pole (downward look), the intention is powerful when it differs a lot of the subject and transform it according to its desire. It constrained without resembling. It's the *will*.

The will makes a *production* from the organization.

The organization is a *sequence*. It is not entirely determined in the initial elements because they are not fully known.

The *cadence* is the interactive time unit specific to an organization level. It is at the heart of its self-definition. The levels are separated by significant differences in cadence. Neighboring rates merge their effects.
The disorganization is not a non-organization, but a transition, or a *de-escalation* of organization.

The elementary consciousness of the organization is based on 3 phases: to experience, transmit, represent.
Experiencing is the merger of the levels of surimposed information.
Transmitting is exchange a message made of one or more levels of intricate information.
Representing is symbolizing a set of information, making it an item available for a superior organization.
The representation has an owned existence. It is free energy (conflictual) transformation into bonded energy (organized).
Neglect the independence of these notions leads to arbitrarily assimilating substance and information.
The organization process adds the levels of representations. The stack of surimposed mental information is what we are experiencing as consciousness. This arise like a float in an information tank. Related material and mental.

Organizational noise does not have the same meaning for the Spirit and Real Poles.
It is annoying for the intention of the Spirit Pole, which wants to infeede the subject to its representation.
It is creative seen from the Real Pole. Noise-related uncertainties diversify possible organizational solutions.

One of the basic concepts is 'organization'. Like the others, it poses a dilemma: either I speak of the *manifestations* of the organization, and we are in front of an inexhaustible library; or I tackle the *very notion* of organization, and my speech stops very quickly, after a few pleonasms and circular comments. However, it is impossible to turn away so quickly from an essential notion. Let's walk around it the same way it walks around reality. *Let's organize* the notion of organization. This path quickly takes us to the heart of *Surimposium*. It makes us guess the beginnings of consciousness in a simple pebble.

Should we start by talking about organization before *self*-organization? We would gladly hurry to answer yes. Yet ‘organization’ commonly refers to human activity, while ‘self-organization’ seems to be a feature of all of reality. The latter therefore seems to be the grandmother and the organizing human mind its offspring. However, let's start with the concept of organization that we know best, since we own it.

How do we go from the concept of order to that of organization? Order is simply the presence of regularities in the arrangement of elements, while organization is the choice of a specific order among those possible. The organization adds the notion of *intention* to that of order. It's a more holistic term; it considers a sequence of orders a priori independent of each other and nevertheless coordinated. *Organization is an order of the order*. A hierarchy appears. The term naturally applies to the structure of *Diversium*, our description of reality as a pyramid of orders stacked on top of each other.

Is the presence of an observer necessary for this distinction between order and organization? It takes an observer, of course, to identify the pattern, but the pattern, as information, is intrinsic to the elements that show it. Order is in the making in the elements, independent of any observer. The order is used by the observer to determine the higher order choice called organization. The observer *gives birth* to the regularity contained in the elements, in the birth of the organization.

The observer, this is the most important, is not necessarily the human mind, and is never passive. Let's detail these points:
A bacterium ‘observes’ its environment and organizes its behavior according to this perception. It has no nervous system or other apparatus to virtually manipulate the concepts. Its intentional capacity is however apparent. It comes from the confrontation between external stimuli and a bacterial identity inscribed in its genome. We could speak of a breeding ground (rather than a 'fragment') for consciousness. Thanks to this intentional presence, the bacterium defines itself as an organized system and not just an ordered system. When the organization seems complex, we are happy to replace ‘organized system’ with ‘living being’. The stacking of

organizations makes the transition from the non-living to the living. 'Living being' incorporates this increasing thickness of intention, this influx of life. The term potentially extends to creatures with more complex intentions than human beings.

But let's focus our interest on crude entities. The observer, we must conclude, does not need to be equipped with a complex vision. It suffices that it is itself an organized representation, a receptacle of *correlated information about it*. But then, in the event that we don't know what it is correlated with, could the observer not take on the appearance of a banal order? Would it not be simple regularity, considered in isolation?

A paradox points its nose: to identify a regularity (an order), a human observer is obliged to isolate elements from a whole. She sequences reality. But by this isolation she temporarily cuts herself off from the rest, to spot whether this order is not itself already an organization of something, a *previous observer* of this thing. The order is *reduced* to the most apparent level of information.

But we now know from reductionist inquiry that *all order turns out to be an organization* of underlying things. Perhaps there is an ultimate floor, an indissoluble order which would be the foundation of reality; but this is just wishful thinking. A wish, that is to say a thirst for anchoring our need to understand. Desire not to let the thread of causality suddenly emerge from nothing. In its appearance of a universal principle, causality does not do what it wants; it is required to have a start.

The distinction initially pointed out between order and organization is blurring. The first is always the second. The only specific notion that seems judicious to maintain is that of height (or degree) of organization, corresponding to the stacking of orders entangled in an entity. It is also interesting to see order and organization as a succession, as two phases of the same process. Order is organization, but also a potential informational reservoir for a new organization. Alternation between order-*potentiality* and organization-*realized*.

We have also said that the observer is never passive. However, can't we observe without interacting? Impossible. There is always an exchange of information. What comes from the observed implicitly modifies something in the observer, if only by awakening the channels responsible for processing this information. The assumption of a passive receiver is an illusion. The reception of a single photon triggers transformations. Energy transferred. Can we argue that looking at an object in no way influences its organization, does not change it at the structural level? Any communication, however small, breaks the isolation of the object. It doesn't matter that it seems one-sided. There is activity in the observer. Its conceptual structure is modified by the presence of the object. Communication is already interaction even before any transformation of the transmitter. The unfortunate object still ignores it, but it has been *seen*! Perhaps the observer will grab it and break it, or cannibalize it, or subject it to even worse torture.

Is the object in fact so completely in the dark that it has been observed? It is less obvious *if we make the photon the true observer*. This, bouncing off the object, has established an interaction with it. That this photon has rebounded while others of different energies are absorbed contributes to more elaborate information. Identity signature of the object. The signature is transmitted to the human observer in the form of a *color*. The intentional part of the exchange is born in the human mind, yet the object is not entirely passive. It created, in its interaction with the 'first observer' photon, the conditions for contact with humans. The production of messengers creates a *presence*. Presence differs from existence in that it is never completely passive. Unsupervised activity. ‘Order’ phase waiting to become ‘organization’ phase.

The role of the observer is twofold: recognition of presence, reaction/intention. Both are included in the act of *representing*. Representation is an *action*, I must argue, since it modifies the observer. Modification forming the heart of an intention towards the represented object. However, does the representation indeed conform to the essence of what is represented? Impossible. Representation can come close to it, but never *be* this essence. Conflict between the two. *Mismatch which is the very root of intention*.

The intention is reinforced in the detail of its conceptual structure. The more correctly it mimics the organizational structure specific to the represented object, the more the object conforms to the intention. The mismatch is reduced. The performance approaches its ideal, *to experience the object*, without ever really reaching it. Intention becomes powerful. On the contrary, an important mismatch makes the intention devoid of power, but also the desire to strengthen it. It all depends on its celebrity within the other acting concepts.

This definition of the power of an intention is that of the Real pole. The object says: « Intention compels me because it looks like me ». From the Spirit pole, the power of intention is seen differently: it seems powerful when it is very different from the object and aims to transform it according to the desire of the Spirit pole. Intention constrains without resembling the object. This power of intention seen from the Spirit pole is called 'will', while the power of intention seen from the Real pole is called 'understanding'.

From organization to production

When the will is strong and a source of radical changes in the object, the term 'organization' gives way to 'production'. The production is a very managed organization. The transition between the two concepts is gradual. 'Producing' is not the prerogative of living things. For example, let us situate ourselves in the universe which is three hundred thousand years old. The context of this time *produced* atoms from existing nuclei and electrons. The organizational intention at this level was very powerful, and few nuclei and electrons escaped it. Very interventionist level which served as a remarkably stable support for the development of the material. Support itself provided on particles with exceptional longevity. Offering a multitude of superior organizational solutions. Eons later, the paths of self-organization find that of a particularly sophisticated entity: the human being. The end of a chain of… productions?

Sequence and cadence

Essential concept for the organization: the *sequence*. Each step is necessary for the next to appear. The organization is not immediately contained in the

initial elements. Freezing initial conditions implies freezing the context. However, this is specific to each step of the sequence.

Second essential notion: the *cadence*. The very great speed of the exchanges as one descends the levels of organization makes that the micro-mechanisms seem to approach simultaneity seen from the higher level. This large gap allows an approximation of intermediary organizations as *permanent* elements.

The interactive cadence specific to each level of organization is therefore at the heart of its constitution. Even when several properties are completely foreign to each other, the fact that they influence the system at a comparable rate confuses their effects. The interactive sequences intertwine. The properties collaborate in the evolution of the system. Its representation can only be a *merged* one.

Disorganization

Disorganization is not nonorganization. It is a succession of organizations insufficiently confined by local conditions, too brief to seem to deserve this title in our time frame. Repository that is not universal. For a quantum virtual 'swarming' entity, the molecules of a gas are as stationary as galaxies to a human observer. The concept of disorganization is arguably the balloon that has deflated the most under the spikes of knowledge, and it is still too chubby. We should probably just talk about organizations that are less high and less durable than others. To tell the truth nothing has been found in this universe which formally escapes organization. We could take the term disorganization as a contraction of ‘organizational de-escalation’.

What is the best organizational solution?

This question does not have a definitive answer until all possible solutions have been tried, or simulated. However, it is impossible to say that the investigation is complete when a system has a large number of levels of organization. Its diversity is increasing exponentially. The range of solutions is infinite. Impossible to make an exhaustive test. How will the system select the most interesting to explore? It is limited by respect for the stability of its own structure. The lower an organizational element is located in this plane, the less easily it is to be questioned. This defines

solutions that are ‘natural’ for the system, and others that are frankly threatening. But nothing is set in stone. If the overlying conceptual tier manages to construct a detailed representation of the lower levels, it can manipulate them with good certainty about the outcome. Human beings are capable of self-modification.

It makes no sense to say “evolution is blind“, or on the contrary “evolution has sought to“. The evolutionary process has no *human* intention; nor is it devoid of any consciousness: it is precisely in the process of being built. Self-organization is content to test solutions that respect the underlying rules. The most effective, in a necessarily limited context, emerges and takes hold.

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Organization and consciousness

From a functional perspective, the organization process can be modeled in 3 phases: experiencing, transmitting, representing. Organization means managing the multiple, managing a conflict between individualized elements, in an effort to merge them. This ‘social’ vision has its physical counterpart: managing an influx of energy into a system, creating individualized elements and new exchanges between them. We will see later that the organization can be seen as a mode of energy storage: the transformation of free energy flowing into bound energy.

The conflict is first *experienced*: each element ‘perceives’ the presence of the others through a set of information correlated to their structure. Consider two very different examples:

1) A human brain perceives the presence of other people in its environment through the senses. Sensory stimuli deciphered by additional layers of information, shape, movement, smell, sound emission, fine characterizations. Hierarchy awakening in consciousness the representation of a person. This representation is associated with the own impression of being 'human', so that consciousness also experiences the other person as human, which it would not do with an object.

This phenomenon is at the heart of the notion of qualia and is not easy to understand, even after reading the *Stratium* chapter, so that it is worth

repeating: The representation is constructed by the whole of the mental hierarchy but it is only its final synthesis, 'represented human being', which occupies the conscious conceptual space. A conceptual space is formed from the interaction of neural patterns of the same level of symbolization. Physically the representation corresponds to the activation of dedicated neural patterns, which would have no meaning without the presence of the underlying neural hierarchy, but it constitutes a certain independence from it.

What thinks is self-experiencing. The ‘experienced human being’ part is done with awareness of the surimpression of the entire information hierarchy. Miracle of *relative independence*, the physical explanation of which we will see later. The feeling is the *fusion* of the hierarchy.

Such a feeling only exists in oneself, but can be attached to the representation of another person, considered as self-mimicry. We can extend our feelings to others by seeing them as similar to our own physical and mental organization.

2) The second example is a pebble located on a slope. It is surrounded by other stones. Let us give it a simple perception: that of other material bodies, the mass of which produces an imprint in the gravitational field. Our pebble therefore perceives the others by this imprint, of course too insignificant to exert the slightest effect on it. It is the much larger mass of the planet that can set it in motion if a shock dislodges it on the slope.

Going down the slope, its trajectory is determined by the impact against the other pebbles. The interaction does not depend on the elementary forces joining the atoms of the pebbles, but on their respective shapes and weights. It is the properties of the ‘pebble’ level and not the ‘atom’ that come into play. The individual interactions of atoms are effaced in front of their general organization. The ‘pebble’ representation is more important than basic information.

You get the analogy with our first example. The ‘pebble’ level of representation *is experienced as surimpression* of the underlying information, including the next lower atomic level. The comparison to conscious

experience may sound ludicrous, yet the two experiences are defined in exactly the same way: they are higher levels of information. Without prejudging their content, obviously greatly increased in surimposed information for human consciousness. However if we look at the 'human consciousness' level in its strict independence, it does not contain such a large volume of information of its own. It is only a few hundred, maybe a few thousand more neural excitations added to the universe of those which form the preliminary contents.

We are dealing, for the pebble as for the consciousness, with representations, with the fusions of individual assembled information. They are both independent information levels, involved in relationships with representations of the same level (other pebbles, other consciousnesses), and dependent fusions, experienced as an surimpression of their underlying information structure.

We could push the analogy so far as to say that the pebble perceives others through its 'senses' which capture elementary forces (essentially gravitational between separate pebbles), and interacts with them through its pebble 'consciousness', the representation of its overall shape and weight.

To speak of consciousness for a pebble risks making you close this book immediately. Yet there is no mysticism in this definition, very structuralist on the contrary. Consciousness has nothing to do with a 'universal field' that no instrument has yet perceived to exist. It becomes *a specific effect of the organization process*. The more the process adds up its levels, the more the surimposed consciousness expands its contents. It looks like a float rising in a tank gradually filling with information.

Our two examples involve the three phases of organizing, experiencing, transmitting and representing. We have just detailed the first with consciousness. Let's take a closer look at the other two.

After 'experiencing', the organization is 'transmitting'. Language suite. Language is bidirectional: it is used to communicate both identity and its

modifications. Each item is changed by the other in the exchange. We have detailed this phase in the 'Language' and 'Communication' sub-chapters.

Then there is the *representation* of the interacting elements, the merged image of their whole, which becomes the essence of this association for higher level interactions. The stability of this representation is extremely variable. It can last almost eternally, or be so fleeting that our means do not even know that there has been an interaction. Stable representations constitute a favorable basis for installing an additional organization.

However, representation is in itself a factor of stability. It is a choice between different possible solutions, all of which do not have the same effectiveness depending on the context. It is as if the representation were a management of the influx of energy that formed the organization, and striving to maintain it. Representation is the transformation of free energy (conflict) into bound energy (organization). The performance does not seem only passive, resulting from the influx of energy. It is a creation of information, has an existence of its own. This is the great debate between strict ontological determinism, which rejects this concept, and teleology, which grants autonomy to representation. Debate which we will take a closer look at but which you can already guess to dissolve with this presentation of the organization. Note that teleology makes it possible to model consciousness, making it the site of active representations, while ontological determinism, in isolation, is powerless to do so.

The decomposition of the organizational process into three phases makes it possible to show its similarity in the levels of matter and of the mind. It always takes place in a single reality, segmented vertically by its levels of organization. It goes from material constructions to conceptual constructions. At the root we find the same physical exchanges, elementary forces, charges shifts in neural networks.

Consciousness is the apex of the process, at the highest hierarchical level, whether it concerns an inert object or a brain. It can be positioned on any of the three phases, depending on the material or mental state. In the human brain consciousness can be *experiencing* (crying with someone else, without exchanging a word), *transmitting* (speaking empathetic words to that other,

without having felt the pain yourself), or *representing* (evaluating the misfortune of the other in the context).

Neurologically 'experiencing' is the synchronized activity of mental patterns that surimpose their information to form the final impression. 'Transmitting' is the activity of language schemas. 'Representing' is the activity of prefrontal diagrams that process images of oneself and others. The importance of the respective activity of these different sets shifts what we call 'attention'. Its positioning means that we alternately experience, transmit, or represent.

The representations about oneself can lead to strange feelings of split. The diagrams relaying bodily impressions and those representing one's own person are not the same. When they are simultaneously very active but not yet merged by higher level patterns, a feeling of split body and mind is perceived. A frequent phenomenon in young people, whose mental maturation is not complete.

Neglecting the relative independence of the different phases of the organization process leads to outrageous simplifications. Reality can be reduced to the message as in Wolfram's calculationism or Tegmark's Mathematical Universe Hypothesis. The essence is confused with information, which makes the universe a giant calculator… without physical support for this calculation. The delicate problem of knowing the medium is eliminated, at the cost of unresolved questions: what makes information individual? How do they change each other? How does a collection of information as improbably complex as our mind come to grips with a datum as basic as the number '1'? Just as it is easy to see similarities in the messages, specific to each level of organization, confusing them with their medium makes their insertion into a 'Theory of Everything' problematic. No mathematics is imperative in order to live, reason, predict, we sometimes forget when the act of modeling is at the heart of everyday life. When logic looks at the operation of its own engine, the mind, nothing allows us to affirm that this logic is anything other than a net of approximate benchmarks thrown over reality, which we patiently try to tighten without ever reaching it.

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Organizational noise

We have already dealt with noise in its relation to information (Shannon theory). This is about its relationship with the organization. Is it the same noise? We again face the obstacle of the same word having different meanings. The only reference to clarify them is to go back to their historical context. The number of neologisms in this book may make it a reason for reproach; however the reluctance to create a neologism is a source of multiple confusions that seal contemporary language. The conservative is blind to novelty by refusing new words. Innovative concepts barely break out of classicism. A little semantic interlude is useful. Let's try to find our way among these terms as common as they are dissimilar in our minds:

'*Information*' etymologically means 'that which gives shape to the mind'. This is the popular meaning: information increases knowledge of the mind. When the word was taken up in modern communication theory, confusion arose: the amalgamation of content and carrier of the message. To complicate matters, the content has two possible aspects: it can be 'given' (regularity proposed but not yet recognized) or real 'information' (recognized). The term 'information' already implies an interpretation of 'data' and therefore borrows from the organization.

While 'information' originated in the communication sciences, 'organization' is older and concerns human and social life. Etymologically the organ is 'disposed for life'. In these conditions, it is difficult to bring together information and organization, one rooted in the physical sciences, the other in the human sciences. Let's say that information is 'organized data' when it is communicated / modeled for the Spirit pole, and 'self-organized data' when it is owned by the Real pole.

Finally, what is *noise*?
Its concept has radically changed from classic to modern. Popularly it is reputed to destroy information, drowning out the patterns it draws. Information replaced by chance. But it is precisely chance that has been redefined. It is now a hidden order. Access to more information because more possibilities.

Foerster (1959) followed by Gunther (1962) defined the notion of self-organizing informational noise. The noise thus considered is not disorder. It is at the conjunction of the known and the unknown order. Compared to what the sender is addressing, the receiver receives both more information (ambiguity) and less (equivocation). In the event that the receiver expects exact information in order to react accordingly, it is in fact following inappropriate, over-informed (unexpected) or under-informed (absent) behaviors. The noise creates surprise. Increase diversity.

Let's use our two approaches to analyze the phenomenon. This is what the downward, *katephoric* approach says: the Spirit pole (the intention of the experimenter) seeks to have its instrument receive the most accurate information possible. The receiving instrument is strictly dependent on the transmitter. The noise is annoying to the intention. The Spirit pole seeks to reduce it.

The upward, *anephoric* approach shows it very differently: In self-organized reality, the sender's message does not represent a single level of information. Constantly, its regularities are liable to be disturbed by the jolts of its own structure, quantum fluctuation, genetic mutation, interaction with a third party… For the Real pole, the task of the receiver is not to give a precise meaning to the message, but to enclose it in a cloud of probabilities. The weaker ones, called 'errors', frame the stronger ones, called 'truths'. The strength of the noise is correlated with the size of the error cloud. In the worst case scenario, the cloud does not point to any privileged truth. The noise is too loud. No regularity is demonstrated according to the criteria used. At best the noise is minimal and the truth is unique.

Seen from this anephoric perspective, does noise create organization, or does it slow it down? We have just seen that extreme noise annihilates it and that the absence of noise condenses the solutions into one. It is for *intermediate* noise that the question arises. It decreases the likelihood that a solution will be final. It enables organization but transforms it, facilitates its passage through a range of possible solutions. *Apparent disorder can be requalified as the review of all orders*. Advantage and inconvenient. The system explores possible solutions, but loses stability. How do you build an

additional organization on top of it? Let us note that this one takes the things in hand itself. Hidden within the system being developed, it exerts a feedback effect that stabilizes it, within a tolerance range. Representation controls the system that produced it. Reality becomes civilized on its own.

We can now understand the different motivations of spontaneous organization and intention. The first diversifies under the effect of a dose of noise diluting the organizational criteria without destroying them. The second seeks to eliminate noise in order to improve the stability of the organization it controls, that is, to make its representation more 'true', its power more tyrannical. The noise displeases the decision-maker, who wants her orders executed to the letter. Noise appeals to the creator, who finds in it a talent for diversifying her inventions.

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What is self-organization?

Order: Regularity of relations between elements. *Organization:* This order finds a function.
Function *with intention* to give it (under the downward look of the Spirit Pole) or *without* intent (under the upward look of the Real Pole).
Thought is historically formatted to say 'organization' in the first case and more recently 'self-organization' in the second case.
The organization seen by the Spirit Pole is rather a *programming*. Non-autonomous. Its maintenance requires *control*.
The self-organization seen from the Real Pole is autonomous. Its maintenance responds to the *retro-control*.
The notion of *'tension'* gives a direction to the self-organization: spontaneous increase in the depth of organization of simple entities towards complexes.
Can we talk about *intent for the Real Pole?* The classic attitude dodges the problem in mathematics. The equations *are*. Is the intention concealed in their unfolding?
Because if micromechanisms lead to human intentions, rid them from all willing is a denial of our intentionality. Eliminativist deadlock. Self-destruction of the Spirit Pole to leave only the Real Pole.
If the intention is hidden in the course of equations, it increases with complexity.

The steps of a simple order becoming self-organization, views of the Spirit and Real Poles:
Views of the Spirit Pole / downward look:
1) *Order:* regularities of the observed thing.
2) *Appearance:* selection of the most characteristic of the thing.
3) *Reaction:* from thing to context changes.
4) *Survival:* maintaining its organization despite changes.
5) *Adaptation:* the thing modifies its own organization to survive.
Views of the Real Pole / upward look:
1) *Auto-assembly:* the elements self-determine a system,
2) *Equilibration:* simple order, state of lower energy,
3) *Organization:* order shaped by extrinsic energy,
4) *Dissipative system:* simple stability of the order found
5) *Autopoic system:* system now its own cohesion when conditions change.

Degree of organization (dO): Proportion of elements of a system establishing repetitive relationships. Inverse informational entropy (Ei).
Limits of these two notions: they do not say anything about the reasons for such a proportion. They are related to ways of defining and observing the system.
The 'law' symbolizes maximum dO. All elements are declared in accordance with their representation by law and infederated at the same principle of organization.
The defects of the concept 'law' are numerous. In particular, the fact that laws seem less ‘fundamental’ than others, without being able to explain the reason.

The variable force of a law encourages us to speak rather of *choice* and evaluate it in its four dimensions: *sustainability, extent, authority* (extension of its influence within the level of organization), and *trans-range* (extension at adjacent levels).
The *trans-range* is what the reductionism seeks to eliminate in a system. It wants to study this one regardless of the variations of its sus-jent and underlying organization.
The mind builds its manikin of reality, the Real Pole. Then try to remove the seams.

Strong *sustainability* and *authority* team up to form a stable level of organization. But it is a strong *trans-range* that gives the higher levels of this stability.
'Matter', 'human' and 'consciousness' are examined as an example of the application of these four dimensions.

The self-organization introduces the *observer*. Separation between 'what is organized' and 'what follows from the organization'.
Observation is an organization measure at a particular level of information from the observed entity.
It bases a model and control whose effects are limited by the relative independence between information levels.

Is the organization hierarchy purely epistemic (tool of the Spirit Pole) or also ontological (constitutive of the essence of real)?
A monist is obliged to keep the mind in the real. Yet the mind is an ontological hierarchy.
Self-organization is not synonymous with complexity. It makes and defeats the complexity, is a motor on large scales of time, is simple diversity factor at our scale.

The first to imagine a plausible simulation of the human being may have been William Ross Ashby, creator of the term 'self-organization'[19], English psychiatrist-engineer interested very early in cybernetics. He envisioned a mechanism acting haphazardly, with no initial purpose, seeking its own end through a process of learning. Isn't that a perfect description of the human being? And of the whole of reality? Philosophers have extensively detailed and reformulated the view of humanity seeking the meaning of its own existence. The supplement provided by the notion of self-organization is to know how such a need could have arisen. Where did the necessary tension come from, without resorting, as the mystics do, to the circular a priori of an intention of the same nature upstream of its birth?

Let's take stock of our terms: *Order* is the regularity of relationships between elements. *Organization* implies that this order finds a function.

[19] « Principles of the Self-Organizing Dynamic System », William R Ashby, Journal of General Psychology (1947), volume 37, pages 125-128

Stop! Here, two radically different concepts blend together, depending on the *origin* of the organization. Either it comes from the Spirit pole: organization with the intention of giving it. Either it comes from the Real pole: organization *without intention to give it*.

Our thinking is historically formatted by the principle that an organization is necessarily the result of a *will*. The majority opinion is still that the universe comes from a higher will. The term 'organization' is thus commonly associated with the presence of human intention. The term 'self-organization' does not correctly translate the radical break represented by the transfer of responsibility to the Real pole. We should talk about self-creation, exposing ourselves more to the stake of religious fundamentalists.

Theists are not the only ones who are in difficulty. Scientists, too, have created an occult problem for themselves by giving reality the possibility of organizing itself. The eliminativists did not remove it from the Spirit pole. So there are two origins to the organization: the downward, from the Spirit pole, and the upward, from the Real pole. Eliminativism is not compatible with this double origin. For it, all causality is ascending, ontological. The downward causation of human intention is inexplicable. Some have gone to the end of their logic by saying that it does not exist. Epiphenomenon, illusion…

The need for the mind to find an explanation for the world is such that it is thus able to deny its own existence. Yet even the most ardent of reductionists can observe that transfers of electric charge in a neural network or in an inert object, physically identical phenomena, do not have the same causal directions on the world.

So I will keep our two directions in terminology and conclude this aside as follows: 'organization' has a general meaning: increasing order, whatever its origin. When the origin is top-down (from a more complex level), I will say either 'representation' (for a close level) or 'programming' (for a more distant and complex intention such as that of the mind). 'Representing' is indeed less loaded with intention than 'programming'. Finally when the origin is bottom-up, I will keep 'self-organization' although it would have been clearer to say either 'formation' (for the close level, that is to say the

elements in the process of organizing) or 'complexion' (for a more fundamental level).

Self-organization is a heavily repetitive term in this chapter. Let's lighten it up with the abbreviation 'SelfO'.

Programming by the Spirit pole has a localized effect. Registration of a delimited organization in reality. A program is not meant to be self-determined. It remains subservient to the Spirit pole. Maintaining the downward organization responds to the term ‘control’. Whereas SelfO has no limits. It creates its own intention. It goes beyond simple organization by seeking additional levels of arrangement while maintaining the previous levels. It is a cyclical process and not the simple spontaneous transformation of elements into an organized whole. Maintaining the upward organization responds to the term ‘retro-control’, which locates control immediately in the representation that has just been constructed.

Finally, let us quote the term ‘autopoiesis’ of Maturana and Varela, which is composite: it amalgamates the property of a system to produce itself and to maintain its organization despite changes in its components. It is a partial concept, centered on the system, paying little attention to its environment. The concept of ‘SelfO’ has a more global meaning; it includes all transformations of the entity and its environment. It is the entire succession of self-construction phases that is so designated, freed from the self-delimitation of the system and the contingencies of downward programming (or artificial organization).

We spoke at the beginning of a ‘tension’ about the SelfO. Why would we need this notion? Due to another question that eliminativism does not answer: Is there a finality to the real process? The reductionist hides this problem in mathematics. Equations have no finality. They *are*. Point. This is not an answer but a dodge. Language is sacred. We are entitled to ask ourselves why certain orders appear in mathematics. We observe that reality seems to migrate from zero information depth (the 'Big Bang' event) to an ever increasing depth (of which human society is an example). We could say that the universe expands not only in spatial terms but also in its organizational dimension.

The self-organizing ‘tension’ responds to this impulse towards an increase in stacked orders. The SelfO process could take us back to the original event. There is no argument for this at the moment. *SelfO organizes more than it disrupts*.

This is all as complicated as it is important for the future. Together, let's redo the path that leads from order to SelfO. Here are the conceptual steps:
1) *Order* is the regularity of relationships between elements. These regularities self-define a system.
2) *Organization* is an additional layer of order: the selection of a set of patterns among the possible ones between elements. But who makes this selection?
3) Either the source is extrinsic. An entity independent of the system (eg the human mind) forces the state of the system. It's *programming*.
Either the source is intrinsic. It is the elements themselves that stop at a specific organization. Organizational crossing that we can call *complexion*.
4) The organization tends to maintain itself even when the elements change. Increased system stability under the effect of *control* (for extrinsic intention) or *self* or *retrocontrol* (for intrinsic source).
5) The sustainability of the system allows it to become part of a higher organization, while maintaining its integrity. We have returned to step 1, ready to begin a new cycle. This sequence defines SelfO.

We have identified in the process an essential point, on which it is necessary to dwell. The intent behind the control is easy enough to pinpoint, especially when a human hand is trailing in the area. But can we speak of intention when the source is intrinsic, when the elements themselves form *self*-control?

The classic attitude is to refuse to see an intention. There is no ‘reason’. No ‘chance’ either. The cause is integrated into the equations modeling the behavior of the elements. Mathematics has no intention; they are.

The downside from this point of view is that by pushing it all the way to the end of SelfO, the same can be said about human intentions. They pass out. They are no more than the inevitable outcome of a series of equations.

The fact that what follows is not calculable serves rather as an entrenchment in the face of skeptics.

Because skepticism is required. This vision is a dead end. A whole part of the intentional reality is ignored. The downward approach is purely erased. The reductionist, having reached the micro-mechanisms of reality and considering that everything starts from them… does not even know how to explain how she got there. The Real pole denigrates the existence of the Spirit pole and asserts that there has always been only itself.

By denouncing this amputation of thought, we are forced to conclude that the classical attitude is wrong. It is obligatory to speak of intention even when the source of the organization is intrinsic. If order increase is built into the equations, then intention itself is built into them. It is part of the intimate process of reality. Its complexity increases with that of the process itself. Its power in the human mind comes from the astounding elevation of the organizational levels upon which it is built. Nevertheless its principle is perceptible from the first levels.

The conceptual steps defining the principle of self-organization are the work of the Spirit pole. Epistemology. They should not be confused with the steps of the SelfO process itself. Work of the scientist, who borrows the eye of the Real pole. They look like this:
1) The elements self-determine a system. *Self-assembly* phase.
2) Order is the *equilibration* found by the system, its lowest energy state.
3) *Organization* occurs when an energy extrinsic to the system shapes the order of the elements.
4) The *simple stability* of this additional order defines the dissipative system.
5) When the system becomes capable of maintaining its own cohesion (retrocontrol), we speak of an *autopoietic* system. These are actually different systems working in cooperation.

SelfO, as a process, is how the elements continue to manage the influx of additional energy into their successive organizations. It is a cycle, each iteration of which can be summed up as follows: in a system an individuation appears, the stability of which perpetuates its existence and whose status becomes an 'organized element'. Seen from the Real Pole, it is

a simple result that lasts; seen from the Spirit pole it is an intention or even a necessity for the system, which *wants* to exist.

The order is requalified as a particular SelfO step that has reached stability. This stability can be quite temporary. Even its function is to be provisional. Most biological molecules are not designed to last forever, but to break down and recompose. Some are very unstable and thus become essential, for example the ATP molecule, very easily split to release the energy that was used to form it. An essential power accumulator for our muscles when it comes to suddenly starting to run.

The spontaneous levels of SelfO are arrangements between elements of the same level of complexity (or of a similar level for the resolution of the observer). The systems are in direct contact with each other, which establishes the ontological continuity of SelfO. While simple organization may involve distant levels, for example a human being filing her books. Note that the organization, in fine, remains a function of maintaining the organizational level. This is convincing for a mind that puts its ideas down on paper: it perpetuates itself. But all of its organizing activities can be traced back to this human need to maintain herself. She does this through art, the perpetuation of an ideal, or by inventing new solutions. The human mind is composite. No mode of organization is unambiguous. This explains the richness of our creative activities, which may appear to be devoid of function at first glance. They are an identity reinforcement.

Let us return to an ambiguity attached to the term 'self-organization': it designates both the process of spontaneous organization between elements of the same level, and the appearance of one or more additional levels. However, the two phenomena are not necessarily linked. The collective of elements may be too unstable to allow superior organization with collectives of the same type. To avoid confusion, we will say '*self-assembly*' for elements that have not achieved stability. We will say '*complexion*' for elements finding a stable solution. And the term '*self-organization*' is reserved for the stacking of levels allowed by successive stabilities.

Equilibration is associated with *looped* computations. Stability is achieved when the sequence of interactions reproduces a cycle, or oscillates within a

fringe of equilibrium produced by the organization of the underlying level. *This stability has a temporal definition*, based on the duration of the cycle. It only has meaning in relation to the elements with which the so-called 'stable' system is likely to interact. The cycles of these elements will have comparable order durations. Condition for them to present themselves as individuals to each other. Basis of the similarity between elements, in terms of level of organization. A system that loops after several years can hardly form a fixed assembly with one that loops in a few seconds. One presents an almost always different face to the other. While two systems with strictly identical properties (except for spatial localization), translating loops of similar duration, "see" each other in the same state over time. They are able to form together a structure of remarkable permanence, to the point of seeming almost eternal for elementary grains of matter such as protons.

However this permanence is always threatened, either by a particularly energetic external interaction (collision in a particle accelerator), or by a change of the context which allowed the stability (conditions of pressure and heat), or finally by a fluctuation of the underlying organization of the element, the inherent stability of which is a mere appearance.

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Degree of organization

The degree of organization (dO) of a level corresponds to the proportion of its elements establishing identical or repetitive relationships. This is the converse of informational entropy (Ei). The Ei is maximum in a gas (zero degree of organization, the relations of one element indicate nothing about the others), minimum in a perfect crystal (perfect organization, the relations of an element indicate those of all others). Note the limits of this notion of Ei. It is attached to specific criteria. For gas and crystal, the maximum and minimum Ei values relate to information on the positions and kinetics of *all* the elements. On the other hand, observing a *single* element consists in identifying the type of molecule or atom from which each is formed, as well as their relational modes, which are identical throughout the gas and the crystal. From this focused point of view the Ei has a similar value for the single element in both settings.

Consider this time a gas and a crystal combining different elements, two or more varieties of molecules and atoms. Whatever their respective

proportions, the entropy of the gas will always be close to the maximum if the agitation of the molecules is sufficient (it can drop in a field of gravity because the molecules have different masses). In the crystal, the outcomes are more varied: the proportions can determine a perfect regularity of atomic assemblies, the information on one of these assemblies giving that of all the others (Ei close to the minimum); or there may be randomly scattered impurities (Ei increases markedly); even it is no longer a crystal at all, because the atoms could not form stable bonds together, and the Ei is close to that of gas.

We will further dissect entropy, a principle placed by physics at the heart of the structure of reality. However, because our mind looks for order rather than its defect, I will tend to use the notion of degree of organization (dO) at the expense of its opposite, informational entropy (Ei), which is counter-intuitive.

The dO is an interesting notion but it does not allow us to understand how a level reaches its degree. We are missing an intention that is not included in the principle of order alone. This intention can be sought in the incentive that each possible assembly configuration represents for the elements. Can we see in this the birth of a retrograde causality? Does the result have an influence on its starting elements?

The classic position of science strangles the question with the lace of the 'law'. The law is imperative. Totalitarian rule for elements, reducing their assembly options to one. Deity of unknown origin. All elements falling under the law are standardized; they have strictly the same structure and the same interactive properties. But where exactly is the law? More in the starting elements? More in the result? In both equally?

The defects of the concept of law are numerous:
The rigor and reproducibility of submitting a system to a law are only valid within the limits of the precision of the instruments used. Take the example of the tiny strings postulated by some physicists as the foundation of matter. No instrument has the energy to visualize them. Only a mathematical model projects their existence. String theory remains an experimental mask thrown over this very basic level of reality.

Other masks exist. Some are to be invented. All of them are capable of producing the quantons actually observed. These theories start from the *result*. The first attempt to find the result perfectly becomes the *force of law*. If inconsistencies persist or reappear, the alternatives become useful again. The exact theory wipes out its less fortunate rivals. However, in the process, it is never possible to say that there are no other solutions leading to the same result. The law is a blindness to these unknown solutions. The Spirit pole has placed an additional chain on the Real pole. Without really knowing the essence it covers.

The result is a fusion that we observe with a resolution limited by that of the observation instrument or the mathematical edifice. Several different theories or systems of equations could lead to the same result. No certainty that our knowledge is exhaustive. Reality shows multiple examples of organizational convergence from very disparate sets. Different mathematical objects form the same final images. The idea of a single equation underlying reality is aesthetic rather than scientific. A law can have several parents who do not know each other.

The law is anchored in a level of reality arbitrarily designated as 'fundamental', despite all the provisional that its history indicates to us. We like to consider it immortal while its parents were mortal.

The law does not explain the organization of adjacent levels of reality. It claims to calculate them but in fact looks like a hook thrown into the depths of a lake: the fishing rod hauls up a particular species of fish that is said to be determined by the characteristics of the hook. In fact, this one does not tell us anything about what swims under the lake or why it is such and such a fish that finally grabs it. Why does the *essence* of mathematics behave like this?

The concept of law leaves no room for varying strength of its effects. Why would one law be more imperative than another? When it comes to classical laws, there is a fragile consensus among scientists about the absolutism of each. Perhaps the prize for universality goes to the second principle of thermodynamics. What does such a crowning imply? That

other laws are less 'fundamental'? Are there masters and slaves among the laws?

The laws plunge us back into a dualistic reality, an ideal reality imposed on concrete reality. They project into an inaccessible space the imperatives and filiations of which nothing can be said, in contrast to the scientific approach. Metaphysics which cannot satisfy the questioning of an epistemologist of science.

The flaws in the concept of law are compounded as the complexity of the systems increases, rising in the levels of *Diversium*. Laws lose their peremptory character. They become uncertain for biological, human and social interactions. Probability has force of law in the microscopic, loses its power in the macroscopic.

Probability, as we have seen, brings its share of dissatisfaction. In the absence of an established point of departure for the micro-mechanisms of reality, it must be assumed by default that the models are probabilistic because their chain cannot trace back to that point, if it exists. We grope not because it is impossible to see, but because the spectrum of our vision is limited. The unpredictability of the world does not prove that determinism is wrong; it implies that deterministic *models* are limited because they are rooted in the unknown. Determinism is under the enormous constraint that every stage in the chain of explanation is determinism. The chain is currently broken on the quantum stage. Probabilistic models break free from constraint. They are judged on a purely utilitarian criterion: the efficiency with which they frame the evolution of the target level of organization. The law is the special case where the model establishes the probability at 1.

From having 'force of law', we have therefore moved on to 'variable force of law'. More pragmatic case law. We will abandon the term 'law' unsuitable for this relaxation, in favor of 'choice' (of organization). What exactly does this revised notion cover? Let's take a closer look at the characteristics of the systems involved.

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Strength of an organizational choice

The more a system is made up of structurally identical elements, and the more precisely it is delimited (defining more radically the citizen and foreign elements of the system), the more the choice of organization becomes a monopoly. The individual stands in front of everything because it is no longer different enough from others. This principle is addressed to a particular level of organization, a horizontal system defined by the similarity of the properties of its elements. The choice we are talking about concerns the options of that particular level, regardless of the structure of the elements themselves. Gas and crystal thus fall into the same category, despite their opposing dO, because they are homogeneous systems, that is to say scrupulously respecting a monopolistic choice (defining the 'law'): no gas molecule can be to associate with another, because of the weakness of the bonds and their restlessness; no atom of the crystal can move independently of the others, because of the strength of their bonds.

In reality, a system is not ‘isolated’. This idea is contradictory with its definition: we have seen that it is self-delimited by the relations of its elements. It is the set of elements in question that recruits or does not recruit depending on the properties and distance of adjacent elements. The system *is self-decided* as individuation, *with reference to a whole*. Vision of the Real pole. While the Spirit pole sees it ‘isolated’ in the middle of the rest of reality in order to manipulate it by a specific representation.

The levels of organization that systems form are not isolated either, but intertwined. The choice (ex-‘law’) of a system therefore exerts an influence in two dimensions: spatial (the extent of the system), and organizational (the extension of this choice to adjacent levels of organization). Within a level and across the levels. Choice loses its power with distance in these two dimensions, spatial distance and additional levels that intersect.

However, the loss of force is independent in each of the dimensions. Some choices are powerful in the system, extend indefinitely as long as the elements present themselves, but are confined strictly to that level of organization. In the example of helium in the form of a gas, the atoms, although perfectly stable, do not associate with each other. Their impressive intrinsic forces have no impact at the ‘helium-gas’ level. This is not the case

with crystalline carbon: strong intra-atomic bonds continue with very strong inter-atomic bonds as well. The fundamental forces are the same in helium and carbon, but form contrasting materials at a higher level of their organization, due to the different properties of the elements they created.

We can now define the strength of a choice in its four aspects:
1) temporal, that of its *sustainability*,
2) spatial, that of its *extent* in an organization level,
3) authoritarian, that of its *hegemony* within the system,
4) transcendental, its *scope* in the adjacent levels.

This last concept being new, it deserves its neologism: the *trans-scope*. The trans-scope is not an esoteric drift. Science already validates this concept, may I say, because *reductionism is an attempt to get rid of trans-scope*. Reductionism is a simplifying approach to complexity. The variety of interacting elements in a complex system seems at first glance impossible to model. The first method to try is to reduce the number of elements to the most significant. An idealized system, free of its 'parasites'. A second method is to keep all the elements but simplify their behavior. Here the elements themselves are idealized.

Now what does it mean to 'simplify the behavior' of the elements? It is in fact modeling them according to their main properties, neglecting those which seem to have little influence in the general organization. However, the low-influence properties are precisely those resulting from low-range micro-mechanisms. It does not matter whether their influence is major at their own level, the fact of losing their strength in the studied level causes them to fall out of the model. Thus the quantum effects, tyrants of the subatomic fields, can be neglected in the current physics of materials.

Reductionism is a pragmatism of the Spirit pole. Since the mind cannot grasp the essence of reality, it constructs from what it perceives a mannequin, the Real pole. Mimicry can start with the rough images of the reduction. Then the resolution is refined. The image increases in number of lines. Levels of organization. Then complex thought tries the opposite approach: interweaving the lines. The concept of 'trans-scope' only restores

reality to a quality that it initially possessed, and that reductionism has taken away from it in order to manufacture the Real pole.

In this subchapter we do not yet specify whether the trans-scope is exerted only in an upward way (classic causality of one level of organization on the following ones) or also downward (retro-causality). Subject of a controversy dealt later with that of emergence.

Sustainability, extent, authority and trans-scope are the 4 characteristics defining the overall power of an organizational choice over reality. Durability, extent and strong authority combine to form particularly stable levels, a solid foundation for subsequent AuOs. However, the entities formed by these AuOs benefit from the sustainability of the base only if it also has a strong trans-scope. Otherwise, any destabilization of a high organization can collapse the entity and bring it down to the level of its foundation.

The human being is a typical example. Its most solid foundation is the same as for any other material entity: the atom, endowed with very strong durability and authority. Humans evolve in a biological environment that survives them. The level of biochemical organization is also very strong. Thanks to a stable environment both at the atomic and biomolecular level, the scope of atomic organization encompasses biochemistry. But not beyond. When human dies, her SelfO collapses from consciousness to biochemistry. It doesn't quite turn 'dust' back, but hardly any more elaborate.

Our 4 characteristics apply to any level of organization's choice. Let us take in humans that of consciousness. If the biological durability of man is rather good, with a life expectancy of a hundred years, it is much less at the level of consciousness itself. Personality changes. Highly organized mental patterns are so dynamic that they can only be said to be enduring within the limits assigned to their fluctuations. Here, consciousness is declared 'the same' because it is associated throughout its evolution with the same bodily envelope. Within, countless states of consciousness have succeeded one another. The characteristic 'sustainability' of consciousness is therefore inseparable from its 'extent', currently the space of the bodily envelope.

What is the *authority* of organizational choice for a consciousness? This is not about its social power. The concept reflects the intrinsic stability of this consciousness, its individual *assurance*. Social power would rather come from *trans-scope*, that is to say from the ability of this consciousness to transmit its organizational proposals around it, in the social hierarchy. This *upward* trans-scope is complemented by a *downward* one, the ability to control objects, even the fundamental organization of matter.

Our four characteristics obviously do not provide a detailed description of every consciousness, but they effectively categorize human beings in a manner that is reproducible in any society. These characteristics are found in any choice of organization of reality. They are transcendent when it comes to SelfO. They are essential for appreciating the complex status of a system, something that neither informational entropy (Ei) nor its inverse degree of organization (dO) can do on its own. A high or low dO is only a measure that correlates with these characteristics of the choice followed by a system. The blur remains important on its *trans-scope*.

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Observation and Observer

The ‘self’ of self-organization introduces the presence of a new entity in the thing: the observer stage, which represents what is organized and the feedback. Separation of 'what is organized' and 'what organizes'. Independence between the two and yet, since they relate, there are common parts. ‘Organized’ addresses the intrinsic constitution of the thing while ‘self’ is the level of observation formed by the thing about itself. It is eventually shared with a higher observer such as the human mind.

The mind itself is an SelfO. It can build an observation on its own mental objects. Within the mind exist ‘auto’matisms which evolve independently of our conscious will.

Observation is a measure of the organization of a system at a certain level of its structure. It's an algorithm. A measurement algorithm, which is surimposed more or less closely on the ‘essential principle’ (constituting the essence of the system). The measurement algorithm itself sits in an organized, mental or computational stack. The stack translates its results

into a form compatible with the higher concepts occupying the observer's consciousness.

The human mind is a monumental conceptual scaffolding that feeds on its basic representations, the measurement algorithms, provided by its senses and its artificial instruments. It draws superior representations from them, acting through their association with different vital pressures: nourishing, reproducing, being useful to the group, standing out from the crowd, working, publishing… all sucked in by the feeling of reward. Human consciousness is an essential, extraordinarily complex, plastic and sophisticated algorithm, overcoming and manipulating a huge tiered set of measurement algorithms.

'Measuring' is a label. When it concerns objects or interactions foreign to consciousness, it is a representation, a point of view specific to the label. The essence of consciousness is not located at these levels, it only integrates the data; while the same algorithms are essential seen from the level that has them. Separation necessary between the conscious and the successive stages of the unconscious. Each level owns its identity work. Each stage experiences in its own way what constitutes it, which is why the manipulations of the unconscious organization by consciousness, through measurement algorithms, are not immediately followed by effects.

Isn't it arbitrary and reductive to make consciousness an 'algorithm', given the diversity of its possible solutions? Despite everything, this incredible variety comes from exchanges between a small number of neurons, compared to all of the existing ones. Consciousness is only the terminal stage of analysis. The complexity of its results, contrasting with the simplicity inscribed in the term 'algorithm', comes from the height of the pile of conceptual organization treated.

The potential diversification of such a building is enormous. That's why it's contingent. Each level selects preferential solutions, neighboring from one individual to another for the foundations. Without it, the conscious top of the pile would be a real chaos unsuited to social life. Relative case of the infant, which possesses the complete neurological support of the adult but not its structure. The infant's consciousness is occupied by a few general

and summary concepts (me, non-me…). Programming latent but insufficient to make her able to care for herself or to establish relationships with other newborns. Supervision of adults is essential to set up our first contingencies.

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Hierarchies

We are going to talk a lot about hierarchies in this book. Our two approaches, downward and upward, each create their own: the hierarchy of representation of reality by the mind, and the hierarchy of organization of the real. The first (epistemic) is hardly debatable: it corresponds to the categorization of knowledge by disciplines and their models. The same object is the subject of a hierarchy of designs. For example a television is the subject of a) a physical description, as materials with specific properties, b) a technological description, as functional parts to be assembled, c) an economic description, in as a consumerist object to distribute and sell.

The hierarchy of upward organization (ontological) is more debated. Does it really exist or is it only our mind that needs these discontinuities to better understand things? It is indeed difficult to define a radical border between the levels of organization. They are always connected by understandable relationships. Should we consider them as tiny dualisms within matter itself, or is the real a continuous ontology? We have started to clear up this question: it is impossible to provide a definitive answer (the essence of reality is inaccessible), but defining an organizational hierarchy is perhaps the only way to attribute a true essence to reality. , which otherwise takes on the appearance of an immeasurable chaos of information and devoid of finality (which excludes us from it).

A clue to the 'reality' of the organizational hierarchy is that the mind *really* defines its own. To abandon dualism amounts to integrating the mind into reality, and therefore its hierarchy as well. There is no clear line between the organization of matter and mind. Human affairs are very real; human decisions are clearly hierarchical.

Horizontal thinking often uses the term 'priority' in place of 'hierarchy', with much weaker explanatory power, and frequent confusion between 'anteriority' and structural hierarchy.

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Self-organization and complexity

Let us attempt the synthesis of the principle of SelfO with that of complexity seen in the previous chapter. The two are not synonymous. SelfO is a perpetual dynamic that makes and breaks, dependent on the context. Overall it seems to be moving towards increasing sophistication, but is sometimes retreating further than where its momentum has taken. So for us who willingly place humans at the top of complexity… the top can be beheaded. What is more characteristic of the SelfO process is its persistent tendency to reorganize, until the systems are in equilibrium, and they never do so definitively. The pile of levels of reality is constantly seeking to rise, provided stable planes are found. It breaks down to recompose from the last firm plane.

Life did not exist at the beginning of the universe and it seems unlikely that it could be completely eradicated, so deeply encrusted on our planet. But the planet can disappear. A chemistry less demanding than that of life becomes once again the foundation on which reality climbs again in complexity.

The disappearance of a species is almost an incident in such a process. This is no indication that life tends to remain poorly organized. The progress of the SelfO will eventually come through monstrous catastrophes and hideous wars. If the dinosaurs were eradicated by a meteor, we are probably already able, after a much shorter evolution, to protect ourselves from the same fate. Even when a species does not change genetically, information SelfO continues to rise in structures such as neural networks. Stable plans become those that social retro-controls put in place. The gains and setbacks of complexity continue in the mental universe.

SelfO is only a driver of complexity over large time scales. For ours, it is rather a driver of diversity. Populations are growing and gaining in variety. Learning quickly elevates the conceptual hierarchy. Neural assistants will soon raise our minds to heights that ancestors of the same physical conformation could not reach. What stable plans will shape the minds of the future to protect life from the upheavals it may still encounter?

‘Complexity’ is too vague a term to satisfy the scientific mind. It is suitable for the privacy of our representations, when they seem clear (simple) or obscure (complex). For science, ‘simple’ and ‘complex’ refer to the ‘individualizing’ and ‘globalizing’ models, respectively. Finally, let us remove the exclusivity of intelligence from the human mind, to distribute it to any entity in proportion to its organizational height. We will say the entity ‘simple’ if it has a strong capacity for self-correction, and ‘complex’ if it perceives a lot of independence within its own structure.

Why is SelfO the only possible support for a theory of Everything? The answer has the simplicity of a mathematical theorem: by definition the Whole is autonomous. Nothing exists to interact with it. It is therefore self-constituting, down to its fundamental principles. Causation does not apply to it. It only has meaning inside of it. The major drawback of ordering super-concepts such as laws, God appears here: they do not belong to the Whole, are imposed on it. To conceive the Whole imposes to reintegrate them, one does not know how. It is not a matter of knowledge. There is no connection between the essence of a law and its effects, nor between the essence of God and His creation, as theologians recognize. ‘Autonomous information’ is perhaps the closest representation to the essence of the Whole.

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Systemic

The main historic stages of the systemic are traversed: Cybernetic (Wiener), General Theory of Systems (Bertalanffy), Chaos (Lorentz), Dissipative Structures (Prigogin), Criticality (BAK), Disasters (Thom).
Take an interest in systems is not necessarily adopting the concepts of self-organization and emergence. It is possible to flatten the evolution of a system by reducing it to its course, calculated by a model.
However, this vision exclusively 'horizontal' implicitly creates a hierarchy of systems, assigning them a constitutive level. It walks out without trying to explain it.
Vertical vision recognizes the hierarchy but does not necessarily make better to predict it, in the absence of a general theory of self-organization.

Systemic models are masks for organizations in succession. None knows where the *tension* inherent in this self-organization comes from.

We have defined what a system is, however the sciences concerned warrants specific investigation. They inhabit a still largely unexplored galaxy called *Systemic*. Recognizing the organization of elements into systems does not automatically imply adhering to the notions of emergence and SelfO. In the horizontal perspective, systems are multiple sets that partially overlap; their relative individualizations are likely to be modeled. When systems meet several organizational principles, horizontal systems follow the sequence of these relationships through their respective models. Sequential, juxtaposed vision of systems. The vertical vision, for its part, observes emergence and seeks to entangle these different levels in a holistic effort. However, in the absence of an appropriate translation, especially of a specific mathematical formalism, it does not make a better prediction. The algorithms constituting the model are the same in horizontal and vertical approach. Their power is depleted as the system moves up to additional levels of organization. The vertical perspective shows the reason but does not necessarily know better how to get rid of the difficulty. There are algorithms with transcendental pretension such as the Boltzmann equation and certain cellular automata, but no general theory of SelfO of systems allowing to pass from one formalism to another.

The models are multiplying as fast as the identified categories of system. They do not lack in common, yet bringing them together stumbles on the lack of a common thread. Take, for example, the classification of animal species: zoologists bring their diversity together in a tree of categories driven by evolution. But this term hides an entanglement of ontological and teleological forces. It is not an algorithm for predicting future species. The models are established a posteriori. The creative tension hidden within micro-mechanisms is not known. A good clue is the term 'energy', found in all models (or hidden in 'information'), each time dressed in a different mask, and we do not know what unites them.

The systemic does not systematically use the concept of emergence, yet it is a stratified approach. Even being interested in a single system, it arbitrarily

delimits its vertical boundaries, between the elements and their whole, which is the recognition of a hierarchical position between the constitutions of the elements and that of the larger ones in which the system participates. To define the elements of a system is to install and isolate it on the organizational scale of reality. In doing so, the structure of the elements is ignored; or else it is summed up in a definition, a level of reality which makes it possible to obscure its intimate functioning.

For example when we saw in the *Stratium* chapter the multi-centric vs stratified brain, the classic multi-centric view is in fact also a stratified view. It is artificially based on one level, the neuron, and builds the mental organization from that element. In another discipline, the system could be based on the level of cell organelles, and study the course of neuron activity. In neuroscience, the neuron is given as having the same characteristics as its counterparts of the same type. Simplification facilitating the analysis of its collective relations. The difference, in the verticality of *Stratium*, is to say: a group of these neurons form a system so independent of the others, in functional terms, that the internal structure of the neuron is a system independent of its relations with other cells. This recommendation for stratification is sufficient to bring out the complexity of the brain's productions, even with a small number of cells. It also helps to understand that one set may be smarter than another when it has exactly the same number of cells and connections.

Systemics arises from phenomenology, that is, from the interest in the forms in which phenomena present themselves to our observation, and from their relationships. This interest crystallized in all fields of knowledge under different names: structuralism in philosophy, thermodynamics in the mechanics of bodies, atomism in physics, information theory in communication (Shannon), automation of tasks in cryptology (Turing), homeostasis in physiology (Claude Bernard), cybernetics for control (Wiener), tectology for the organization of sciences (Bogdanov) followed by the general theory of systems of von Bertalanffy. It is, within the broad areas of knowledge, the subspecialty of everyone who is interested in the structure of the observed systems, regardless of their appearance.

Historically, the first system is thermodynamics, the science of heat and thermal machines; we will examine entropy, its central concept, below. Then the systemic was enriched by various names: cybernetics, general theory of systems, chaos, dissipative structures, critical self-organization, catastrophe. Each is of course entangled with its predecessors and with the mathematical formalisms which make them reproducible. After a quick introduction we'll see what they have to tell us together. This history is brief, but if it seems tiresome to you, it is not necessary to understand the rest of *Surimposium*. In this case, skip to 'Synthesis on Systemics'.

Cybernetics

Cybernetics: art of making action effective (Couffignal), science of systems control (Wiener). *The first cybernetics*, formalized by Norbert Wiener in 1948, analyzes the interactions between elements of a system. An element is only considered by its relationships. It's a *black box*. Regardless of its intrinsic processes, cybernetics is concerned with what comes in and goes out, what information is communicated to and received from other elements. The effect of the output is feedback. The feedback loop is positive when the two elements vary in the same direction, negative when they vary in opposite directions. Positive curls amplify trends. Since the control wants to keep the system in an equilibrium range, it is therefore necessary to introduce negative loops.

Humans was interested in means of controlling their environment long before cybernetics, but before that they amalgamated target and means. Cybernetics is the first science of control as a subject, regardless of the elements involved. With the notion of black box, the elements are declared identical if their actions / reactions are the same (within the limits of the measuring means used). Their substance is out of the game.

Cybernetics concerns all categories of systems, biological, digital, social, economic. Feedbacks increase the effectiveness of the constraints one wishes to impose on them. Robotization of tasks, management, artificial intelligence (limited). It is about self-regulation rather than self-organization. Cybernetics is a science little known to the general public; yet it is the one that radically transformed human society in less than a century, making it the ultra-secure world of today. Worrisome power, depending on

who uses it. The American authorities, on which Wiener depended, wanted to keep his activities secret. Cybernetics is the puberty of mankind. After a spontaneity, often dangerous and warlike adolescence, we have entered the era of generalized control. Heavy supervision for individual exuberance, certainly, but limiting its outbursts of aggression. Who claims to know the right balance?

Philosophically cybernetics is the heir to dialectical materialism and the theory of reflection. According to this theory, reflection is a general property of matter which takes on different aspects depending on the level of its organization: chemical, biological properties, action and communication for the living, representation and abstraction for the mind. This theory is the basis of the idea that the real is self-represented, both in the non-living and in the living. Strong anchor for monism.

The second cybernetics goes beyond simple self-regulation and is concerned with the construction of new structures by systems. Spontaneous morphogenesis, self-organization (Ashby), autopoiesis (Maturana, Varela). It is no longer a question of systems in equilibrium, since they are mutating. On the contrary, self-organization concerns solutions resulting from the dynamics of structures and nevertheless finding a permanence. From this derive the dissipative structures and critical self-organization, seen below.

Cybernetics has been an extraordinarily diverse breeding ground for projects and new branches of research. Structuralism of physical systems, but also of thought. Classical idealistic reason is replaced by procedural reason, drawn from the observation of facts. The motivations of the real are replaced before the motivations of the observer. Observer procedures are also analyzed: observation of observation, or second-order cybernetics (Von Foerster). Cognitive simulation programs of human behavior (Newell, Simon), artificial intelligence… all categories of systems are concerned.

General systems theory

Von Bertalanffy introduced the notion of *open system* in 1937: it exchanges energy and negentropy with others within a general system. He published in 1968 'The General Theory of Systems' (GTS), still a reference in systems

because of the abundance of its developments. Wiener bases his cybernetics in mathematics, while Bertalanffy starts with biology. His claims extend from the outset to the human sciences, classified in a hierarchy: chemistry, biology, psychology, sociology, history, arts. The GTS seeks isomorphism of conceptual models between disciplines to bring them closer. It postulates that there are fundamental laws common to the entire hierarchy of systems, living and non-living.

Von Bertalanffy is viscerally emergentist. He calls the *system effect* the principle that the whole is more than the sum of the parts. Its GTS introduces three visions of the system: *functional, organic and historical*. The first two overlap perfectly with our two-way approach: 'functional' adds to the 'teleological, epistemological, significant, katephoric' galaxy; it is the complex intention looking at the simpler intention behind it. 'Organic' adds to the 'ontological, informative, anephoric' galaxy; it is the simple intention, in conflict with others, seeking a solution with a more complex intention.

The third vision, *historical*, is from my point of view a belated contribution. Initially it is redundant: basically the evolutionary history of a system is already embedded in its structure. It suffers from one flaw: it is not always possible to trace this story back to the initial conditions, because several contexts may have produced the same result. The historical view adds little information to the organic and functional. Everything changes when a memory is specifically registered in the system. The first occurrence is the genetic code. The historical, evolutionary vision explodes with the living. It becomes essential there since living systems reproduce this history during their construction. The development of a living being is a compressed version of the evolutionary history of the very long list of its parents. It sort of rechecks all the steps. It may eventually take another branch, often disastrous but occasionally beneficial to the species.

As a good student of its own principles, the GTS itself is layered:
-The *technology* focuses on independently modeling each of the systems.
-The *systemic* seeks the correspondences between the models in the hope of finding a universal root for them.
-The *philosophy of systems* rejects the reductionist paradigm in favor of holism. The world becomes a vast organization stripped of its partitioning.

Conflict, our fetish principle, ironically presides over the authorship of the GTS. Its real precursor is the physicist Bodganov, whose 'tectonics' was published in Russian in 1912 and translated in Germany only in 1928. Von Bertalanffy, a German biologist, most likely read Bogdanov, but never referred to his work. Rival theories because they are too close? The conflict is not just between extremes, it must be remembered. Slight shifts are sufficient for men. Both the context and the content of GTS tell us a lot about systems. Wonderful vertical thought, the elevator of which leaps from one end of reality to the other.

Cybernetics and GTS overlap in their main objective: relational information as a subject, regardless of its forms. At the same time, researchers have always been interested in the specific shapes of models because of their very profitable technological applications. The sciences of complexity have followed a pulsatile evolution, phases of diversification into a mosaic of mimetic models of the sets studied, phases of regrouping of research in a meta-system of reality.

Chaos theory

is particularly synergistic with the previous ones since it seeks order in seemingly random systems. Edward Lorentz designed it in 1963 while working on weather forecasting models. He discovered their extreme sensitivity to initial conditions. Despite a large number of measurements, they quickly exhaust their predictive power. Lorentz's equations make it possible to identify a process deemed to be random, the climate, in forecasts whose reliability can be calculated, according to three parameters: fineness of the collection of initial conditions, time scale, acceptable error tolerance.

More generally, a system is said to be chaotic if it is sensitive to initial conditions, if it is topologically miscible (its identifiable regions can mix with each other), and if it shows dense periodic orbits (any point of the system can be approached periodically by one of these orbits). We will detail later the main manifestation of order appearing in a chaotic system: attractors.

Dissipative structures

Systemic fundamentally rooted in thermodynamics created in 1969 by Ilya Prigogine. In his Nobel reception speech, he said that his title would simply have been "Macroscopic and Microscopic Aspects of the Second Law of Thermodynamics". Classical thermodynamics only separates two reference states for a system, order and disorder, with an irreversible evolution from one to the other. According to the second principle (or Carnot's principle): every system naturally tends towards its equilibrium, which is to maximize its entropy (becoming disordered). Prigogine upsets this classic vision. He shows that a system crossed by flows of matter or energy can produce phenomena of spontaneous organization, far from thermodynamic equilibrium. The term ‘dissipative structure’ reflects the paradox suggested by this discovery: the order of the structure is mixed with the disorder of the dissipation.

The effects of the second principle are easy to observe: any movement tends to slow down, following friction; any hot object tends to cool, to equal the temperature of the surrounding environment. In order for the movement to continue or for the object to stay hot, they must be supplied with energy. Prigogine overturned this simple observation by showing that the input of energy into a system diverts it from its equilibrium and creates an unexpected organization. The most cited example is that of Benard cells, stable convection patterns appearing in a liquid placed between two surfaces of different temperatures. Another particularly spectacular example is the cyclone. The intense evaporation of tropical waters sets in motion updrafts of warm air, while cold higher air descends to the surface to be heated in turn. Vertical air movements concentrate in a depression and begin to rotate under the effect of the Coriolis force. The tourbillon is engaged. A colossal thermodynamic machine where energy dissipation can reach a power equivalent to several atomic bombs per second. The cyclone's power supply drops as it moves over colder water or over land. It slows down until it disappears.

A dissipative system functions as a temporary store of energy. It imports and then rejects it. Flow dependent on continuous injection. An accumulating effect explains why it does not disappear as soon as the energy is cut. Overall, a living being corresponds to such a system: it must

feed itself otherwise its structure withers. By turning energy into a form of information, a dissipative system becomes temporary memory. A living being resists entropy (the dispersion of its information) by constantly extracting new information (organized food matter) from its environment. This substitution of the notion of energy by that of information extends the principle of the dissipative system to an ecosystem (Ulanowicz), the human brain (Stassinopoulos and Bak), society and economic exchanges.

Classical thermodynamics made order an exceptional event: rare ordered structures scattered among statistically more probable disordered systems. Under Prigogine's eye, order is born within disorder, is created by it. Systemic which goes far beyond the scope of thermodynamic heat transfers. It can claim to apply very generally to the phenomena of SelfO.

Self-organized criticality, biphasic evolution, catastrophe

Critical phenomena relate to systems whose state remains within a range of stability. They accept the intrusion of new elements up to the threshold of this range, then abruptly escape. Critical phase. The state eventually moves to a new stable range. In 1987, Bak, Tang and Wiesenfeld sought to unify this type of systems in the theory of self-organized criticality. Key point: the same disturbance can have minimal or very large-scale effects in the system, and in an unpredictable way. Bak's prime example is a pile of sand to which grains are added one by one. A number of them catch on the pile and lift the pile, others cause an avalanche of varying size. There is no ‘average’ effect expected for a grain of sand. However, systems subject to self-organized criticality show recurrences. Patterns repeat themselves regardless of scale: spatial and temporal fractality.

Bak and the researchers seduced by his theory boldly extended it to the behavior of many complex systems, earthquakes, traffic jams, stock market crashes, massive extinctions of species, geometry of welds, neural excitations, urban networks, grouped flights of birds, etc. Criticality creeps in among general theories of self-organized phenomena. However, although Bak's sandpile responds to a specific algorithm, a general mathematical model of criticality is lacking.

Dual phase evolution (DPE) concerns systems where the local order of components suddenly reveals a large-scale order when they add up rapidly. This phenomenon is also a property of networks and graphs: when the density of related edges increases, global connectivity suddenly cascades. In the local phase, components only interact with their direct neighbors; in the general phase they are influenced by all the components. The two phases change reciprocally.

In terms of modeling, the DPE brings together a family of algorithms that heuristically explore the transition between the two phases. It addresses a wide variety of systems (social, economic, ecological) without there being a unifying model for these developments. It is similar to self-organized criticality in that it is concerned with the rapid change in the organization of a system, but differs from it because several processes can contribute to it. DPE thus addresses the natural destiny of systems, organized locally and encountering critical phases, while self-organized criticality describes a system *whose nature is critical*.

If DPE is an application derived from self-organized criticality to large systems, *catastrophe theory* is rather a mathematical precursor. It is a branch of the analysis of dynamical systems by their bifurcations. The models used contain nonlinear parameters; small variations can cause significant disruption of the system. Thom's theory of singularities in 1972, then developed and called catastrophe theory by Zeeman, defines 7 possible forms of upheaval for a system with a maximum of 4 input parameters and 2 output variables. With 5 parameters, 11 forms of 'catastrophes' are mathematically possible. With 6 or more parameters, the number of shapes becomes infinite, but we can still group them into modules.

The aim of catastrophe theory is to reduce the brutal hiccups in the behavior of systems to progressive and inescapable underlying mechanisms. Like the previous ones, the theory applies to a wide variety of natural, biological, geological, geometric and even linguistic systems. This extension to the humanities by Zeeman is controversial.

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Synthesis on systemic

The systemics that we have just enumerated have changed the way of looking at organized systems. Classically they seem to respond to strict laws, translated by stable and imperative balances. They ‘wander’ to the inescapable mark of maximum entropy, and never leave it. When an equilibrium is possible out of tyrannical entropy, only a careful experimenter can find and maintain it by finely tuning local conditions. While under the eye of contemporary systemics, areas of stability become attractors towards which systems spontaneously tend. Natural sources of complexity. The organization is genuinely acquiring its prefix ’self’.

The orders hidden in chaos and disaster are revealed, but they are not easy to relate to each other. We easily understand the origin of fights between male animals over females, because our minds still accommodate the ancestor of this concern; it is harder for us to guess the cause of a zebra's coat pattern, or an earthquake. So-called ‘natural’ laws are a huge and practical catch-all, even for scientists who extract models from them. We relate the disjointed orders assuming that there are others, invisible and in between. We fish them with an *hypothesis*, and if that hook is agitated by valid *predictions*, then can an underlying order be said to have been found.

That the forecast is systematically realized makes it possible to affirm that the two orders are strictly chained to each other, without an intermediary. On the contrary, that the forecast frequently fails indicates a model that is too distended, a hypothesis that is too random, that is to say neglecting criteria (for horizontal vision) or out of whack by intermediate orders (for vertical vision). If several probabilistic models attempt to predict a system with incomplete data, the distribution to choose is the one that maximizes Shannon's entropy. Even when this projection turns out to be false, it is informative, pointing out that missing data is essential to building the right model.

The systemic paradoxically associates two somewhat contradictory approaches 1) that of calling 'random' or 'natural' the spontaneous march of the real, as it is presented, and 2) that of assuming that there is a hidden order in all these appearances, detectable with the help of probabilities. In the mind of the systemicist, two causalities collide: the most archaic is the

upward causality, that of the 'natural', which constitutes reality; the most recent is downward causality or retro-control, which needs to be anchored in the first by discovering in it roughness, identifiable micro-mechanisms, transposed into descriptive concepts and then acting.

Resurgence of our question about uncertainty: is it the property of the real, or only the mind's action to throw its hook into the unknown?

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What are the obstacles to building a general theory?

The processes giving rise to structures are classically categorized in phase transitions, organizations and self-organizations.
Classification rooted in the history of systemics (and the Spirit Pole), rather than in the systems themselves (and the Real Pole).
Paradoxically systemicians hinder a general theory of systems by categorizations, while what is sought is a common principle.
The Descartal Dualism of the intention, reserved for the spirit / foreign to matter, is always inlaid in our thinking.
No 'intentional property' is suddenly appearing between the two. It must be assumed that it is the intention itself that progresses and is recognized when it approaches that of the observer.
The intention is refused to matter because of the postulate of a foundation to reality. Impossible for fundamental elements to make choices at a level so close to an equation-origin.
The interest of renouncing this postulate is discussed.
By removing the dogma of the laws everything becomes self-organization. Categorizations skip. The path to a general theory of systems unlocks.

The intention of an element comes from the fact that *it is container of its own constitution*, facing the context in which it appears as an element.
Essential contributions of the systemic: decryption of chaos, and stability in replication, equilibrium found in the heart of perpetually changing states.
A paradigm is an organization model that the mind promotes on its other representations. It cements the mental structure and not that of the real. It is *identity*. The mind defends it... and must self-observes in doing so.

Historically science has relied on horizontal thinking, to escape the magical sides of vertical thinking. It was about making reality a self-sufficient continuum, free from Olympus, Valhalla and other Heavens supposed to rule it. The proliferation of aspects of reality forced to segment its study into disciplines. The first scientists were multidisciplinary; they emancipated the Real pole of religion by creating science, but did not eliminate the Spirit pole: they were also concerned with philosophy. True transdisciplinary monism that has become difficult to maintain when the amount of knowledge has become such that only hyper-specialization allows one to approach the unknown. The limits of the human brain cause knowledge to be pragmatically segmented.

The reductionist approach strives to attract all disciplines to the fundamental. Without achieving it. The complex approach is more ambitious: it is about understanding through the upward approach how reality passes from one system to another, without reducing them. Finally, a general theory seeks a principle common to these crossings. It is hypothetical at this time.

Paradoxically, it is possible that the systemicists themselves help to curb this general theory because of the *categorization*. Categorization is a valuable tool in the downward approach. Deciphering micro-mechanisms involves finding similar filiations between macro-mechanisms. In this book, like all authors, I resort to categorization, perhaps too much. Because in the upward approach you have to get rid of it. Why use it since we are starting from the origin? Plotting categories about its paths does not say more about it. Categorizing improves *predictions* of the upward approach, but separating cannot help understand what was unified, not in that direction of looking at what persists from unification. My fear is that if there is an origin principle, I will lose it in a mess of categorizations, laws, models, dimensions… each associated with its own codification. Even mathematics is a collection of languages without a metatheory to unify them. The hypothetical principle-origin is drowned in the noise of speeches and equations.

So what are the categorizations used by system specialists and are they essential?

Three categories of ordered phenomena are believed to lead to structures: phase transitions, organizations and self-organizations. *Phase transitions* correspond to simple changes of state of already constituted systems. They differentiate themselves into two categories, first and second order. First-order transitions require measurable time, so phases can coexist, like ice and water. Second-order transitions are instantaneous, between two incompatible phases, such as paramagnetism and ferromagnetism.

Organizations are structures arising from environmental constraints called 'laws', which are imperative. It is thus considered that the elements do not decide on the organization but obey it. The imposed mode is predictable. Within this category, we differentiate between elements that only react directly to changes in physical laws (chemical bonds, electronic signals, heat) and those that modulate them through a pre-established behavior (robot, various programming, instructions from a trainer athlete to his team).

Finally, *self-organization* concerns systems whose destiny is not defined by any pre-established order. The structure is self-building and varies according to initial conditions, in a way that is never rigorously predictable. Here again we differentiate between elements without autonomy but whose organization is entirely the result of the collective (lasers, Belousov-Zhabotinsky reaction), and autonomous agents (humans, swarms, social organizations). The first form structures that can be modeled by nonlinear equations, the solutions of which are the different choices offered to the system. The second form structures that respond to a coherence rather than a range of fixed solutions. The number of criteria involved is much more important.

We already have a clue to the origin of these three categories of phenomena with the history of the systemic: organization at the heart of Wiener's cybernetics, self-organization in the general theory of Von Bertalanffy, phase transitions in Prigogine. But categorization is especially integrated into our way of thinking: it seems foolish to grant matter the slightest hint of intention, while it is easily attributed to organisms endowed with a brain. Descartian dualism is still deeply tattooed in our view of reality,

whether we are layman or scientific. Matter must conform to laws while humans escape them by the grace of their spirit.

Nevertheless, the physical support of the two phenomena belonging to the same reality, where then is the border established? There is not the slightest speculation about this. No 'intentional property' suddenly arises when organizing a system. On the contrary, the presence of an intention seems to arise gradually over the course of these constructions, as it begins to resemble that of the observer.

As a precaution, therefore, one must refrain from denigrating any possible choice in the matter. Whether 'laws' impose their organization becomes suspect, since the environment that creates laws is itself the result of organization. Do we have a proven, *definitive* ultimate framework, the characteristics of which would be binding on reality? No. Even space-time is possibly the result of an organization. As well as the quantum universe. Recent frameworks in human thought, they are incompatible and insufficient on their own to explain everything that can be observed, especially the mind that conceived them.

The concept of law implies that of choice. Addressing the relationship between an element and its environment, the law enacts the tyranny of the environment, but it also indicates that in its absence behavior belongs to the element. The law is a change of outlook. We no longer fix the element but what surrounds it, and by doing this we have objectified the element. It is free from all intrinsic intention. The focus is on the environment. But it is actually the *attention* of the look that changes. Intention exists in both the element and its environment. The individual and the whole. It seems more complex in the whole than in the individual, which is why the look does not pay attention to the intention of the individual until it has itself reached a certain degree of complexity.

So we deny an element the quality of intentional because we deny it the quality of being complex. We have laws about it that freeze its structure enough to assume it to be immutable, with no other intention than to exist as such. Easy to manipulate for the mind. Can we say that it is the same for this element in its essence? No, because we do not have access to this

essence, but also because we represent it within the limits of our instrumental capacities. Technological and mental limits.

Has quantum physics turned things upside down? In a rush, many have decreed that quantum probabilities are the birth of intention in matter. In the current state of knowledge, this is a sham. Indeterminacy is not synonymous with choice. The choice is the collapse of indeterminacy. This one has no satisfactory modeling, but above all no explanation. Why this collapse? Why do we go from indeterminacy to decision? The human mind decides by choosing one behavioral solution among others; we can follow the reasons for this in the form of a chain of celebrities and mental histories. What can be the equivalent for a quanton? It is impossible to reduce the principle of one choice to the collapse of the number of possible solutions. This is to make the effect the principle.

Quantum mechanics does not provide a solution to the problem of intention in matter. On the one hand it is not clearly linked to macroscopic reality, on the other hand it says nothing about its own origin. Indeed its interpretations hide a postulate: the quantum excitations would be extraordinarily close to the ultimate floor of reality, and to a possible equation-origin. Postulate which makes quantons extremely simple entities. Immediate consequences of the origin-equation, they themselves find it impossible to be complex. Only their multitudes are stunning, as well as the superposition of their states, which makes each of them a mixture of potential destinies. This is where some see the root of intention and free will.

Rather disastrous step for the quality of human intention, created by eliminativism: if the causality is purely ascending, it is necessary to go where it becomes blurry to see it arise. We come to neglect social education, instincts, natural evolution, the self-replication of living things. All these reasons collapse before the superimposed states of a quanton. Blur terribly similar to that of its neighbors in fact. A quanton has no other intention than that attributed to its species. What makes it choose a particular state in its macroscopic interactions? We do not know. The explanation is hidden behind equations that do not contain theirs.

We will detail this subject in the chapter devoted to the physics of origins. It will be necessary to give up the postulate of a foundation of reality, whether it is the quantum echelon, strings or loops. This is proof of confidence: by removing the floor, the task of understanding reality becomes more complicated. Because is our current confidence so strong? It comes from the presence of extremely stable organized levels, such as the atomic: they give our reality an unchanging, graspable, reproducible appearance. But they are not so in essence; they are so because our instruments do not allow us to look at them otherwise.

What I have just done is analyze how the Spirit pole looks at the Real. By definition, this way is *psychological*. We find historical and cultural origins there. The Spirit pole easily grasps the intention as it approaches its own, the one it can feel. While the intention of the Real pole appears oversimplified and mechanized in the extreme. Reduced to equations. An equation is not considered intentional. Yet it transforms reality. An equation *is not* a result; it *leads* to the result. Is our reluctance to see intention in the 'real' process a purely semantic matter?

This seems to be the case, to see the sequence of terms translating qualitative leaps in intention, progress in its effects on the environment: equation, organization, autopoiesis, autonomy, will. All these terms have in common the notion of advancement, impulse, unfolding, meaning. 'Intention' is indivisible from 'arrow of time'. What's more? A complexion of the process. The more complex it is, the more clearly its intentional retrocontrol over the environment becomes, and approximates that of the human mind. Ironically we have an identical term for both ends of the chain, for the origin of matter, and for the more sophisticated functions of the mind: *calculus*. Everything is information…

Now that the vision of the Spirit pole is deciphered, let us look at things through the Real pole and see if the categorizations of ordered phenomena are still justified.

We seek to escape the scientific theology of laws. Only one way is possible: we must suppose that reality builds them itself. *It is entirely self-organizing*. Phase transitions, organizations, autopoiesis, mental functions, are

successive solutions. In this upward view, reality is not grouped into categories; it is diversifying. It explores solutions.

By eliminating categorization by the upward approach, we have just dissolved the most important obstacle to building a general systems theory. They all come from the same phenomenon: self-organization. The different aspects taken by it depend on the visibility of the intentions within the elements of the system, and therefore on *who is watching*. The separation between the element as an individual and as a part of the whole depends on the point of observation chosen. This point may be the property of the element, of the whole, or of a more complex observer such as the human mind. How does the distinction between element-individual and element-part appear (between the T for 'solitary' and the D for 'solidary')? The mind *knows it*, as a limited level of information. The element *experiences it* as a constitution. Its fate is entirely determined by this conflict, the solutions of which it explores. The element *accommodates* its reality, while the observer simulates it through a representation.

Another obstacle to general theory, another categorization: that of equilibria, sometimes stable sometimes unstable. Here the systemicists have solved the problem, requalifying the apparent chaos of complexity as stability of another order, different from entropy equilibrium. Pioneers such as Kaufmann, Prigogine or Pross saw the stability of an animate or inanimate system in its ability to duplicate or repeat itself indefinitely, a paradox of a stability found at the heart of an ever-changing state. The more accurately the system reproduces, the greater its stability, but the lower its adaptability. A complex entity resembles a building being built at full speed: workers have started on the upper floors while the first are not finished. If you have ventured to climb, you will find that the building swayes the more you are perched high. But the oscillations always bring it back around a point of equilibrium. Stability does exist.

Let's continue with a new vocabulary point, very useful for our author / reader relationship:

What is a paradigm?

With *Stratium* we have defined levels of mental organization. Each floor is a set of concept-elements, many of which compete to represent the same thing. The paradigm is the majority party in this assembly. Party of concepts sharing a satisfactory and lasting coherence (enough to explain its current success). Others may eventually step in and create a new favorite party in the assembly, which sets a paradigm shift.

A paradigm is therefore attached to a level of mental representation. Those present in consciousness result from the dialogue between the Spirit and Real poles, between self and non-self. The concepts included belong to these two poles; they reflect each other; so-called 'objective' image of reality and interpretations by the mind. Something in the essence of the real corresponds to the paradigm, but is not directly accessible. The difference between this something and the paradigm is that the essence of the real has achieved its cohesion, including in its conflicts (otherwise it would not be so); while the paradigm tries to follow it; it hides behind its celebrity its character of temporary solution.

A paradigm can create an irreconcilable conflict in the mind. It nevertheless manages to exist among others. The overall coherence of the mind is an illusion. It is based on permanent sorting. Faced with each situation, some paradigms come out of the drawers and others are put away. Compartmentalization facilitated by specialization of mind. If we exercise a particular scientific discipline, the paradigm attached to this restricted level of reality acquires an omnipresent celebrity. It intrudes on other levels of observation.

A paradigm is therefore deeply identity. It makes people think about different things identically. The mind defends it. However, the conceptual edifice remains virtual (based on synaptic weights) and susceptible to upheavals. Its top can collapse as quickly as a stock price if the grassroots paradigms are not met. Fast a few days and you will see the turn your thoughts take…

It is important for a researcher to observe herself trapped in her paradigms. She still has a particularly famous one, around which the coherence of her

specialized knowledge is gathered. Principles so proven that she readily calls them ‘laws’. From this preferential paradigm, moving away to the higher levels of *Diversium* (upward approach) means that the laws ‘lose their power of prediction’; moving away to the lower levels (downward approach) makes the laws depend on the ‘initial conditions’, that is to say, we shift the explanation into the unknown hidden behind these conditions. The researcher pulls on the links of her paradigmatic straitjacket, one way, then the other. Only vertical thinking, and the appropriation of paradigms adapted to these floors, allows her to untie them.

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Emergence

The properties of the whole are more than the sum of those of the parties.
Classically the 'weak' emergence (properties of the whole come from the parties but subjectively interpreted as emerging) is differentiated from the ‘strong' emergence (true causality of the whole on the parties).
Emergence is an attractive notion to describe the complexity but criticized for the ontological problems it triggers: the principle of upward causality can not accept the intrusion of retrograde causality, from the whole.
The idea of properties of the whole, 'configurational', was actually contradicted in the 1920s by the progress of the atomism. Link between atom and chemistry established by the quantum model of the atom.
The classic causality in the hands of eliminativists is however sterile. It does not allow predicting properties from new organizations. Emergingism is a pragmatic framework to separate knowledge into different disciplines.
The most convinced eliminativists behave daily as emergingists.
Emergence is a characteristic of knowledge. Does not it conceal a genuine retrograde causality in adapting a model to its results?
The eliminativist reality is a vast single mathematical system. Yet no mathematical language can describe its entirety. Each of them, stating its postulates, also poses its limits, its non-universality.
The reality as an infinite calculator has no reason to build a consciousness. This is not the number of calculations that changes nature. Consciousness comes from the substitution of one calculation to another, that is to say a representation of symbols by another.
This only principle of representation suffices to found that of emergence.

A comprehensive representation then becomes 'observation', associated with others in the mind.

The favor for the reductionism is explained by the intimate functioning of our mind. It flattens the reality to handle it, erasing its complexity.
The loss of information is avoided thanks to the lamination of the language. Words host the information hierarchy of reality.
The reductionism also draws its celebrity of omnipresent technology. Used by all, integrated, identity, while the theories are born of a small number of minds. Occultation of creative intention by the mechanical ontology of everyday life.
Concealment permitted by a radical dualism between the Spirit and Real Poles, which is not adequate: they both stand in mind.
Emergentism that structure the mind reflects its counterparty in reality, since the mind is the culmination. The other hypothesis is that it is a divine gift. Non-explanatory postulate.
The mind is part of the reality, and the reality started without it. The process must make sense to itself. A self-organization has *self-meaning*.

The notion of emergence is based on the very old idea[20] that the whole is more than the sum of the parts. We have taken it as a starting point in this chapter by defining the individual elements and the whole formed by their relations as two independent entities. The properties of a phenomenon are not systematically reducible by adding those of its elements, and cannot be deduced a priori from them. We classically distinguish the 'weak' emergence where the properties of the whole are indeed derived from those of the parts, but subjectively interpreted as emerging by an observer (example of water transformed into ice, with apparently new properties but explicable from those of hydrogen and oxygen), and the 'strong' emergence where there appears a new fundamental and irreducible influence of the whole on the parts, that is to say a real additional, retrograde causality. Classic examples of strong emergencies: life, natural selection, consciousness, society.

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[20] It has been traced back to Aristotle, whose texts dub this notion, without his writing verbatim "The whole is more than the sum of the parts". Etymologically, ‘parts’ (*partialia*) mean ‘partial aspect’ of the whole. The term gives priority to the whole over its parts.

The weak emergence therefore appears as epistemic, property of the Spirit pole, while the strong is ontological, anchored in the Real pole. A priori is excluded from this dichotomy the emergence resulting from ignorance of the mechanisms involved in the observed properties. Nevertheless this 'false' emergence remains in ambush, in particular for the strong emergence. Many phenomena have lost this connection with the progress of science.

A second problem is more serious, undoubtedly impossible to solve: remember that the Real pole is only the mask cast by our mind over the essence of reality. The term 'ontology' always conceals an inadequate assimilation between the two. If we believe to demonstrate the existence of an authentic ontological emergence, it can still come from the need for our mind to construct it, only because the 'mind process' imposes it, that it has no means of grasp reality differently. This cannot be proof that emergence really belongs to the essence of things.

However, in this *Surimposium*, theorizing a coherent Real pole is already an ambitious project. Let us content ourselves with resolving the controversies over emergentism within the Real pole. I will show that the categorization of emergences is arbitrary. There is a continuing spectrum of weak to strong emergencies. Their characterization is entirely dependent on the definition given to 'observer'. The notion of 'subjectivity' about the human mind is particularly hazy. It is not explanatory. It is impossible to base a categorization of reality and emergence on it. Observation should be taken in a broader sense: it is about the self-determination of the system itself within its environment, which can be seen as self-observation. Of course, the way the human mind determines itself is more complex than assemblies of molecules. So it is no coincidence that when climbing the scale of complexity, emergences appear stronger and more difficult to decipher. I will justify this position as completely as possible, starting from the decryption of the principles of order and causation.

The downward/reductionist approach, which seeks to explain everything using micro-mechanisms, severely criticizes the notion of emergence: 1) Emergence does not offer an explanation for the observed phenomenon (a

rabbit comes out of the hat). 2) The non-traceability of the emerging phenomenon may result from an insufficient understanding of the properties of the parts and their interactions. 3) Retrograde causality is logically incompatible with the principle of causality per se. 4) The concept implies the existence of emerging laws while the mechanisms of reality must be able to be fully explained from fundamental laws (principle of reductionism). We will analyze these critics in detail in a moment.

The upward/complex approach asks less closed questions: When a system interacts and organizes itself, why does it produce this one solution rather than another? What were the possible alternatives? Would this choice persist in a different context? It is true that by digging deeper into the chain of causalities, science ultimately debunks 'magical' emergences at first glance. However, it still has as much difficulty in making predictions about the fate of a system, for two reasons: 1) Some are not calculable (abyss of complexity, undecidability). 2) We do not fully understand the chain of causalities. There is no official and ultimate foundation of the real.

The properties of an organization level are related to its neighbors. The causal hypothesis only becomes clearer when these are known. For example, we can understand the arrangement of electrons in energy levels by the fact that they also behave like waves and must complete their orbit without phase overlap. But we lack a clearly established causality for the underlying stage, namely the wave-particle duality. The eye of science wanders the chain of causalities, from elementary particles to human consciousness; in the middle everything is increasingly clear, we manage to trace the origin of the emergences; the ends remain unclear, no prediction can be sure.

Let's start by recognizing reductionism's relevance: strong emergence, in the sense that it is an influence *replacing* elementary interactions of matter, is a false notion. There is no fundamental force specific to chemistry, another to biology, and one specific to consciousness. The notion of strong emergence was built in ignorance of the processes connecting these levels of organization. Cause of the fall of British emergentism at the beginning of the 20th century: its last major work, "The mind and its place in nature" by Broad, was published in 1923, a few months after Niels Bohr's

revolutionary presentation of a model quantum of the atom, making electrons the orbital planets of the nucleus. The model has been proven wrong in details, but its explanation of the periodic table of elements remains correct, establishing a strict correlation between atom and chemistry. From then on it seemed obvious that the hypothesis of unknown forces organizing chemistry, biology and psychology, according to the emergentists, was based only on the insufficiency of our knowledge.

The notion of strong emergence nevertheless has an essential interest in the procedures for representing reality: by being blinded to the fineness of the fabric of phenomena, it allows us to step back and see the more general structure of reality. The mind does not see just the fabric but the dress. The nose on the thread you hardly find magnificence to it. From a distance you are amazed by the complexity of the work. Another metaphor: if we analyze the chemical composition of a masterpiece, we will not have much appreciation of its value as a work of art.

Let us consider a particularly strong and didactic emergence: the Schrödinger equation describes the kinetics of an elementary particle. At the same level of observation, a human being is a considerable collection of these particles, united in an obscure pact for physics. Which leads to the question: Can we, using our ultimate equation, predict the path of this cluster of particles in three-dimensional space, relative to those that do not constitute this human? No, physics is astronomically far from it. The equation does not allow us to calculate the chemical, then biological, and finally psychological properties of the 'human' cluster that lead her to choose one direction over another. Obviously there is something about the movement of the world that our ultimate equation does not take into account. The burial of the notion of emergence in the last century was premature.

The notion of emergence is inseparable from that of *causality*. To close this flashback, let's remember that causality, in Western thought, was born less monolithic than it is today. Aristotle divided it into 4 categories: material causality (what constitutes the thing), formal (what modeled the aspect of the thing), efficient (what changed the thing), and the finality of the thing. Example: the material cause of a bowl is wood or metal; the formal is the

model suitable for containing food; the efficient is the process of its manufacture; and its causal end is its food use. In this classification, the notion of causality switches from one point of view to another, one upward (material constitution), the other 3 downward. Why 3 expressions of the downward look? Because they belong to 3 different levels of observation: the formal is the spatial relationship between the objects, the efficient is the technological and the finality is the observation of the consumer.

The constant progress of knowledge has ended up merging these causalities together. At the end of the 19th century, the apotheosis of determinism, it seemed possible to trace the tiniest known cause in matter to human intention, without disruption. Blinkered triumphalism. In practice, the most precise physical equations have never given any insight into how to run human affairs. Self-satisfaction has only grown in a matter / spirit dualism. Pragmatic split of the sciences between physics and human beings. The problem of causality was swept under the carpet by this simple trick: the two fields of knowledge each used their version of the causal. Epistemologists noted this fragmentation without being able to bring together the variety of postulates in a coherent whole. Even today, the 'causality' wiki bears witness to this: the page refers to a list of articles dedicated to different disciplines. Isn't this fragmentation astonishing, about such a foundational concept in our representation of reality?

At this point in the investigation, let's simply define emergence as the only paradigm for connecting polymorphic visions of causation. It lends its discontinuous framework to knowledge. It helps us to look up at the physical, evolutionary, psychological, social, religious causes in which our daily activities selectively plunge us. In order not to transpose them peremptorily from one domain to another, the only way is to grant them each relative independence. Protect your favorite paradigm, but make it dialogue with others. Emergentism thus gains a *utilitarian* definition.

Each of us uses it routinely. Even when our favorite paradigm dazzles us with its specific successes, we willingly use others where they are most *useful*. Behaviorists strove to improve their intentions even as their cognitive paradigm declared them epiphenomena devoid of causation. A physicist does not calculate the activities of her children using a wave

function. A priest would rather audit his accounts than hope that God will keep them fair. *We are all pragmatic emergentists*…

Let us return to the controversy at its root. What are the criticisms made of emergentism by reductionism? The appearance of order in a system defies entropy. The principle of self-organization seeks to explain it, but only succeeds properly in systems of limited size and complexity. It is a failure when, for example, 'living things' are regarded as a general system. Here we can guess the misdeeds of the exclusive horizontal vision, when it flattens the self-organized pyramid of the living into a single system. A failure also linked to bringing together under one banner a host of subsystems considered to be satellites of each other. The hierarchy, very intertwined and difficult to follow, is erased.

Emergentism is criticized for the vagueness it maintains about the conditions for emergence. It only seems to be looking for new classical laws applying to phase transitions, the area where emerging properties appear. It does not clearly separate what seems explainable by the properties of the underlying level, actually predictable if the laws governing that level are refined, and what is truly unexpected. Is it not based on insufficient knowledge of the modeling of the underlying levels? Theoretical progress seems likely to bring back the emergence within the totalitarian world of the 4 fundamental forces, especially as even indeterminism seems to constitute these laws (quantum probabilities). I show in this book that the fundamental is only the contemporary limit of knowledge, and that the vagueness surrounding the transition between mathematical formalisms concerns the horizontal view of systems as well as the vertical.

An emerging property seems to be based on a contradiction: it is dependent on the underlying processes, and at the same time it is autonomous. In *Surimposium* I call this paradox *blind independence*. It is characterized by a fusion of the underlying elements in a single image, both new and necessarily based on the persistence of the constitutive processes. As when a manufacturer puts chocolates in a box and affixes a beautiful silkscreen with their images: the appearance symbolizes the content, can be distributed and sold as a 'box of chocolates', but would lose all validity if these were removed. Screen printing is blind independence; it thinks it is a

box of chocolates but is only really a box if the chocolates are inside. This is the difference between being only a 'representation' or being the 'essence'of the thing. The number of levels of information included is not the same.

Let's start again from the definition of emergence. It refers in the first place to the notion of property: a set of associated elements under particular conditions shows a property that the elements taken individually do not have. Emergentists differentiate a simple resulting property from an emerging property. A resulting property is for example the liquidity of water, or its transparency, or the weight of all the elements equal to the sum of their individual weights. These are properties of the whole that the individual elements do not have, but they are 'directly' derived from them. The low innovation provided by a resulting property may make it prefer the term 'characteristic'. It responds to the following terms: evidence, constitutionality, instantaneity, universality, exclusivity (the characteristic cannot be otherwise). It does not require any particular interaction. The mere presence of the elements brings about that of the general characteristic.

Emergentists and reductionists agree on the origin of a resulting property: it comes entirely from the observer, linked to the change in the level at which he is located in order to observe: she looks at the whole and no longer at the elements. A characteristic, without more precision on its role, is thus pure appearance. Epiphenomenon. The observer uses it to *characterize* the whole, to give it an identity. However, this added identity / representation belongs to the observer, not to the whole considered. The essence of it is not changed in any way. As long as we equate essence with 'information contained in the system', there is no addition of information *in the system*. The real is not modified, *it is the Real pole that has been enriched* (the representation of the real by our mind). Until then the emergentist and the reductionist with notions of philosophy understand each other.

The deal is not as enthusiastic on *emerging* property. The 'hard' reductionists, whose ranks are thinning, refuse any independence about it. For emergentists, taking it into account is essential in order to understand how the whole works. For example the behavior of animal *A* cannot be described only by knowing the sum of its primary instincts; it is under

social pressures, which are a level of organization higher than its bodily system. Retroactive causality on instincts. Therefore it is not possible to predict the evolution of 'system' *A* only with the help of its intrinsic laws. Social pressures must be modeled, which are the emerging properties attached to the group of animals.

Suppose a mathematical archangel manages to precisely describe the behavior of *A* using the intrinsic impulses of *A* and the environment (which contains other *A*(s) supposedly independent). The calculation starts; reality unfolds; the model works. Suddenly the extrinsic pressures change because an *A*(s) society has arisen. The model must be adapted. The reductionist defends herself: she did not have the right initial model. Now the archangel takes over the calculations and ascending causality explains everything, through a correct model. But wasn't there cheating? Did we only start from the initial conditions or did we not dig into their future, during the adaptation of the model? Haven't we in fact used genuine retrograde causation in summoning this future? The rules attached to the *A*(s) society, clearly, were not written into the initial conditions and interactions used.

The divergence of the reductionist and emergentist points of view therefore rests on a crucial point: are there only 'characteristics', that is to say, resulting properties only apparent to the observer, or do there exist also true emerging properties, endowed with an authentic retrograde causality?

By embarking on this investigation, a trap awaits us: consider reality as a unique system. The principles of such a system, in the first place causality, are necessarily transcendent. They are identical regardless of where, when, or what aspect of the system is considered. It is a postulate and it is not that of emergentism, which says: reality is a set of surimposed systems. How could we study the validity of emergentism with postulates that nullify any possibility for it to exist? To use the principle of causality in a single system makes fall obligatorily into reductionism: if the emergent property M is obligatorily caused by the properties P(*i*) of its *i* assembled elements, M can be replaced by P(*i*) and has no self-interest. It is a pure mathematical deduction. More simply still, the emergence which associates a dependence and an autonomy with respect to its constituents is a mathematical

nonsense. As if we simultaneously affirmed a = b and a ≠ b. Emergentism is liquidated without possible recourse by this process.

Yet it is mathematics that comes to save it. A mathematical system clearly states the postulates that determine it, and the limits that this imposes on it, in particular the impossibility of describing itself. We also know that no mathematical system can fully describe reality. For example, try to predict your thoughts for the next week with the Schrödinger equation, yet universal about each of the particles that constitute you. Impossible ? Any honest reductionist knows by purely mathematical means that reality is not a single system, that a system cannot describe itself on its own, let alone relate to the postulates of other systems (which can be radically contradictory). How could she eliminate the possibility of emergentism, which provides a way out? What is emergentism in the end, if not a framework for a meta-system bringing others into harmony? It is not an attempt to create new laws or modify existing ones. It consists in simply saying: there is a meta-organization of laws and we must seek there the unifying principles of reality.

A reductionist may retort that reality is a giant calculator, immeasurable for our small human scale of computation. After all, it's calculating your thoughts well for the next week, since these are going to arise, and they wouldn't be considered random if we had detailed knowledge of all the steps in between. The problem is, no calculator, even of this incredible size, has a reason to become conscious of the calculation they are performing. Whatever the number of operations carried out in parallel, no principle modifies their quality, except one: that a calculation can replace another, that it establishes a representation. It is precisely on this principle alone that the notion of emergence can be established. Observation is as fundamental a principle as ascending causation, which must be placed at the heart of the 'reality' process. We were not ourselves, as observers, dropped there from an unknown paradise. The mind is the most remarkable outcome of an observation long before it, born in the innermost mechanisms of reality.

*

Causality

That emergence is a breach of causality is a disturbing hypothesis: cracked reality?
Yet the reality 'hold'. How to insert the unexpected within it, over the complexity?
Before physical explanation, there is a semantic reason, a language reductionism, which assimilates interaction and result: on either side of the sign '=', a complex equation becomes a single symbol.
Acceptable reduction when it is a strict mathematical formalism, suspect when it comes to words (which are used in strong emergences).
Because we know how to cut the words and rephrase them, while the numbers seem to be genitors. The words *contain* the complexity, the numbers *base* it.
The mind can not dismember further the numbers, maybe because it emptied its toolbox? Numbers do not self-explain. Causality is based on their semantic privilege.

Two causalities: *linear* and *circular*.
Linear causality is the simple translation of change: A> B> C
Circular causality is the retro-action of elements on each other up to a stable order: A1> B1> A2> B2 ... An> Bn> An (potential element couple for a higher organization).
Thus causality is not monolithic: it is stratified, peculiar to each level of organization.
When the links between levels no longer seem exceptional, the mathematical correlation becomes the equation of a unifying theory.
Thus the independence of causalities disappears in the heart of mathematical language.
When the causalities intervene jointly we must prioritize them.
When they compete with the same level they are separating according to a principle of *celebrity*, which we will try to give a physical definition.

The downward or recursive causality, basically, is a result that influences the course of the interaction that produced it.
By its stability, the result can become itself element of a new interaction. A level of organization has been crossed.
Each level has its own time, elemental unit defined by the fact that an interaction has taken place.

Emergence is *diachronic*: the properties of the assembled elements are not simultaneous with their assembly, since the 'time(s)' of the elements and of the assembly are different.
The downward causality does not occur at the same time as upward causality. The temporal frame is not the same. The reducer physicalism is not denigrated.
The duplication of causality is the manifestation of the dichotomy of the elements in relation: element as an individuality and as part of the collective formed.

The controversy on recursive causality is also that of *functionalism*: organ created randomly discovering its function, or need the function creating the organ? Both are true, by the sequence of the two engines of the evolution: mutation and selection.
Conscious thought is the phenomenon largely presented in support of recursive causality. In its womb it becomes *intent*.
The intention has been evacuated from matter for historical reasons. Man emancipated from the divine laws, from a matter *commanded* by God. Without soul the real becomes a mechanic devoid of any objective. Corollary problematic: How to parachute from nowhere the intention in consciousness?
Consciousness is the summit of a sequence of surimposed direct and recursive causalities. The intention is built a little more on each floor, until arising in the consciousness, where it is proven, which makes its particular quality.
Our mind marks the origin of a cause according to its complexity, in the elements interacting when it is simple, in the resulting organization when it is complex.
Reserve the term 'intent' to consciousness is a cultural choice. Sequelae of the deification of the human mind.
The adoption of upward and downward causalities dissolves the problem. Distributed intention between the elements and their organization. The filiation of the conscious intention reappears.
...as well as the principle of *conflict*, possible between independent upward and downward causalities.

Is emergence a break in causality?

At first glance, an emergence could be likened to a break in causality. If the emerging phenomenon cannot be reduced to the properties of its parts, it is

because there is an ingredient to produce it in addition to classical causation. A fragment of explanation is missing, creating a zest of anarchy, from which comes unpredictability.

A much more frightening prospect than it seems, considering its extensions. We are not talking here of an only incalculable causal chain. We are talking about the emergence of a totally unexpected factor within a system that was hitherto predictable. And not at the hazy ends of the origin or the end of the universe, but right in front of our eyes! Reality cracked by unknowable flaws. Terrible blow to determinism. Does technology have to dramatically improve our hold on the world, and we no longer have to fear the sky falling on our heads, to make us accept such a threat!

The most reassuring thing is that reality *holds*. Despite its hypothetical tears, it does exist. Sign of a coherence hidden in the unknowable? Our observation is punctual. No matter how much science extends its tentacles to the past, we have not seen the world form. If the emergences are causal blanks, how can we be sure we haven't missed something?

The problem with emergence is that it declares an organizational crossing of which we hardly detect any trace within the model describing the system. The equations do not contain a causal break or a clear reversal of a process that could indicate the emergence of a new causality, called 'retrograde'. Where does the unexpected come in, the grain of madness that is added to the sum of the parts? There are several ways to resolve this delicate problem: disruption of symmetry, energy and time scales, infinite regression. We will see them in the next chapter. Structuralism allows the unexpected to regress beyond the observable in a way that satisfies both reductionism and emergentism. However, let us now examine a purely semantic means of reconciling causalities. Retrograde causality is perhaps hidden in causality, quite simply.

Causality, quite simply

Doesn't the controversy around emergence come from insufficient precision in the definition given to causality? In its clearest sense, causality targets relationships between elements of the same level of organization: two atoms interact to form a molecule, molecules interact to form a crystal, or a

more complex molecule. The resulting property seems to us to be a direct consequence of the interaction. It therefore seems ‘causal’. For example we see the property ‘solid’ as the strength of bonds between molecules, ‘heat’ as the degree of agitation of molecules. In each example, this is indeed a property of the whole; causality is about the outcome of the interaction; it does not deal with the interaction itself; it is opaque like a mathematical symbol, ‘plus’, ‘divided by’, or any other equation; causality does not deal with the content of the symbol; it uses. When it is concerned with deciphering the symbolic representation of interaction, it does so at a lower level of organization. And this pyramidal survey does not meet a definitive floor.

Causality is a superposition between the interaction and its result: the initial elements are always present (in the case where they organize themselves without disappearing), but new information has appeared resulting from their interaction. Reductionism is a reduction in language, within the very term ‘causality’, which equates interaction and result. This is the reductionism contained in the "=" sign in mathematics, where we can see a simple symbol on one side and an extraordinarily complex equation on the other, or an infinite number sequence (Pi).

Perhaps the most astounding example of reduction is the Boltzmann equation: $S=k_b*\log(W)$. On the S side, the entropy of a system (or measure of its disorder); on the other side W, the number of states in which the elements of the system can be. S can never decrease; its evolution is irreversible. While the states of W are interchangeable; it is always possible to go back from one to the other. The sign "=" here conceals nothing less than the transition between microscopic and macroscopic, and the arrow of time.

In terms of causality, we readily accept the assimilation of the "=" for levels of organization that seem adjacent to us, united by precise theories. Thus the characteristics of materials are derived directly from the theory of electronic orbitals. On the other hand, faced with a distended and vaguely theorized relationship, such as neural metabolism and consciousness, the phenomena no longer seem united by direct causality. Is causality then rather epistemic, a matter of putting into perspective by these conceptual

representations that we call "theories"? Let us imagine that foreign intelligences know a more advanced explanation of the relations between particles and the properties of materials: our theory of orbitals would then appear to them as a summary belief, fallen just because we do not have the instruments fine enough to see its errors in contexts less common.

With this semantic approach, the notion of emergence is already contained in the notion of causality in the current sense that we attribute to it. We assimilate the emerging result to the elements that produce it, through the theory that puts them in relation. Causation is not the monolithic principle it seems. Each causality is specific to the relational theory that determines it. It brings together conceptually independent notions such as "heat" and "agitation of molecules". It is in this sense that it already contains the principle of emergence.

When the phenomena seem to have a strict and direct physical relationship, we speak of *weak* emergence. When the phenomena are distant in the organizational dimension, they are separated by a multitude of weak emergences which are not all the object of a relational theory. The phenomena then seem independent and we are talking about *strong* emergence.

Strong emergencies certainly exist in the sense that they represent big leaps in organizational levels, each one carrying its own information. A strong emergence is not only the sequence of the theories of these levels; it can have its specific framework, including its own rules, in a theory that seems independent. Theoretical emergence over the previous ones. Functional translation of the surimposed levels of interaction that it covers.

Of course, deciphering this surimposition makes the theory more precise and connects it to the most fundamental. But remember that a theory is fundamental only by lack of assumptions and tools to decipher it itself. The provisional theories built around strong emergencies have rendered invaluable services. Positivism essential in the face of great gaps in knowledge. As shortcomings, they encourage further and refine research. Do we actually have anything other than provisional theories? Imagine for a moment in the universe a population of purely reductionist beings, only

capable of understanding micromechanisms. Unfit to represent their higher organizations, they would have collapsed very quickly.

For recreation, let's test our framework of thought with the concept of 'God'. God is the most archaic of theories about a strong emergence: He is the immeasurability of the universe and of our existences in relation to what our consciousnesses perceive of them. The influx of intermediate theories from science has significantly clarified the structure of reality. It pushed back the strong character of this emergence. The need for the 'God' theory is correspondingly less important. We have in a way autopsied the anatomy of God and it seems less mysterious to us: its functioning becomes accessible and reproducible. This does not actually change the essence of what we have delimited by the representation of 'God'. The totality of reality and of us who observe it is still not commensurable. We just gained confidence in the belief that it could one day be.

In fact we have theorized our own limits by stating that a system cannot fully understand itself. Which is ultimately to establish some representation of the immeasurable, placing it just beyond an asymptote of knowledge. The Whole and the vagueness that surrounds it does not go away. The concept is there. Whether you change your name of 'God' to creation, multiverse, real, order, nature, keep the concept merged or split it up into levels of organization, it persists. Reason can only profess an agnosticism about it. Gnostic atheism is wrong if it addresses the concept; it can only concern precise theoretical formulations of the concept.

Before returning to the delicate problem of retrograde causation, let's investigate a little further with two complementary questions: How do we relate causality and order? Are the causes monolithic or decomposable?

Connect the notions of causality and order

Let us individualize two causalities: linear and circular.
Linear causality is classical determinism: a cause always gives the same effect in a similar context.
Circular causality is the existence of a feedback of the effects on the causes. A -> B -> A_1 -> B_1 until A_n and B_n version forming a stable couple, which can serve as a foundation for a higher organization.

Linear causality does not define an order. Chaos responds to linear causality. Linear causality is a *spontaneous change*, an irrepressible succession of states in the continuum of possibilities, which eventually stops at certain orders. We will see later with time whether there really is a shift, a tension running through this succession.
Circular causality corresponds to *the ordered thing*. The interactions come full circle. The information they contain is a finite amount. *Order is limited information*. Organization is the process by which the real selects the information of which it makes its essence, within the continuum of possibilities.

Interesting corollary: the Popperian scientific approach is based on linear causality. It is therefore indeed a *search for order*, and not an attestation that the thing is ordered. This attestation is found on the contrary in circular causality: a postulate founds a system, the developments of which adjust the postulate as best as possible to corroborate it, until it reaches perfect internal consistency. This degree of agreement only exists within circular reasoning, while linear reasoning leaves its beginning and end unclear. This is one of the arguments to justify the claims of *Surimposium*, even if it is not scientific in the Popperian sense of the term. The objectives are different: science investigates; its theories are hooks cast into the unknown. *Surimposium* is a framework of thought that aims to be the twin of the organization of reality. Yet the order of reality, in its essence, does not need to be theorized. It contains its own justification.

Non-monolithic causality

Causality itself is a layered principle. Consider the following event: The growth of a plant is caused by light, water and nutrients in the soil. Stated thus, such a causality is very difficult to specify. In what exact proportions are light, water and nutrients involved? No scientist can quantify it with certainty, except by focusing on a specific time of plant growth and a particular aspect of the organizational mechanisms involved in it. She can only give an answer by reducing it. To reduce is to fragment causality into its more basic components. But how far can we go like this? Far enough, today: we even know of quantum effects involved in the photosynthesis of its constituents by the plant. However, the causal thread ends up fading away. No one can explain quantum fluctuations. Causality is, like the

reality it describes, an edifice suspended between unknown foundations and an unfinished summit.

A stated causality is all the more fragile as it covers a large number of intermediate levels of organization. The scientist seeks the most reductive causality possible: *A* causes *B* in the smallest instant *t*. But can she be sure that there is nothing between *A* and *B*, that *t* is not divisible?

Here appears a new, very strong argument for limiting the scope of laws across the organizational pyramid: causality itself suffers this loss of power, in a perfectly correlated manner. The more we extend the 'cause' to phenomena that are far removed from it in the organizational dimension, the more frequent errors are. Scientific reason indicates why it should restrict the scope of its own laws, for example Gödel's incompleteness theorem. We will soon study the reasons for this variable scope of organizational choices on adjacent levels.

The role of reductionism is to refine the correlations between phenomena belonging to different levels of organization, until they are linked by precise mathematical theories. This eliminates the independence of causalities in the language of mathematics itself. The misuse of reductionism is to want to extend this downward efficiency to upward use, that is, to make it an explanation of the complexity.

The resulting confusion is apparent in this example from a text by Carnap: « Peter has an accident because he is driving at 50 km/h on a wet road. Peter is the cause. But you could also say that the wet road caused Peter's crash at 50km/h, or even that it was the car's speed of 50km/h that was the cause. » The confusion made by Carnap stems from the flattening of organizational levels. For horizontal thinking, the different factors of the accident (Peter's behavior, weather, car characteristics) are part of a common system. The accident was the result of their simultaneous interaction. Causality exploded between 3 culprits or even more. Stop! The sterility of such an idea is intuitively obvious to us. It is essential to prioritize the causalities and distribute the responsibilities according to the degree of intention attached to each one.

Which brings us back to an interesting idea, evaded and always in ambush: that matter is assigned a certain degree of intention, proportional to the level of organization it attains in the considered object. But the intention is only exercised in the level in question. It is ridiculous to seek to transpose it to a distant stage, for example in human social morality. A car is not shown in court!

Both intention and causality are defined strictly in the organization plan of the elements interacting at the same level. For example, it is wrong to say that the heat of a gas is "caused" by the agitation of its molecules. This is not a causal relationship but two surimposed levels of information. It is a single fused, simultaneous state, a state that is measured in two different ways, amount of heat or average molecular agitation, the measurement itself belonging to the chosen level of organization. At this point in our investigation, we must speak of correlation and not of cause. The exclusive horizontal view assumes a strict correlation with 'cause', which leads to misunderstandings when the levels are farther apart than you might imagine, for example between neural activity and consciousness.

When the correlations are mixed with the causes, we get the impression that properties from different levels co-operate in an interaction. How then do they negotiate the result, if they are not of the same order? Mixing together several foreign and simultaneous causalities takes us out of physicalism. The causes must be prioritized. The decryption of classical causality shows that it is never monolithic, on the contrary it can be broken up ad infinitum.

Let's choose a difficult example, from psychology: Say you have to buy a water heater. What will be the cause of your choice? There are many criteria: cost, ease of installation, efficiency, sunshine (for solar), number of users, ecological concerns, aesthetics. The weight of certain criteria can be added because they are of a comparable order: practical, or psychological arguments. But how do you add those of different order? How do we choose when practical preference differs from aesthetics?

The answer is, we are not using a mathematical rule, but *celebrity* discrimination. If the fame of the aesthetic principle is higher in our mind,

it will take precedence over practical consideration. Celebrity is the weight of each solution when several are irreconcilable. It reflects a preferential organization between them, often temporary. But how to transpose this decision-making process to the physical medium?

Celebrity at the neural level is a pre-existing organization of activation patterns that, when two options are in the balance, tip over to one, even when the choice seems tricky. The result is both deterministic and unpredictable. Deterministic because any strictly identical starting situation will give the same result, unpredictable because the complexity of the organization at the origin of the choice makes its calculation impossible (the process is the calculation).

There are identical situations at the physical level. For example if a bar with an ideally symmetrical structure is compressed by two increasing forces oriented in opposite directions and ideally in its axis, it will end up bending. Why does the bend start at one point rather than another since the bar structure is ideally homogeneous? Why is this point becoming famous among the rest? Where does the break in symmetry come from? Answer: Not all covalent bonds between atoms are as equivalent as common measurements indicate. They are linked to a ballet of particles, to tiny oscillations of fields, which the measurements merge into a uniform covalent force. A smooth dressing was thrown over a grainy skin.

The comparison with mental choice is legitimate because while on the surface the balance between the options seems perfect, in reality it is not at the level of the micro-mechanisms. The property of a level, as conceptualized, is the smooth mask placed on an irregular surface. However, our analogies do not completely solve the problem of the surimposition of causalities. How do properties of different levels come together at the same time? How are top-down and bottom-up causalities intertwined? We will see that reality itself seems to favor *famous* causalities, to the point of neglecting others.

Recursive causality

Feedback is evident in all communication. The order is not to receive it, but to acknowledge receipt.

Recursive causation is a less controversial term than 'retro-causation' or 'backward causation'. All competition with classical causality is eliminated; it follows the ascending and descending paths of the organization, and takes the title of recursive in the descent. Just as causality is bidirectional in the dimensions of space and time (on a microscopic scale) so it is in the dimension of organization. The elements form the whole and the whole influences the elements in a continuous loop. To tell the truth, is there another kind of causality since all that we know is the organization of something smaller? Individuations can only be maintained through stable loops. Causality is built on top of it. Succession biting its tail. Ironically, it is the causation with most sulphurous reputation in philosophy, the circular, which founds the order of reality.

Recursive causation, basically what is it? In the simplest possible terms, it is the action of a result on the terms that produced it. How can it act in reality? A result has certain properties. In the context, these properties may or may not be ordered. By ordered, I mean here the simple persistence of the result, as local stability. Unordered, it immediately disappears. Orderly, it is maintained. Persistence is judged in relation to the elementary time of the interactions which produced it. The effect of the outcome persists as these interactions continue. The context modified by the result keeps the cycle of interactions. The stability of the system is defined by the closure of the result. Instability is the situation where interactions take a different course.

An organization level is made up of evolving elements achieving relatively similar results. These neighboring states have common properties that allow them to interact. One thing is remarkable: elements of different constitution can lead to the same kind of result / properties and participate in a common organization. The notion of level does not imply the similarity of the elements. The only requirement is to be able to recognize the information carried by others.

For example, several proteins containing different amino acid sequences can show an identical physiological role. While this role is important, all the genes encoding these various proteins are favored by natural selection,

while they are redundant. While models of the same genes making incompetent proteins are eliminated. Here we have a clear example of retro-causality: a new property has appeared: the physiological function supported by competent proteins. This emerging property, defining a higher level of organization, retro-acts on the elements that formed it, down to the genes, because its presence is ordered (made permanent) by the context.

A confusion overwhelming the discussion on emergence is that between the temporal synchronization of elements and that of their properties. The historical emergentist view considered the emergent property to be simultaneous with the association of the elements concerned. Not circular but *concurrent* causality, superimposed on direct causality: the elements create the emergent property which simultaneously influences the elements in return. The notion of initial cause is destroyed. Uncomfortable.

The researchers of the following century, on the contrary, insisted on the diachronism of emergence. We can doubt in fact that there is a single authentic case of instantaneity in the examples of emergence, I mean that is not related to the limits of our measuring instruments. This statement is important for the very understanding of the phenomenon of emergence. Simultaneity implies that the emergent property emerges from nothing like the rabbit out of the hat. It is surimposed on the existing reality without our having the slightest idea of its origin. This version of emergentism is radically incompatible with reductive physicalism.

It is quite different with diachronic emergence. Emergence only appears as a consequence of an interactional computation. It is calculated. The complexity of the operations reveals a new, more synthetic way of describing them. Validation of a new information layer. The term 'diachronic' is even too weak, because the proper times of the elements and their assembly are different. We can speak of temporal planes attached to each level of organization, surimposed but independent, where 'simultaneity' is only a correspondence between two interactive phenomena in the same subjective space of time.

Diachronic emergence is no less mysterious in origin than instantaneous emergence. Both are only modeled after they have been observed. But the first has the advantage of corresponding to a known framework of conceptual logic: algorithms can describe others, at a lower cost, when they become incalculable. This emergence is not incompatible with physicalism; it only sends us back to the mystery of mathematical metaphysics.

Emergence is not defined only by incalculability. The behavior of a level can be incalculable, chaotic, and show no emergent properties. Emergence is based on an associated recursive causality: the higher level exerts a constraint on the behavior of the lower level. The fate of an element of the lower level is influenced not only by those with whom it is directly related, but also by all those in the considered system. If a water molecule freezes in a small ice cube or an iceberg, its fate in the middle of the ocean will not be the same, even though it exercises rigorously identical interactions with its immediate neighbors. In fact, it is not possible to predict the fate of this molecule from its own characteristics, while this is possible from the characteristics of the ice cube, shape size homogeneity. In this sense it is permissible to speak of (weak) emergence when water turns into ice. It is no longer the sum of the calculations of the individual molecular shifts that predicts the position of each, but the calculation of the displacement of the sum of the molecules.

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Functionalism

The controversy concerning recursive causality is also that of functionalism: is the organ created randomly and does one discover a function for it, or does the need for the function create the organ? The answer is provided by the evolution of species: both are true, under the effect of the two associated engines of evolution, mutation and selection.

A mutation changes the genetically determined pattern in a discreet way. Butterfly effect: it can be fatal to the body. More often, the existing organization is sufficiently stable, refined, and layered for a self-rebalancing to take place. The mutant is viable, and provided with new characteristics. An organ has changed its usual function. To say it more or less efficient than before makes no sense at this point; it is the other engine, selection, that determines it. For example the dominant thesis about the human brain

is that it results from the mutation of a gene, having exploded the multiplication of neurons in the neocortex to its present impressive size. These new neurons did not appear out of necessity but by chance[21]. Can a function be found in these neurons? Yes, they interface with and extend existing networks. The schemes of excitations organize the regularities of their regularities. More elaborate conceptual levels arise. The range of behaviors widens into more and more refined solutions.

The selection then applies. If a new function creates a significant advantage, its carriers benefit and the gene spreads. In practice, mutations and the various possible genetic associations frequently create new functions and above all a great diversity of individual expressions. The environment in which this effervescence occurs selects the most suitable variants. The context enhances a function and therefore the organ that supports it. Function did not create the organ in the literal sense; but the organ is what persists after the function has selected it as the best. In the end, the mutation operates an ascending creation, the selection operates a descending creation. Recursive causality / functionalism is indeed part of the self-organizing process.

Thus recursive causality is understandable only in a concatenation. Simultaneity is fictitious. Sequences so vivid in the micromechanisms that they seem confused. Confusion due to the instrumental limits, to the process of observation itself, which is a series of merged states. By climbing the *Diversium* scale, the delays between parent and emerging properties become perceptible, until the almost lazy succession of abstract treatments represented by the thought process: the time between event and reaction becomes manifest.

Thinking is undoubtedly the most demonstrative phenomenon of the necessity of the concepts of emergence and recursive causality. If neurons only provided sequential signal processing, we would have a brain capable of responding to stimuli but no consciousness. The organism with such a brain would be a 'zombie', a robot processing incoming data with its

[21] 'Chance' can be replaced here by 'reality is exploring its possibilities', or 'the evolutionary process has launched a test', depending on the degree of intention one wants to put in Nature.

biological circuits without perceiving the existence of its own process. The emergence of the representation of one signal by another changes everything. This image modifies in return the initial signal. There appears a recognition of the origin, an access to existence validated by something else. *It is the surimposition of the signal and its representation that establishes the fragment of consciousness*. The surimposition is initially a sequence which, by incessant back and forth, ends up creating a new joint equilibrium of the states forming the representation. This surimposition has its mathematical corollary: the information of the two levels is coordinated by calculations of different order and leading to concordant results, once the mathematical language adapted to the emerging properties has been found. An algorithm represents the assembly of others.

In the philosophy of science, the heart of the problem of recursive causality, associated with emergence, is the principle of *representing*. Classically the reductionist vision considers it as entirely passive: the representation is independent of the phenomenon studied; it has no direct influence on it. Yet, obviously, our mental representations are what allow us to manipulate reality. There is indeed a recursive action of mental organization on matter. The intention that it conceals is not just an epiphenomenon since it decides, for this matter, of a destiny which is not inscribed in its particles.

The difficulty is this: if the existence of a will is clearly perceptible in the action of a human being provided with a brain, how is it constructed? Once rid of the tendency to deify human faculties, we guess this is a sophisticated version of the more modest intention of a bacterium reacting to its environment. The presence of neurons is only an added step, allowing a greater elaboration of the intention. The root of the intention is then towards the origin, hidden in the foundations of matter. Molecules associating together show an extremely crude form of intention, but it is not nonexistent.

Removing from matter any hint of intention took place at a precise moment in the history of knowledge: it was during the creation of the 'laws' which are imposed on it. Is this an explanation, or a simple resignation, or a rebellion against divine creation? Laws are in fact associated with the postulate that there is no intention behind it, or none that can be

discovered. Laws are a simple process of appropriation of the course of the world by man, who stole it from God. There were divine laws, there are now those 'discovered' by human, created by her in fact since it is still a mask placed on the world. One thing does not change: the world is deprived of intention. Arbitrary? Inconsistent even, when the only realistic explanation of our will is that it comes from the world, if we remain physicalists. A world driven by laws revolves, and no one witnesses its movement. A world making representations ends up observing itself, generating a high level conceptual organization that we call human consciousness.

The brake blocking the concept of intention, therefore, appears fundamentally cultural. To be more convinced of this, let's watch our mind signal the existence of an intention:

We tend to locate its origin in the system when the intention is complex, and in its elements when it is simple. Take the example of thermodynamic equilibrium; for a living being we say: « Human must maintain a permanent exchange of energy and resources with the environment in order to maintain herself ». The human being is a system with complex intentions; it is 'human' who owns the intention, not her organs, let alone her biomolecules. For a simpler open system, such as an oil heating on a pan, we say: « The oil molecules forming Benard cells must maintain a heat exchange with the environment for this dynamic of alternating conduction and convection to be itself maintained ». Intention shifts to molecules. It is not 'Benard's cells' that are trying to maintain themselves. Yet what fundamental difference is there with a living being, other than a complexity of intention? Why should the system as a whole, at the level of matter, be denied ownership?

We see that there is a lot of human deification left in our way of thinking, even in the scientific approach. The worry disappears thanks to the adoption of the two directions of causation, anterograde and retrograde, without simultaneity. The intention is thus distributed among the elements and the whole that they form. The ontological and teleological wills are protected. *They can come into conflict* because they are independent.

Here arises the transcendental principle which forms the framework of *Surimposium* as a general theory of reality: *conflict*. The conflict is *reproduced*, giving birth to new forms. With each of them is associated a new fragment of intention to organize it. The surimposition of such a great height of these fragments ends up creating such thrilling characteristics of human intention, elaboration and diversity.

Let's take a closer look at this conflict between ontological and teleological intentions.

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Concept < > matter

Bidirectional relationship mind <> reality. Each model-tool contains an intention of the mind towards reality (the concept) and an intention of reality towards the mind (the essence).
Both paths can coincide or miss. They exert pressure on each other. Confrontation between data borrowing the same formalism.
In fact it is a conflict within the mind, between Real and Spirit Poles, between suggested and expected visions of reality.
If the paths are missing, the concept remains suspended in its mental virtuality. It does not mobilize the material. No interaction with the essence of reality.
The reality is first. It permeates the conceptual pyramid of its model. The more the established concept brings together and assembles all the significant information, more in return it acts in a predictable way about reality.
Goings and comings between experimentation and conceptual adjustment refine the quality of the action.
The concept emancipates from reality by associating on the desires it is otherwise. Beginning of the intentional offset of the mind.
The mind never becomes an absolute master. Reality changes only if its identity is taken into account.

Simplification is an indispensable process in mind in its relationship with the real. Can not store all the information present. It brings together the most relevant in a representation adapted to each context.

The real, as a succession of organizations, is a representative process in the same way as the mind. An organization represents its own constitution.
Does the real opt for simplifications, about itself?
The mind practices two types of simplifications: the horizontal synthesis (global representation of the elements in relation) and the vertical flattening (occultation of the structure of the elements does not intervene in the relation).
The horizontal synthesis / compression does not lose information, unlike vertical compression, which occults.
The essence of the real does not lose any information. It stacks its levels of organization without canceling the previous ones, so its vertical dimension is not compressed. The newly created level, as representation / compression of the underlying data, is an information *added* to the previous ones.
The mind mime these newly created levels but can not experience them in all of their underlying structure.

Is the emergence constitutive of reality or is it a simple conceptual classification produced by our mind?
The question extends to chaos, which contains a concealed order, containing attractors rather than equilibrium.
The definition of an emergence becomes more general: recognition of an order built by the interactions of a system, obvious to our observation or concealed (for which our senses have not been designed).
In favor of a discontinuous reality in the complex dimension: our mind, conceptualizing by discontinuities, is completely integrated with such a reality. Why would it work differently at the level of matter?
In favor of a continuous reality: the mind accesses the space of the possible, larger than the real. Different modes of operation. The essence of real is perhaps continuous and only discontinuous in its modeling by the mind.
Nevertheless, this last hypothesis reintroduces a dualism which is an additional postulate compared to monism.

Can *epiphenomenism* save the hypothesis of a continuous reality while remaining monist?
It fails in front of, among other things, the argument of *multirealisability*: physical elements are interchangeable to ensure the same function, which can not be reduced to a simple appearance.
The interest of epiphenomenonism is to separate 2 categories of emerging phenomena:

1) Those intrinsically modifying the system as soon as its constitution (*autonomous* emergence).
2) Those manifesting only in a certain context (*potential* emergence), responding to the definition of epiphenomenon.

The definition of a system intrinsically contains the notion of emergence: the properties constituting the system are added those individual of the elements.
The complete determination of the system is necessary to identify the constituents. The whole is decisive for individuals.
In terms of information levels, eliminativism no longer holds: which individual microstructure could contain information from all complexity built over it?
Each level of organization is its own information.
The term 'reality' is litigation by seeking to apply it uniformly to anything.
The solution is to assign a personal reality at each self-constituted level of the real.
Which rejects the hypothesis of a continuous reality, in favor of discontinuities of the essence of reality overlastable to those of its representations in our mind.
Discontinuities are emergence, representations of the elements included, surimposed information to the elements, introducing an evaluation. Inversion of entropy. Root of intention. The self-organization is *self-observation*.

Emergentism is easily rooted in the conceptual gaps of the observer, must make its self-criticism.
Emergence is not defined by the complexity of the models.
Do not make properties of a level some new fundamental ‘laws' then spread over exaggerated.
Make the downward causality a rival of the upward exposes to circularity. They are a bidirectional continuity, with an upward start.
Eliminativism and emergentism are reconciled: define the mere additiveness of properties as the beginning of emergence puts it on the threshold of eliminativism. Relating an eliminativist result for the stability of the context brings it to the threshold of emergentism.

« What you do is your reality » (Tryo song)

Regarding the mind/reality mismatch, I insist: the conflict is not between the mind and the *essence* of the real. The first does not accede directly to the second. It manipulates first through representations of 'proximity': motor patterns controlling body movements. Secondly, it uses more 'foreign' models, abstractions on which its instruments are based, directly in contact with a specific part of matter. These intermediate tools should be seen as hierarchical entities, whose surimposed levels allow the translation of one aspect of reality into the language of another level. Here is sought the strict correlation of the modifications between levels. Their relative independence is a drawback to be minimized. It distorts the translation and makes the instrument less precise.

I have called 'Real pole' these mental models representing the essence of reality. The conflict we are concerned with is within the mind, between the Real and Spirit poles. What I have called the 'Spirit pole' brings together the most identifiable mental elements: generated directly by the body, biography, dominant persona, present and future self-images.

Every model tool used in the mind to represent reality is bidirectional. It transmits an intention from the Spirit pole to the Real (called an 'idea') and an intention from the Real pole to the Spirit (called 'objective reality'). These two directions can take the same path, or miss themselves (with a large number of intermediate results). In the event that the intentions meet on a neighboring path, they exert pressure on each other, each with its own power: idea constraining reality and reality constraining idea. Both are information encoded by neural networks. It is in this sense that they can directly connect. Confrontation is possible between representations using the same formalism.

In order for the idea to mobilize objective reality, the latter must first be imprinted on the conceptual pyramid. In other words, the mind must first receive the adequate concept, integrate it into the Real pole. Its structure must be able to accommodate it. If an erroneous or approximate concept is formed, the chances are low that the idea will later act on reality. The first direction is therefore an influence of reality on the concept. It is the intention of reality that originally passes through the mind and is

rearranged there with other, contradictory ones. The resulting organization gradually builds the independent identity of the mind.

Settling the quarrel for the primacy of the mind or the real is easy: remember that the mind is born equipped with a summary conceptual baggage, a few instincts installed by evolution in the species, and that most of the phenomena experienced by the adult brain comes from contact with its congeners. The cycle of mental enrichment also stops with aging and individual death, and leaves only written traces. The same instincts remain the initial baggage of the next generation. The disappearance of culture would take humanity back to the Stone Age. Perhaps some vague echoes would survive in the genetic heritage? Do not believe the consciousness preinstalled under the skull as the muscles have been attached to the bones, and that it could thus apprehend the real independently. The mind does not spontaneously capture images as the hand closes over an apple to pick it. « I » forget my debut and that's how I convince myself of my total freedom. But my progenitor is the real. « I » am only shifting away from it, and it is a necessity for my intention to exist.

As soon as it is imbued with the mind, a concept can be related to others, placed within a stable pattern, to become intention. This uses the cascade of interactions already known to influence matter in return. It may use intermediate instruments (ranging from a simple manual gesture to the implementation of a nuclear accelerator), the structure of which combines the new concept created with the underlying pyramid, like the target material. This similarity in structure makes action possible. The matter changes. The concept, in this second, intentional direction, exerted its power over reality.

In the end, the two directions of the relationship between concept/intention (Spirit pole) and concept/image (Real pole) form an exchange: initially it is the first which is modified, then in return the second. We summarize both in "I learn" and then "I act". However, these terms lack clarity. They do not provide information on the reasons for one or the other's failure. Note: reality is the engraver as long as there is not already an established representation to dialogue with his appearance in the moment. It inscribes an image that is still fragile, in the state of potentiality

in neural networks. Secondly, the repetition of the same appearance consolidates the autonomy of the new image. It forges its bonds with others. It becomes 'real' enough to mobilize the locomotor means of the mind; it becomes 'operative'. Its effectiveness decides its survival. There is a 'natural selection of species' for concepts as in all diversification processes.

In practice, many round trips are usual to harmonize the mental and material structures until the faithful and systematic 'obedience' of the second. Does the slave mind of the beginning end up dominating the master matter? The teacher only accepts change while respecting its own identity. Rather, the mind generates an 'enriched return to sender'. Influence is constantly two-way. « I'll change you if you say yes ».

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Simplification

To deepen our investigation it is important to consider separately each of the real <> mental directions. Do they respect the same principles? Is the information organized in the same way going up / down in these two directions?

Let us start from the meaning of 'mind considering reality'. Faced with the information overload encountered, the mind uses the *principle of simplification*. To simplify is to determine the elements of a system whose presence can be neglected without seriously affecting the validity of the model annexed to the system, which is supposed to predict its evolution. Is simplification only a necessity of the mind, or is it present in the essence of the real itself? Is it the exclusive mark of spirit > real or does it exist in the other direction? *Does reality also simplify existence*?

The need for the spirit of simplification is certain. Impossible to represent *the whole* structure of reality, from its tiniest identified micro-mechanisms. Impossible to calculate reality as it is calculated, since *it is the calculator* and we are only a tiny fraction of it. Even though it is redundant, even compressing it losslessly within algorithms, it remains inaccessible to us.

However, is simplification the prerogative of the human mind? A priori, it is only valid because reality itself operates a pruning. Some of its calculations have a negligible influence on the others, separated by several

orders of magnitude. And above all, the appearance of an additional level of organization erases approximations. This is what happens in a system that loops on itself: stability defines its own time, with new properties. A higher level of information has formed, and is maintained despite the turmoil in the underlying interactions. It is the negation of its diversity. Realistic approximation. *Reality has indeed operated a simplification*.

Thus we observe the influence of laws at a fundamental level diminish as reality adds additional organizations, until, for example, heat exchange becomes a law manipulated at will by a consciousness that lights or extinguishes a stove, regardless of any discernible intention among the atoms of the cast iron involved.

Reality is an organizing process; its progress is punctuated by multiple simplifications, which are organizational crossings. Therefore the mental process can try to mimic it, and get 'right', that is to say take the same path as the intention of the real in its process of organization. If it is mistaken, that the simplification operated by the concept is false, that means that the factors retracted were ultimately not so negligible, that is to say that the mind operated a simplification not consistent with that of the real. This does not imply that the *principle* of simplification is wrong. Experience shows that it is perfectly 'natural'.

However, certain simplification methods are not used by reality. Only the mind practices them. Most common and easy method: ignore the vertical dimension of reality. Flatten it. Align its components. Do a 360 ° on yourself, and forget that the camera is neither the spirit nor the real, only an instrument. The Real pole is not 'objective'; it is a mixture in perpetual reshuffling between a mind clinging to its concepts of identity and an essence of reality which bends only in its own identity. Flattening it horizontally is a welcome facility for resting our neurons hungry for expensive glucose, yet it does generate errors. In two ways: either the spirit uses a layered concept but obliterates certain levels; or it uses the paradigm from one level to another, where it no longer operates with the same influence. Sometimes it is even radically different, and the mind is fooled by the similarity of local relationships. It imitates a known principle that is not the right one.

Small thought experiment as an example: A man who grew up in a primitive tribe finds himself for the first time in a civilized city. He observes the behavior of people on the street. Some get into a car, and after a few seconds, the car miraculously moves and cuts into the traffic. The primitive does not see the detail of the gestures made. He suddenly feels the urge to move like these people. He opens a car door and gets behind the wheel. He waits, very disappointed that it does not start spontaneously…

Its conceptual staging is too short. The one who triggers the miracle is more fleshed out. 'Starting a car' fits into the middle of a pile of knowledge: downwards it can go down to the details of automobile mechanics, fuel combustion, even the molecular reactions involved. Upwards it goes through the consequences of our way of driving, the general principles of traffic, the social utility of this mode of travel. Usually, there is no need to use the entire stack. All you need is the 'user controls' markers and the traffic rules to get to your destination. Of course, in the event of an engine failure, the driver with the 'auto mechanics' floors of the pile has a better chance of performing the miracle / starting the car.

Our mind learns by mimicry. Horizontal thinking is a library of these fragments of knowledge spontaneously called upon when the context arises. By observing a driver more closely, the primitive can acquire the mimicry needed to move the car forward. Horizontal thinking has obvious and immediate payoffs. It breaks down the agglomerated information into elements. Reality becomes a mosaic of elements identified by their regularities, a beginning and an end, both in spatial (location) and temporal (duration) dimensions. It does not matter that each element has a hidden structure, horizontal thinking identifies it by its properties at the level where it needs them to associate its representation with others.

Simplification is therefore an intellectually judicious and necessary process. The mind squeezes environmental data into 'pieces'. Horizontal thinking takes hold of them and applies rules to them. Sufficiently stereotypical, they become 'laws'. The organizational dimension of reality is divided into its different levels and a discipline of horizontal thinking attacks each of them. The mind places its labels.

How, in the other direction, did this dimension come to be? The thesis of *Surimposium* is that the real exercises the same type of simplification as the mind to form its levels of existence. Compression *surimposed on data* and not replacing it. The lower levels are maintained, necessary for the integral essence of reality. No information is lost.

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Ontological emergence?

But maybe it's my personal Real pole racing a bit fast, mistaking itself for the essence of reality but actually seeking to reproduce itself in your mind, dear reader? Let's let go of the previous convictions and float for a moment in the neutral space between spirit and reality. Let us return to this crucial question: Is emergence constitutive of reality or is it a simple conceptual classification exercised by our mind?

A priori, the real seems to function in a fluid manner, without rupture caused by the appearance of an emerging property. What seems brutal to us is only a faster transition between states with very different properties. Certain emergencies radically transform reality in our eyes, but does reality itself experience such a shift? Even the sciences of complexity discover, calculate, model, without the concept of emergence intervening directly. There is no generalizable mathematical translation of an emergence. The notion of chaos describes pseudo-random systems on which we run statistical or algorithmic models, but does nothing in itself to predict the behavior of the systems. Emergence and chaos are pragmatic frameworks that allow us to prefer one mode of analysis over another. We know that it is useless to look for a simple deterministic equation to describe a chaos. An algorithmic automaton with unpredictable development will better simulate its behavior. We replace a finite computation by a perpetual computation, the characterization of an equilibrium by the simulation of a dynamic.

Chaos is a special variety of emergence. Unlike the familiar, obvious emergences, chaos contains a hidden order, sometimes revealed only by geometric figures. Here the order only appears by performing the measurements in a certain way, with certain time intervals and by selecting

the relevant criteria. Could any chaotic system be described by sufficiently increasing the number of dimensions of the model? Possible speculation.

The definition of an emergence, then, becomes more general: it is the recognition of an order constructed by the interactions of the elements of a system, sometimes immediately obvious to our senses because they are 'set' to make it appear (morphological regularities, luminous or colored, thermal…), sometimes concealed and only obvious for complex and multi-dimensional analysis tools. Trivialization of emergence. Its definition merges in this case with that of a set of interactions, without further requirements. Everything interacts and, the result never being truly random, produces an emergent order. The residual interest of the notion of emergence is to have twisted its neck to that of chance, by having shown straight away that apparently random interactions in fact conceal a descriptible order: emergent properties. Our senses have been designed to easily recognize the most useful (in the context of our evolutionary history). If the environment had been more chaotic, perhaps we would have developed senses that allow us to directly discover strange attractors, without the need to interpose a conceptual edifice. But nature contains enough ordered systems for our present senses to have been shown to be effective.

The recognition of emergences is indeed a faculty of classification belonging to our conceptual edifice, itself organized in this way. Our mind starts from a plane of reality and expands through the successive models it establishes about its own representations. So does reality fundamentally have the same discontinuous, stratified order, where is it only the Real pole, its model in our mind?

Let's not decide the issue at the outset. Recall that it is impossible to access the essence of reality. At this point, two powerful arguments clash:

1) In favor of stratified reality: the fact that our mind is in essence a continuation of reality. No break between the structure of matter and the structure of mind, as we saw in *Stratium*. The mind is a conceptual stack that extends, from the physical neural support, the stack of material organization, without identified radical transition. We have good reason to

suppose that the entire structure of reality is layered, as is our mind, the only part whose essence is truly accessible to us.

2) In favor of a continuous reality: the fact that all discontinuities correspond to *interpretations*. Reality seems one, unperturbed, a block where only our minds do the accounting, and no certainty that these accounts are necessary. Reality is all information, not how it unfolds. It may be endlessly pointillist and so only the mind defines information in it, like points on a line, but these have no real existence.

This second posture implies a dualism, a major paradigm transition between real and virtual. Because our mind designs alternative information plans to reality. Real and virtual would then be two separate continuums. The functional structure of the mind, anchored in the virtual, dissociates itself from the structure of the real. The latter, independent, can do without organizational discontinuities even if our mind likes to lend them to it.

Unfortunately for 'continuing reality', dualism is an almost crippling flaw. Our investigation seeks to encumber itself with a minimum of postulates and dualism is a major one. Let us not consider it as the counterpart of the alternative postulate of monism. It's wrong. Dualism divides reality without substantiating experience, while monism does not perform any such operation.

Nevertheless, for the 'continuous reality' hypothesis there is a classic way of escaping dualism and returning to a monist eliminativism: it is epiphenomenism, where mental phenomena are denigrated all causal properties, and therefore all reality (« what is causal is real »). Let's take a closer look.

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Epiphenomenism

The reverse conception of emergence is epiphenomenism, which considers the properties of a whole as a mere 'appearance' of the functioning of the parts, not participating in them at all. Eliminativism alone cannot compete with emergentism. Indeed, it superbly ignores the presence of any properties at all. To this must be added epiphenomenism for a full explanation of reality. While emergentism does this by superimposing

different levels of causality. Can the eliminativism associated with epiphenomenism compete with emergentism? Is epiphenomenism logically tenable?

Its most famous and disputed use is this: it does not matter whether mental properties are superimposed on neural activity, they can be reduced to the mechanisms of neural activity and their consideration does not add anything to the understanding of the world.

If we state a more general form of epiphenomenism, it becomes: regardless of the existence of an emergent property, it can be reduced to the mechanisms of the underlying elements and their taking into account does not contribute anything to the understanding. For example, the spatial conformation of a molecule and the properties it determines is of little interest in chemistry or biology since it can ultimately be reduced to the interactions of their elementary particles. All the sciences are collapsing except physics, and again: how can we affirm that the so-called fundamental forces are not properties emerging from other laws still inaccessible to our instruments? Terrible peak in unemployment to be feared among researchers.

Additional problem posed by epiphenomenism: if we witness the same epiphenomenon from different element systems, it is a coincidence and it will not coordinate the fate of the systems, since it is not causal. For example, consider the following two systems: the brain neurons of a human and the electronic circuits of a calculator. Let's make them perform a simple operation, 2 + 2.

At first glance, human and calculator are described by the same quantum laws. But the interactions of their particles result in different configurations. Macroscopically the contrast is frank: on one side we have the human, a bag full of soft organs, liquids, and pierced with various orifices, some gaping and lippus, two others occupied by a moving, shiny, curious globe. . One of the holes ends up slowly speaking out the result of the operation using coded sound waves. On the other side we have the calculator, a block of rigid materials, where the only circulation is that of electronic charges, and whose orifices are geometrically aligned and occupied by depressible

keys. It instantly announces the result using coded refractions of liquid crystals. On top of these surprisingly alien appearances, a strictly identical epiphenomenon occurred: 2 was added to 2 to produce a 4 (assuming the soft organ bag went to school).

More amazingly, one of the calculators was built by the other. The organ bag miraculously managed to seize materials much stronger than itself and create a fate for them they were not prepared for. One collection of particles began to manipulate the other to change its configuration. Here is yet another major problem with epiphenomenism: it does not allow the slightest ersatz *intention*. Neither can elementary particles, according to the reductionist view. The only causality is that of the fundamental forces. How do these forces establish the identity between the two epiphenomena of the mental states of the individual and of the computer, with their common consequences? By a simple superposition of appearances?

Epiphenomenism has nothing of an explanation; it's a sweep. Observation cleaned of its inexplicable elements. The process has a certain usefulness: it makes it possible to concentrate on one level of information independently of the others. It clarifies the process of separation of organizational levels. But if we make it an explanatory principle, it destroys our understanding of the world rather than reinforces it. By abandoning the notions of emergence and superimposition of information, the universe becomes an immense bath of particles differing only by their interactions, a vision which annihilates all intention apart from this stupid agitation. The terribly narrow residual significance is again shattered the day a finer foundation is discovered. Wanting to reduce the universe to its micro-mechanisms makes it ghostly. It is an authentic nihilism that is ignored. We seek to escape it with this *Surimposium*, a concept of a self-meaning reality.

Is it a negation of epiphenomena? No. They exist, of course, as regularities apparent to an observer. This is already enough to endow them with indirect causality. Property without effect on the thing itself but on what surrounds it. Contextual emergence. Which leads us to define 2 categories of emerging phenomena: 1) Those which immediately and intrinsically modify the behavior of the elements of the system (the simple constitution of the system creates the modifications). 2) Those that will only manifest in

a certain context (the emerging phenomenon only appears when the system reacts with something else).

Let us call the case (1) 'autonomous' or autopoietic emergence. The behavior of the elements facilitates and perpetuates the integrity of the system. 'Autopoiesis' relates more specifically to living entities: the clearest examples of complex systems that perpetuate themselves. Here we do not separate alive and inert. Sometimes the emergent property is, on the contrary, self-destructive. Molecules quietly neighboring at a certain concentration form an explosive mixture at another. The 'detonation' property terminates the system. Intrinsic instability.

Case (2), a 'potential' emergence, is less obvious. It is not visible to the isolated system. This reveals its properties as an individuality of a new whole. Its intention is latent.

All organized systems have a potential emergence, a latent intention based on their structure. Intrinsic stability. Some also acquire stability through their role in an overlying organization, their participation in the whole. Extrinsic stability. These systems deserve the title 'autonomous emergencies' because the presence of the environment increases their complexity rather than freezing it. They are also more fragile. The most complex entities form active retrocontrols on the underlying levels, which keep their instability in a low threat range. A stone is an example of potential emergence; its bellicose intentions are only revealed if it is falling on your foot. On the contrary, a human being is agitated by autonomous emergences: intentions which, sufficiently lively, make her withdraw her foot in time!

With the mental-calculator rapprochement we have planted on the back of epiphenomenism a banderilla which is called *the argument of multirealizability*: the same property or function can relate to physically very different objects. The most classic example is money, which can be represented by coins, a note, a precious metal, bits stored in an electronic memory. Examples independent of the human mind exist in the self-organization of living things; evolution has produced multiple ways of moving: crawling, limbs, fins, wings, various organs united under the term

'locomotors', providing common functions: interaction, flight, dispersion. Multirealizability is the basis of the presence of a level of information surimposed on different systems capable of producing it. This level cannot be considered as a simple epiphenomenon when it is selected by its environment. Its relative independence gives it a reality of its own.

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Emergence founded in the very notion of a system?

The notion of 'system' is at the root of reductionism. But does it not already contain that of emergence? Let's take a closer look at this disturbing question:

A system is a group of elements that interact in a particular way within a larger whole called an environment. The largest known system is the universe. The ultimate framework of systems is the possibilities. The particular way in which the elements of the system interact can be ordered or (seemingly) random. A system is generally built on the spatial proximity of its elements. This closeness involves relational strengths at close range. It can also result from compartmentalization, or isolation. The existence of the system is reinforced by the concentration of the elements, which multiplies their interactions.

A system intrinsically contains an emergence in this: to the properties of the elements taken individually are added the properties as *constitutive* elements of the system. A third group of properties has also appeared between the two: these are the individual attitudes of the elements *towards* the system. Everyone's reaction is not necessarily the same. Obviously for a human being placed in a social system. But it is also true, more subtly, for an atom in a crystal lattice: an atom located at the limit of this network does not have the same relations with the whole as another located in the middle. The forces to which they are subjected differ. The boundary atom is more likely to leave the system than the center atom.

The overall properties of the system are *surimposed* on the elements. Let us take a very banal example of matter: a rock. For a given atomic element of the rock, the motion is no longer determined by its individual mass but by the mass of all the atoms to which it is firmly connected. This global mass is in no way reliable to the individual interactive properties of the atom

considered: such interactions are directly causal by the bonds with the neighboring atoms, but not for the distant atoms. The chain of interactions is involved. The overall mass is therefore dependent on the number of atoms, which is a characteristic of the system and no longer of the atoms themselves. The reality of the system manifests itself independently, by the appearance of information not included in the individual elements.

Likewise, the shape of the rock is independent of that of the atoms. We cannot calculate the spatial characteristics of the rock from those of its atomic elements. Here the additional information required is more complex. Simply adding the number of atoms, as for mass, is not enough. It is necessary to know the totality of the interactions of each element with the whole (what we have defined as the third group of properties) to precisely determine the spatial characteristics of the rock.

For the sake of simplicity, let us be satisfied with these two properties of the rock, mass and shape, independent of those of its individual atoms and surimposed on them. The downward causality of the properties of the whole on its elements translates as follows: a tiny rock does not roll on a slope like a huge rock. The shape also has a determining influence: the atoms of an outgrowth of the rock can separate from the others during an impact and lead the new life of a pebble. Downward causation is no more limited by strict barriers than upward causation: it can come from very high up the organizational ladder. For example, the fact that the rock has a sharp edge can make it grabbed by a hand of the genus Homo and use it to sever the tendon of a freshly slaughtered animal. The fate of the atoms of the rock in contact with those of the biological molecules of the tendon then comes from a causality very far removed from the individual properties of these atoms, and yet these properties are found at work in the detail of the interaction during the chopped off. This astonishing entanglement of downward and upward causalities is the principle of surimposition.

We see here that there is no need to ascend to consciousness to perceive the phenomenon of emergence. There is already a property in the form of the rock that is not simply additive, the ‘cutting’ property being opposed to the ‘non-cutting’ property. It is not described by the characteristics of the atoms of the rock. It's not just in the eye of the beholder or the user: any

interaction of the cutting edge with softer material will sever the latter, whether there is a hand to maneuver the rock or not.

Each level of organization is thus characterized by the appearance of a *real*, causal property in the interactions of both the organized level and the adjacent levels. The properties of a level are all potentially of upward and downward causation. The formation of a micelle, at the biological level, defines the criteria 'in' and 'out'. The binding of several purine bases, in a DNA helix, defines a complex genetic language.

Thinking in terms of levels of information, we see that it is no longer possible to support eliminativism: where would these extra levels of information be stored? In the structure of the fundamental elements? We have just seen that it is impossible. It only exists in their relationships. How could fundamental information include that of their relationship to an entire universe, for forces of infinite range? The temporal dimension cannot suffice. It only stores the successive states of the individual elements, not the additional information that arises from their relationships. This requires creating an *organizational dimension*. Dimension made up of information levels. Each of them surimposes their own essence on the previous ones to form the *experienced* reality.

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Reality divided into levels of existence

Let us return for a moment to the problem of the *reality* of a property. This attribution is a source of endless litigation because of a summary premise: we seek to attribute or deny the same reality to all things. Classic but untenable. Take the example of a thought: it is surimposed on a neural interaction but is not *described as a concept* by the interaction. Its only material manifestation being the neural interaction, we cannot attribute to both the same 'reality' without obscuring one of the two. And it is not limited to the mind. Physics shows a macroscopic reality very different from quantum reality, to the point that it has to build empirical bridges to tie them together. These are two separate and yet inseparable realities.

Solving these problems is possible *by attributing a personal reality to each level of self-constitution of the real*. This shift in perspective is made easier by experiencing the different conscious levels of reality in which our brains

roam. Each one constructs a domain of our mental activity: daily life, perspectives, representations. A religious contains a mystical paradigm observing the world; a paleontologist contains an evolutionary paradigm; a physicist contains a quantum paradigm. Each is a pragmatic polyphrenic who commonly uses these paradigms and others, disconnected or even contradictory, adapted to different aspects of everyday life. For each one, one is more famous than all the others, identity, elected as 'fundamental'. Fundamental? Here is the heart of arbitrariness, in a reality without base or summit, without origin or end. What should we say the most fundamental about the human being, her thought or the movement of her atoms? Our beloved paradigm rushes to answer, while whoever observes them all keeps a neutral silence. Then, with haste subsiding, she makes this omnivalent response: each level of reality has its fundamentals. Looking for the universal? Personal identity comes first. The universal succeeds in appearing when paradigms are stripped of their 'importance' and placed in their dedicated levels of reality. Nothing *matters* to the universal. Everything brings it *matter*.

Our rock example shows that the simple addition of properties such as mass and space occupancy is enough to create emergent properties. No need for a system of new and complex equations to characterize an emergence. The simplest operations are enough. Essential before tackling mathematical formalism.

Can we say that the appearance of an emergence is correlated with a greater mathematical complexity of the system considered? A priori no. It simply appears a new layer of information, describable by an additional mathematical model, surimposed on the previous algorithms. From the inside of mathematics, there is no model that is more complex than another. A language naturally self-defines. It's not complex on its own. At a very high level of organization such as human consciousness, most behaviors are described with very simple formalism. The function 'to put on one's shoes' is written: 2 (shoes) [to put on] 2 (feet). Yet the detail of the operation, in terms of neurological coordination and the thousands of muscle fibers involved, is extremely complex.

Complexity, thus, rather describes a difficulty in mimicking the formalism of the real with the conceptual edifice that is our mind. It is the transposition that is difficult. *Experienced* concepts are used 'naturally', without the need for such transposition. Isn't it amazing, in a way, that we need extremely difficult mathematics to model the behavior of particles, tiny stupid entities that experience these equations as 'natural', while very simple human behavior, such as 'putting on a pair of shoes' is unimaginably complex from the point of view of the same particles, and perfectly simple for consciousness? Complexity to put into perspective.

But the *complication* of the text is undoubtedly perfectly felt by your mind. Let's relieve the pressure on your memory a little by taking stock of our investigation:

We now know that emergence is an intrinsic feature of the order. Initial states form an order-result. It is a succession of information in the time dimension, but an surimposition in the organizational dimension, because the structure of the initial elements has not disappeared. So emergence already exists in atoms assembling into molecules. That we can explain this assembly does not contradict this principle. However, our explanation comes a posteriori. The reductionist direction does not make it possible to predict the assemblies before having observed them. The predictions made by a theory about the unobserved remain within the same level of organization. They cannot be extended to emerging phenomena, since it is information not present in the initial states. The universe is self-calculating 'in real time'.

The principle of emergence is deeply rooted in reality and defines organizational levels there. As a result, the 'weak' and 'strong' categories of emergence become obsolete. It is quantifiable more precisely, from the emergence-unit, defined as the creation of an organized level surimposed on its elements. A single unit makes the weakest emergence. The surimposition of several units makes it 'strong' for the observer, who tends to flatten the intermediate levels (she does not always know them) and finds a correlation between two phenomena very foreign to each other. This is the case between consciousness and neural excitations. Thus, seeing a strong emergence simply indicates the presence of several intermediate

levels hidden between the phenomena. This is an admission of ignorance, but it does not detract from the reality of emergence.

At the same time, we are led to reject the hypothesis of an entirely continuous reality, in favor of discontinuities in the organizational dimension. This discontinuity exists both in the essence of the real and in its representations within the Real pole. This is how we remain monist. The organizations of the real and the Real pole are similar, the second mirror of the first, both included in a single reality. Discontinuities define levels of reality, which are self-delineated sets of information. Self-delineation is a simplification: the rest of the reality is considered 'negligible' within this set.

Real and virtual are intertwined. Each 'real' level is also a 'virtual' representation of the underlying. A level defines its reality as this information surimposed on the elements that formed it, and which in turn influences their behavior. The virtual does indeed exert a causality. The faculty of representation does not begin at the neuron. It exists within the whole of self-organized reality.

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Good use of emergentism

We have just escaped emergentism from its main criticism, which is that of belonging only to the observer. Admittedly, seeing a strong emergence corresponds well to blindness on the part of the observer, but this is no longer the disavowal of *ontological* emergentism. The observer is reintegrated into a monistic reality, which functions identically. To say a strong emergence is pragmatic: it is not to *break* the chain of causalities but to *note* that the chain of causality is broken, because of missing organizational links. There is thus a good use of emergentism:

Emergence should not be defined by the complexity of the model. Example: Whether it is a simple addition of masses or more detailed calculations determining the volume of a set of molecules, the result is perfectly calculable and predictable. There is no reason to deify complex operations and view them as causality of another nature. Whether you add the masses or have difficulty establishing the overall shape of an assembly of molecules, the properties of the whole are indeed different from the simple

juxtaposition of the individual properties of the elements. There does appear to be an emergence, but it is not based on the complexity of the model. Emergence is only relative independence. It judges itself within the organizations that surround it. It is futile to consider an emerging property in isolation. When the addition of masses produces a large or small volume body, its rate of fall in air is different, while the weight is the same. Additive organization has created an emergent property in a system where the body falls, not if it is motionless. Emergence is *contextual*. Its reduction to 'fundamental' properties is impossible.

A frequent error in emergentism is to sanctify the properties of a level in order to make them initial rules, a primum movens. In doing so, the emergentist falls back into the same trap of 'fundamental' laws as the reductionist. For example, this means that biological evolution 'requires' genetic variability, to test all viable species. It is the opposite: genetic diversity has led to biological evolution, and natural selection is its retrocontrol. There are no fundamental laws, only more rigid rules in the less complex levels, because their weaker diversity of elements does not allow the coexistence of different rules. Laws are the solutions preferred by the universe in the successive stages of its self-organization.

In both emergent and reductionist thinking, downward causation tends to be seen as a rival to the upward, and one is preeminent. Celebrity of intention or micromechanisms. Two forces fight to dominate each other. Circular causality that ends in equilibrium. This vision does not explain the progress of the organization. A self-organized system is not causally circular, it is a dynamic spiral. It adds one information plan to the other, does not oppose the previous one. Conflict builds the organization and not the contrary. The upward and downward causalities are a concatenation before being an intricacy that is difficult to disentangle. An intention is understandable only in its conception. Downward causality is gaining its independence, but has been given birth. An upward causality, too, has been (and still is) downward, brought into the world before it can give birth. A chain of parents and children, which the proper sense of our conceptual edifice, steeped in causality, forces us to read in the upward direction. This is how we give this one the preeminence of the origin.

Reductionism and emergentism are thus reconciled: defining the simple additivity of properties as the beginning of an emergence puts it at the doorstep of reductionism. Relativizing a reductionist result to contextual stability brings it to the doorstep of emergentism.

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Synthesis

What more have we found in this chapter? We started with the organization: a sequence of interactions modifying the relationships of the participating elements, in particular their location, with the appearance of regularities. The whole is an original spatiotemporal configuration, indistinguishable from the constituent elements taken independently.

The crossing of a level of organization, *emergence*, is thus the appearance of a spatial and temporal 'occupation' specific to the whole. The new spatial occupation is called 'form', the new temporal occupation is 'dynamics' or 'unfolding'. The organized entity has fuzzy 'limits', decided jointly with the environment. Limits endowed with thickness, better rendered in the term of 'fringes'. The entity still exerts its presence there as it interacts with other entities of the same order, an order based on common 'properties'. This extension of the entity varies extremely. For example, the fringe related to the gravitational influence of the entity is spatially infinite, while for the strong interaction it is extremely short.

It is more appropriate to speak of an *attractor* to define this level of organization of the entity. Attractor whose influence collapses suddenly or slowly with distance, creating a more or less wide fringe around its existence.

The form and dynamics of the organized entity exert retrocontrol on its constituents. 'Screen' on the individual organization. The self-organized edifice gains stability through the existence of this backward control, as if each additional level were to 'sediment' the previous one.

It is possible a posteriori to follow the chain of interactions that produced a shape. Delighted, the mind baptizes it 'law'. However, how can we be sure

that this is the only possible organizational solution? As one climbs the complex dimension, the diversity of solutions becomes evident. Even at the tiniest level, field excitations can organize themselves into different particles. It is because the context that compels them to do so seems formally simple and tyrannical to us that we give up talking about 'choice'.

This is the most important point in understanding the notion of emergence. Its appearance differs for our mind, for the emerging level, for its constituent elements. The mind classifies things by reference to itself. It does not attribute the same level of complexity to the assembly of atoms into solids, the formation of biomolecules, the code carried by a DNA, etc. This attribution depends on the bricks available to the mind to build its model. Are they simple numbers? Are they elements themselves decomposable?

Going down the *Diversium*, the self-organized reality, the bricks become simple and fewer in number. The levels lose in complexity, the models of the mind gain in rigor. The unexpected associated with the notion of emergence collapses. The model acquires the status of evidence in knowledge. It becomes *part of* the modeling mind and no longer just a modeling tool. It becomes *fundamental*.

The emerging level sees itself only in one possible way: by experiencing itself. This is how the consciousness of the mind, a fusional emergence, experiences itself with a quality different from any other concept, from any other content that would reduce it. The conscious experience, the *qualia*, is unique and ultimately 'simple'.

The point of view is different in the interacting elements. Each has a part of the property of its destiny, and a part belongs to the whole of the assembled elements. For each element, the emerging level is the entire universe, the ultimate whole of which it can only experience a part: itself. This inaccessible complexity is ontologically the same for each level of interaction. Without doubt, it is in this constant that we must seek the transcendent principle of emergence.

The principle of emergence is now correctly surrounded: it is perfectly justified from an *epistemic* point of view. Our minds need it to cut out and appropriate models of reality. Eliminativism is not tenable, in particular because it must be associated with epiphenomenism, a tool of exclusion and not of explanation of phenomena.

But this does not imply that emergence is also ontological. This is just a guess. Reality is one. How to know if these ruptures belong to it? Our best argument is that the mind is part of it and that it organizes itself as conceptual emergencies *within* reality. This shows the existence of ontological emergencies, simply by no longer seeing the mind as an extremity but as a *content* of reality.

What is remarkable is that we can also do the reverse: consider reality no longer as an end but as content of the mind. How is it possible ? Remember our prelude: it is in the *overall essence of reality* that the mind is content, while it is in the mind that the *Real pole*, mask of reality, is content.

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Interlude

There are indeed two causalities. For the upward look, there is an ontological causality, based on processes. For the downward look, there is an epistemic causality, based on representation. The two causalities are just as obvious to their respective looks, and just as disparaging to the opposite look. Let us bring the two views closer to their common subject. On the one hand the upward look sees an organization, on the other the downward look sees a retro-organization, or retro-control. The solipsist denigrates that there is an organization other than that of her own mind. The reductionist denigrates a retro-organization independent of the organization, which in her eyes would be an impossible top-down causation.

However, there are many examples of retro-organization. They are ubiquitous in mental processes. Conscious levels retro-control more basic levels such as motor coordination to satisfy an intention. Epigenetics is also a reverse organization. Certain abilities of the individual retro-control their genome.

If eliminativism has taken hold so widely in scientific culture, it is for historical reasons and for approximation. The historical reason: the success of Darwinism over Lamarckism has been considered without appeal. The minds of scientists have been deeply tattooed by this. It was no longer possible to pass on to our descendants any intentions other than those of our genes. Decapitation of downward causation. Today we know that there is some Lamarckism in evolution through epigenetics. But that doesn't dissolve eliminativism quickly, nor does awareness of a neurosis instantly evacuate it. Science and the mind of the scientist are different spaces.

Classical science liked to solve problems; to be fuzzy is a recent whim. It has cut too sharply between Darwinism and Lamarckism, as well as between organization and retro-organization, because their effects are of a very different magnitude. Seeking their independence requires comparing them; in comparison the first largely dominates the second. Models are approximations; but those who neglect retro-organization are generally excellent approximations. The effects of retro-organization are subtle,

difficult to perceive in the fearless march of the organization. Negligible for the upward look, which attributes them to the imprecision of the measurement. The interacting elements do not harbor any of this retro-organization. It is only apparent for the whole that they form. The soldiers do not know the intentions of the leadership. Their life is changing, they don't know the upper reason.

Comparing organization and retro-organization in terms of *power* is a bad angle of analysis. They are intimately interdependent. The retro-organization has no meaning without the organization, which is constitutive. Organization inevitably leads to retro-organization, which stems from the superior stability of certain solutions, of an order visible only to the downward look. Retro-controlled organizations do not carry any superiority or will in themselves. They are more persistent, more prone to reproduce. This stubbornness has earned them, at the highest levels of complexity, the title of *intentions*. An intention is not something that makes the world spin. It slowly influences its course. It has no possible existence without a world already spinning.

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5
Third foundation
Emergence ontology

In the previous chapter, we could not conclude on the ontological reality of emergence for a simple reason, to be constantly remembered: the essence of reality is inaccessible. It is possible that the continuous / discontinuous opposition only makes sense to our minds, designed to contrast reality in order to capture it. Perhaps everything that is individualized, elements, numbers, landmarks, are they only hollows and bumps of a continuous essence?

This type of question is asked by the Spirit pole, which is self-observing under the pressure of the Real. The Spirit pole was featured in the previous chapter, to the point that its endless philosophical ruminations may have bored you. Let us now let the Real pole exercise its rigor, to reduce our uncertainties on the continuity of causality. What does reality per se tell us about emergence, through models of the Real pole? In other words: *by what mechanisms is reality likely to create a break in causality and form an emergence*?

We will talk about three categories of mechanisms:
1) Ontological causality breaks: critical phases, symmetry breaks, topological defects.
2) Ontological approximations: statistical thermodynamics, quantum state, renormalization, time scale.
3) Mechanisms hidden in terms: diachronism, emergence in the spatio-temporal framework.

But before that I must consolidate a peremptory postulate, and it is not trivial: I forced you to accept nothing less than *the existence of a new physical dimension*: that of complexity, which is the basis of several innovative notions of this book: vertical thinking, surimposition, *Diversium*. Is making it a material dimension only the attempt to land a philosophical elucubration? Or can it be anchored in the Real pole by a mathematical framework?

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Mathematical indices of complexity

Brownian movement: particle path in an environment where they undergo microscopic shocks. Random: Its evolution is independent of its past history. 3 levels of description:

1) Microscopic: obedient particles with Newtonian mechanics.
2) Mesoscopic: particle density with a given speed at a given point.
3) Macroscopic: overall observable properties (fluid movement, heat).

The microscopic description does not make it possible to understand the qualitative properties of the set. The other two do it at the price of an approximation of microscopic.

Mathematically pass from the microscopic to macroscopic model is possible. Particles remembering their path (Newtonian) become a process without memory (Brownian).

This mathematical transformation involves extensions to infinity (passage through the limit) and change of temporal scale. Two crucial elements of the complex dimension.

Staggering consequence: the accuracy of an approximation of a level of reality by another. Everything happens as if the reality itself made such an approximation.

The model of a higher level can be mathematically simpler than that of a lower level.

The wavelets: another mathematical tool for switching from one level of complexity to another. A signal is broken down into its coefficients and transformed into function. 10% of the coefficients carry the complete signal information.

Consequence reverse of the previous approximation: here it is the upper level, the one that represents, which contains unnecessary noise.

The diagonal of Cantor: in any way to create a repertoire of the real numbers, some lack. There is no complete list of them.

The Cantor demonstration uses a vertical index for creating new real numbers in any existing list. Cantor adds a complex depth to a list that would actually be complete if it was confined in its level of information.

The complex dimension is hidden in the mathematics themselves.

I admit from the outset that I am insufficiently competent to create a metamathematics of complex organizations. Its very existence leaves room

for doubt. Supporting it requires two more speculative beliefs: on the one hand, that mathematics is not only the language of reality but its very essence; on the other hand, all reality is made up of information, and so it must necessarily contain the metamathematics that structures others.

However, I will gather some clues about what this metamathematics could be. Let's start with those that show us the existence of a complex dimension.

Brownian motion

It is the seemingly messy journey of tiny grains through an environment of microscopic shock. Path considered as random (Albert Wiener): its evolution at a given moment is independent of its past history. Analogy: the walk of the drunkard, who constantly forgets where he comes from.

There are several levels of mathematical description of this phenomenon:

1) *Microscopic level*: particles assimilated to balls obeying Newtonian mechanics. The equations are simply differential and derive the variable 'time'. But the gigantic number of particles separating this level from the macroscopic (of the order of 10^{23}) does not allow us to understand the qualitative behavior of the whole.

2) *Mesoscopic level*: the medium is defined by the density of particles at a given point having a given speed. It is described by Boltzmann's kinetic equations, partial differential equations more elaborate than the previous ones: they derive position and speed. The model makes a qualitative leap: it allows us to know the evolution of an out-of-equilibrium gas.

3) *Macroscopic level*: the medium is considered by its general properties: motion of a fluid (Navier-Stokes equation), thermal conduction (heat equation). Equations deriving only time and position, not particle velocity. New qualitative leap: models describe what we observe through our senses.

The last two levels are approximations of the first: they reduce the amount of data involved but gain in quality for the properties of the level of

organization examined. Interestingly, the degree of approximation does not correlate with the degree of additional mathematical complexity. On the contrary, *a model describing a more complex level can be mathematically simpler*. The coded language specific to each level shows relative independence.

The big challenge is to connect the levels by rigorous theorems. None claim the status of metamathematics. However, the task does not seem impossible. Three researchers[22] succeeded in 2016 in combining different tools to go from the disturbance of the trajectory of a particle to its effects on Brownian motion and then heat. They transformed deterministic (Newtonian) equations into statistics: balls remembering their path become a memoryless process (the Brownian).

Let us note two essential points: 1) The method involves *two extensions towards infinity*: first that of the number of balls involved in the shocks, then that of the rate of collision between balls. 2) The main obstacle to passing without restriction from the Newtonian equations to that of Navier-Stokes is the time scale: we know how to do it over a tiny time (average delay between 2 collisions), far from the time scale of the motion of a fluid.

Extending to infinity (also known as 'crossing the limit') and changing the temporal scale are two crucial elements of the complex dimension. Extension to infinity results in this astounding paradox: the *accuracy* of one level of reality *approximation* to another. Everything happens as if reality itself makes such an approximation.

Wavelets

The wavelet transform from Yves Meyer is another example of a mathematical tool for moving from one level of complexity to another. A signal to be analyzed is broken down into its elementary wave components. The tool allows to change the scale of these wavelets to obtain an orthonormal basis, that is to say a structure of simple algorithms which are

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[22] T. Bodineau, Inventiones mathematicae, 203, 493, 2016
details that the framework of the system studied is limited: the shocks between particles must not be too frequent, thus the extension of the equations to infinity (the number of elements of the system is very high) allows the approximation that a particle hitting another has not encountered it before.

deduced from each other by translation-dilation. With this tool the signal coefficients are transformed into function. Transition from qualitative to quantitative. Useful reminder: the first cannot be reduced to the second, even with a fluid mathematical connection. The equation contains emergence, in the passage from the equation to its result.

Wavelets tell us more about approximations of reality. A small part (10%) of the signal coefficients carries its complete information. The rest is noise that is irrelevant to the properties of the signal at the level considered. It is the careful choice of the basis of the wavelets that identifies the important coefficients. The method goes back and forth between the above and the underlying information to select the former. A kind of compression of information upside down, compared to that of Brownian motion.

Conclusion: *A level of representation is not just useful information*. It can include noise inherited from the underlying level, or even create it itself because the boundaries of the system are too blurry.

Cantor's diagonal

Cantor has shown that in any way to create a directory of real numbers, some are necessarily missing. In other words, the very notion of a complete list of real numbers, whatever its infinitude, is false.

Let's see how the demo works and why it's called 'diagonal':
Take the real numbers between 0 and 1 and assume that there is an infinite list of them. Let's associate each of these with a positive integer. Here is for example the start of a list where the integer N is associated with a real r(N) :
r(1)=0,**3**691…
r(2)=0,1**2**54…
r(3)=0,33**3**3…
r(4)=0,775**5**…
…
The infinity of integers allows us to list the infinity of reals between 0 and 1. And yet we are going to construct a real that does not belong to the list, like this:
You noticed that I put a number in bold for each real, diagonally on the list. Let's follow 0 with the sequence of numbers in bold: 0.**3235**… This is a real

between 0 and 1, necessarily included in the list since we said it unlimited. Now let's build a new number *g* by subtracting 1 from each of the bold numbers: g = 0.2124… According to this method:
-the 1st digit of g after the decimal point is different from r(1)
-the 2nd digit of g after the decimal point is different from r(2)
-the 3rd digit of g after the decimal point is different from r(3)
-the 4th digit of g after the decimal point is different from r(4)
…
so :
-g is not r(1)
-g is not r(2)
-g is not r(3)
-g is not r(4)
…
that is: g is not in the list, although it is infinite. And g isn't unique: there are many ways to change numbers to bold. Finally, if all the possible values of g were added to our list to complete it, it would still be possible to use the diagonal on it to discover new reals that are not included in it.

What relationship with the complex dimension? Cantor's demo happens to work because it uses bold numbers *at two different levels of information*. They are part of a horizontal index (for each real number) but also of a vertical index for demonstration purposes, the flattening of which generates an unexpected new horizontal real number.

The infinite list of reals between 0 and 1 would be complete if it were based on a single level of information (the horizontal index of these reals). But the introduction of an additional level of information makes this list obsolete. Wonderful illustration of a system that seems to display all of its intrinsic information, to the point that it seems infinite, and it actually hides a greater depth of information, evidenced by vertical thinking. Without a proven limit to the number of levels, this depth is itself infinite. The infinities of horizontal thought conceal another, in an orthogonal dimension: that of complexity.

Vertical thinking is therefore not only a property of the mind. It is backed by a physical dimension, like space-time. Space-time is both a mental

representation and (hope of the realist) a property of the real. The same is true for the vertical scale of complexity, or depth (and height) of organization. What I call *Diversium* is the observable universe with its complex dimension. Including the observer. The literature refers to this dimension by various terms: scale of organization, depth of information, holarchy, complexity.

Is it a finite or an infinite dimension? A priori there is no need to decide. No complex-dimensional theorem requires positioning. Because it is the constraint that links space-time. Spatial and temporal infinities are essential to some of its theorems. However, there is one trick to get rid of the cumbersome nature of infinities: it is to bring their ends together, as a two-dimensional circle or the surface of a three-dimensional sphere does. Likewise for complexity, we could assume that the maximum complexity of a universe is based on the minimum of its beginning. Unfortunately, looping is not as easy as it is with space and time. We seem to end up with a chain of universes rather than a single one, failing to declare the finitude of complexity. Let's not give up on the matter entirely, however. We will see that it is possible to find a common thread at all levels of reality, which can be used to pose *complex coordinates*, equivalent in this dimension to spatial coordinates.

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Chance (ontological)

The epistemic chance appears with the downward look. Based on the incompleteness of this look, which uses masks of reality and not the reality by essence.
It attributes a strong random to an isolated event. Its repetition decreases its uncertainty.
The epistemic chance corresponds to the lack of intention in the phenomenon that is understandable by the intent that looks at it.
The ontological chance is a more framed tool of the upward look. It declares the uncertainties as fundamental. The real does not know what it will become. The Real Pole models its probabilities.

Can the ontological chance make the epistemic obsolete? No. The initial conditions are not fully known. Chance is an ignorance framed by the double look.
Chance is specific to each level of organization, framed by the model and its interpretation. *It is incremental in the complex dimension*.

With the downward / upward approaches we separated two visions of chance: 1) The epistemic: the inability of the mind to calculate the evolution of the system (the chance of apparent chaos). 2) The ontological, contained in statistical thermodynamics and quantum mechanics.

Epistemic chance comes from the fact that the mind defines the initial conditions with numbers or events that do not *really* exist. These are *mask* measures placed by the mind and not reality per se. Epistemic chance attributes *strong randomness to an isolated event*. It can result from multiple initial conditions. The more similar experiments are repeated, the more their mean converges towards a precise value. Value that centers an uncertainty associated with the isolated event. It is an *attractor* attached to it. A lonely experience departs from it; its repetition approaches it exponentially.

Take the example of a genetic mutation triggered by a cosmic ray. It is impossible to predict whether it will be beneficial or lethal. It occurs 'by chance' for a human observer, who sees no intention in the mutation comparable to her own. No downward, epistemic intention. But the intention does exist in the ontological, upward direction: particles and ray have interacted to trigger molecular breakdown. In this direction it is no accident; causality is well established.

There is therefore an 'epistemic chance' because the ontological intention is not known. This type of chance is denigrated. It would only be the ignorance of the intimate mechanisms of reality. But as a concept it does exist. It simply corresponds to *the absence of intention in the phenomenon which is understandable by the intention which is watching it*.

Ontological chance reflects a more cautious attitude of the Real pole of the mind. It admits to seeing only results, and uncertainty is never absent from

the initial conditions. Reality itself does not 'know' what it's going to produce, until it 'realizes'. How would the mind know before it did? Tracing a precise path between start and result is difficult. So many variables go in and out of the game. It is more realistic to draw all the possible paths, with their chance to arise. The determined fate of reality is replaced by a curve of probabilities. This erases the uncertainty about the initial conditions. Many beginnings will generate the same curves, provided that the system *collectivizes*, for example that it is confined in the case of a gas, or that it is observed in the case of a quantum object.

We will see the mechanisms underlying ontological chance later. Can this entirely replace the notion of epistemic chance as reality? Of course, epistemic chance rests on ignorance of the Spirit pole, but ontological rests on that of the Real pole. The initial conditions are never known. The quantum probabilities are also an absence of intention in the phenomenon which is understandable by the intention which looks at it, in this case that of quantum theory. The underlying causality is unknown.

Chance, at the end of the day, is *framed ignorance*, both in the direction of the Spirit pole towards the Real, and in the reverse direction.

Let us remember above all that the two directions of chance do not cancel each other out. Its definition only becomes clear within an organizational level, and it should not be left out. *There is no such thing as universal chance*. Kolmogorov defined probability in the 'space of possibilities' as the number of cases where the event occurs divided by the number of possible cases. But the space of possibilities is only known within a single level of organization. For example, it is illusory to integrate in the same space all the potential evolutions of a hair thickening into a feather, in particular the fact that it will later allow a bird to fly. It is also illusory, at the time of the manufacture of a screwdriver bought by Marconi's grandfather, to include in the possibilities that the grandson will make of it 80 years later the antenna of his first radio station.

Chance is also incremental in the complex dimension.

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Properties

A *property* is a mask applied by the downward look on the stereotyped behavior adopted by an element in a context.
An *intensive* property does not change with the size of the element: temperature, pressure, hardness.
An *extensive* property changes with size: mass, volume.
'Intensive' is an internal point of view: each component of the element "sees" the property.
'Extensive' is an external point of view, solely capable of measuring the property in its entirety.

A property is stereotypical behavior. It is a systematically chosen organizational solution in a specific environmental context. Slight differences in this context, in heat, pressure, molecular density, inclusions, etc, can considerably modify the properties of the element or the medium. A different mode of organization was chosen.

The most illustrative example is that of the very banal H_2O molecule. The properties of its aggregates are among the most changeable depending on the context. These molecules were thought to be closely dependent on their hydrogen bonds (H^+), fleeting forces that encourage molecules to cluster together in pentahedral shapes. However, the water seems to hesitate between two organizational choices, high and low density. In the first few H^+ bonds are formed, the molecules come together. In the second the pentahedra appear, the molecules move apart but are more firmly connected, producing surface tension. This explains the astonishing variations in density of water, maximum at 4°C, decreasing towards 0° and lower in ice, allowing the solid form to float in the liquid form, because the molecules are more apart. Pressure causes water to flow faster by weakening the bonds between molecules; even close together, they become independent and move more freely. At very high pressures, the ice becomes fluid again ('glassy' or 'amorphous' water) and hesitates between the two states, high and low density. At -40°C low density water crystallizes into ice but high density water still flows and is called 'supercooled'. Finally, hot water paradoxically freezes faster than cold water, because the latter contains more H^+ bonds whose energy must be dissipated. It is also the

presence of these bonds that forces water to be heated to 100°C to vaporize it, while oxygen alone gasifies at -183°C.

The water shows that the elements of a system can jointly use several relational solutions, diversifying the properties of the whole. The material becomes particularly polymorphic, sensitive to environmental conditions.

Properties arise from the way we look at things. New visions create new properties. Topology, a mathematical discipline of recent extension in physics, is concerned with the codification of forms. It allows us to understand certain breaks in symmetry, the importance of which we will see below. The breaks appear as topological defects. For example, if we try to draw a well-ordered velocity field on the surface of a sphere (all the points have a vector parallel to the others), we have to place 2 defects. Breaks centering a vortex. The number 2 is here a topological property specific to the surface of a sphere. This category of properties explains, among other things, the quantum Hall effect[23]. It reconsiders a certain number of known characteristics of materials and adds new ones to them.

Intensive and extensive properties

Why do some sets of elements form a whole with their own reality ('Whole' with capital letter), and others not? We have seen that the Whole, as relative independence, is a level of information surimposed on the previous one. It does not appear for any combination of the elements. Some combinations are just sets, simple associations. The realization of the Whole therefore depends on the properties of the whole which vary according to the elements present.

Which brings us to the classification of the properties of a system into *intensive* and *extensive*. The intensives do not change with the size of the system; they are homogeneous at any of its points. These are for example the temperature or the pressure of an isolated system, or the hardness of a

[23] A material bathed in a magnetic field and traversed by a current emits a voltage perpendicular to the direction of the current. At very low temperatures and with increasing field strength, the relationship between current and voltage loses linearity and jumps from one level to another. Effect related to a topological property of electrons seen as a set of vectors.

crystal, identical for all its faces. The extensive properties are, on the contrary, relative to the size of the system; they are additive for the parties. These are for example the mass and the volume of the system.

Intensive and extensive refer to internal and external points of view: an intensive property can be accurately measured from within the system. In a way, any part of the system 'sees' this property the same. *The elements are perfectly collective in their perception of intensivity*. Whereas an extensive property is only exhaustively measured outside the system, since it varies within it. In a way each element 'sees' the property in its own personal way. *The elements are individualistic in their perception of extensivity*.

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Ontological causality breaks

Causality is an absolute mystery. Do not make a mathematical reason, which consists of deifying algorithms.
How to say whether there is an ontological causal principle? What we observe is a bunch of links, each endowed with its mathematical formalism.

The *phase* of a material is characterized by the changes in symmetry accessible to its elements.
Each restriction of symmetry is an additional fragment of order for the material.
Physical order is thus a discontinuous principle, quantifiable, inversely proportional to the number of permitted symmetries.
Symmetry restrictions create stable organizations, foundation for additional levels of complexity. Quantons, atoms, solid material, biomolecules...

The topology includes objects in a common class when it is possible to switch from one to the other by deformation without creating a hole or cut. The switch is a topological phase transition.
The topological phase is modeled by a vector field. The phase is ordered when all vectors are aligned. Some objects contain irreducible *topological defects*. These are ontological breaks, found at all levels of organization, physics to biochemistry.

A good example of a complex *phase transition* is that of water.

The displacement of H_2O atomic nuclei is described by the molecular Hamiltonian model.
Due to electrostatic links and the temperature / pressure context, the water can undergo extremely varied phase transitions where the Hamiltonian becomes incompetent.
Symmetry breaks reveal additional levels of information with their own model.

A transition between two phases is not linear. It goes through a *critical point*, abrupt, where the real seems to be mad. Fluctuations between phases lose their local character and extend to the entire system.
At the critical point the distance does not intervene anymore. The difference between the individuals and the whole disappears. Levels of information merged.
At the critical point approach, the radius of the effect of a fluctuation accelerates according to a constant (critical exponent).
The critical exponent takes identical values for very different materials and properties. Universal classes unifying critical transitions.
The reason for this universality is unknown. Index of the existence of a meta-theory of emergence?

The phenomenon of *frustration* occurs when several causalities argue the result.
Example: 3 triangle elements can not be in the same state as their neighbor.
The general state of the system is a quick alternation.
The perpetual alternation of this state is a constancy in a higher level of complexity, of which they are a single element.
The upper element is a merger of the underlying conflict and not its negation.

Last point before tackling ontological emergence in physics. This survey does not select its subjects to demonstrate my general theory of reality in the next chapter. The theory in question does not really require demonstration because it is not binding. It doesn't say anything about what physics should be. Does not claim that reality is deterministic or not. It is a framework where thought includes itself. Which includes privileged theories, and others… not eliminated. Most of the time *Surimposium* tries to

find an organization of these theories where the claims of each become understandable, even if they ultimately turn out to be false.

It is possible, if not likely, that you will find errors in the following investigation. This in no way threatens the framework of *Surimposium*. It is elastic. Each paragraph can be updated. The point here is to place a number of successes in physics in a unifying dimension, without the need to discover any 'Equation of Everything'.

In the previous chapter we looked at what is hidden in causality, in this language-principle used to serialize the states of reality without us being able to understand the primitive reasons for the series. Do not be quick to say that mathematics is the origin since we do not know why this series corresponds to such mathematics. We are looking for the reason for the unexpected causality crossings that give rise to emerging properties. That crossings appear within algorithms themselves, for example in cellular automata, is not a sufficient reason. They are not explained other than by the superior reason of the algorithm, which is then deified. There is no explanation within automata for the increasing control that elements exert over their own rules as complexity increases.

It is also impossible to be satisfied with the intricacies of quantum states to explain these unexpected crossings. Determinism reigns over macroscopic matter. Quantum indeterminism challenges the principle of locality, which becomes an emerging property of macroscopic levels and no longer a fundamental property of reality. The space background has vanished. Paradoxically, it is emergentism that comes to the aid of eliminativism by recalling that causality can take any aspect within an organizational level. Independence which limits the scope of its particular aspect to this place. Not only does quantum indeterminism not self-explain, it also fails to account for the causal breaks observed earlier in the complex dimension. Let us then see causality not as a monolithic principle but as a bunch of links which we use opportunistically, each link fortunately corresponding to a mathematical formalism. We don't know why this one should be chosen from the bunch, but it probably respects a meta-organization, since we are able, by changing assumptions, to invent new links and make them work.

Symmetry restriction

Previously we saw the difficulty in defining order other than by itself. We have failed to philosophically get rid of the problem. For its part, how does fundamental science manage to define and quantify order? It is also a snake that bites its tail, and in physics the tail is called 'symmetry'.

Symmetry is at the heart of states of matter. In a gas, the molecules are free, that is to say they can undergo all possible translations or rotations in space without this changing the gaseous state. We speak of invariance by translational or rotational symmetry. In a liquid, weak bonds (electrostatic) partially reduce this invariance. In a solid, strong (covalent) bonds allow only a few changes. A solid has much less symmetry than a gas. The change in the number of symmetries accessible to the elements thus corresponds to a change in phase of the material formed by these elements.

The set of possible phases of a material is redefined as the set of accessible symmetry changes that can affect its elements. *Each symmetry restriction is also an additional fragment of order*. Order becomes in physics a discontinuous and quantifiable principle, inversely proportional to the number of allowed symmetries.

Two major parameters of phase changes are temperature, i.e. the agitation of the elements, and confinement, i.e. the restriction of their freedom of movement. Other parameters are conduction properties (electricity, heat) and magnetism. Shifts in symmetry are possible at all organizational levels and do not necessarily take place in classical spatial dimensions. Exotic states (superfluid, superconducting) arise from changes at the quantum level of matter. Here the symmetry restrictions operate in purely mathematical dimensions.

The symmetry breaks leading to phase transitions only concern global symmetries. For locals, such as gauge symmetries, a theorem by S. Elitzur has shown that they are impossible. *Superimposium* offers a simple explanation: breaks in symmetry are triggered by the action of one level of organization on another. It is the rules generalized in a level that form the global symmetries. These rules *form a point of view superior to the elements*

that created them. A global symmetry no longer belongs entirely to the level that constructs it. Local symmetries, on the contrary, are rules specific to parts of the same level, linked to the relative separation of these parts from the rest. Local rules remain entirely the property of the level that creates them.

A break in symmetry only occurs for global rules, because it constitutes an intervention of the higher or lower levels on the interacting elements. It is for example a human technological intervention recruiting these levels. It can also be a so-called spontaneous breaking coming from the underlying intrinsic organization of the level (quantum fluctuation, transmutation of a radioactive isotope, genetic mutation).

Symmetry restrictions create enduring organizations with stable properties that serve as a foundation for additional levels. The most fundamental examples are the organization of quantum excitations into subatomic particles, then atoms into liquid and solid materials. The restriction of symmetry resulting in a solid seems trivial to us. Yet this is a surprising order, on such a microscopic scale that it is invisible to us. A similar phenomenon, more apt to surprise us because it is more apparent, is to shake the box with a set of balls and magnetic sticks. When you open the box, the loose items spontaneously assembled into stars, squares and cubes. A blind energy, which served to shake the system, reduced its symmetries and produced manifest order.

Other remarkable properties, because they lead to life, are self-replication and self-containment: self-replicating molecules, enzymes, micelles. We, human beings, are a superimposition of chaotic systems chained by successive restrictions of their symmetries.

Topological defect

Topology classifies objects by their shape. The invariance between objects here is to be able to deform one into the other without creating a singularity, that is to say a hole or a cut. A sphere is topologically equivalent to a cube. On the other hand, a torus, a sphere pierced with a hole, is of a different topological class. Topology identifies elements whose properties do not change under the effect of deformations. It applies in

particular to two-dimensional systems, where the fluctuations are too large for an order-disorder transition to appear as in three-dimensional systems. It is possible to identify phase transitions between topologically equivalent states.

A topological phase model is a field of small vectors. The phase becomes ordered when all arrows point in the same direction. During this transition faults may appear, depending on the topological class of the system. For example if you look at a vector field on the surface of a sphere and try to line up all the arrows, you end up with 2 irreducible defects, where the arrows form a vortex. The number 2 is a global topological property of the vectors on this type of surface.

Vectors can represent any element or quantify any parameter: speed, conduction, magnetism, etc., explaining the rapid expansion of the discipline. Like breaks in symmetry, topological defects are constraining orders, imposed on reality at different levels of its organization, and linked to the dimensions that constitute it. These are indeed ascending / ontological transitions of the structure of reality, and not descending transitions linked to the application of a model.

Topological defects exist at all levels of organization, from physics to biochemistry[24]. There has even been an attempt at 'social topology' to model social trouble. The defects potentially concern the more basic known levels of reality, in particular the space-time framework. This is the cosmic string hypothesis. The unified physics of the beginning of the universe would have split up as a result of expansion and cooling. Large regions where physics remains uniform would be separated by boundaries with special properties, elongated distributions of energy called cosmic strings. These defects, if confirmed, are ontological breaks at very low levels in the complex dimension. Potential explanation for the appearance of additional dimensions above the level that creates them?

[24] Vortex networks in superconductors, protein folding…

Phase transition

Systems are never really closed. Closure is a property of the context that allows a system to abruptly self-delimit. The term ‘context’ is too vague to attribute any properties to it. Usually we reserve the properties for the system, whose intentions are clearer. Not always. If an experimenter encloses a gas in a chamber, the intention of the ‘human observer’ context becomes more precise than that of the gas-system. The roles of the context and of the system depend on their respective degrees of organization. This is inconsistent with the upward look alone. The double look is again necessary to understand the evolution of the system.

Let’s look at the evolution of a system of atoms. When it exchanges energy with the ‘context’ its physical state changes. It can be superfluid, gaseous, liquid, solid, magnetic or not, etc. The change is called 'phase transition'. Atomic micromechanisms are involved but do not explain everything. Phase transitions hide real emergences. Take the water-ice example. The atomic nuclei of H_2O molecules move in a pattern called molecular Hamiltonian. H and O pool their electrons asymmetrically (oxygen is more electron hungry). They form a polarized molecule, establishing electrostatic bonds (called ‘hydrogen’) with its neighbors. Bonds counterbalanced by the agitation of molecules. They break and reform more or less vividly with other molecules, or they simply twist. Depending on the temperature and pressure, as well as the rate of their change, water can crystallize in many possible ways, or change in viscosity and become gelled.

If the agitation of the molecules is high (high temperature), hydrogen bonds cannot form. Steam state. The Hamiltonian predicts the motion of molecules, considered equivalent. No one influences the fate of others differently. The whole is described statistically. When the temperature drops, hydrogen bonds form. Condensation of vapor into droplets. Molecular symmetry is broken. The Hamiltonian becomes ineffective in describing the system. In the liquid state, the model is different. The molecules glide over each other with a fluidity based on the delay of twists, breaks and reformations of hydrogen bonds. Since the thermal range between gaseous and solid states is only a hundred degrees, we could say that liquid water is a brief passage between the two. Life is born in a short phase transition!

The molecules still lose symmetry as they approach 0°C. Hydrogen bonds form a crystal lattice, ice. New properties have appeared. Another model. Each state responds to specific laws. The same set of elements produces different systems organized according to context, separated by phase transitions. The Molecular Hamiltonian, which accurately describes the behavior of a single molecule, gives no indication of the overlying organizations. It is only valid for the whole if the molecules are in perfect symmetry. The break in symmetry reveals an additional level of information.

Critical point

Synonyms: singularity, inflection point.

When a system receives or loses energy, the relationships of its parts change. Is this change linear? No, it's usually exponential and steep. The water remains liquid within a range of a hundred degrees and becomes ice or vapor for a few more degrees. Is there a precise mathematical rule that models the transition? This is where the real seems to briefly sink into madness. It's going through a critical point, which is like having an epileptic seizure!

Back to our H_2O. This time, instead of cooling it down, let's heat it up. The agitation of the molecules increases. The hydrogen bonds become too weak to compensate for the agitation and the molecules break apart, forming a tiny vapor bubble. Of lower density, the bubbles rise in the liquid. If the system is confined in a transparent container (vapor cannot escape) a level appears between gas and liquid phases. Liquid-vapor separation is conditioned by a pressure / temperature combination. Pressure fluctuations in the vapor condense water drops (which join the liquid) while temperature fluctuations in the liquid form vapor bubbles (which join the free gas).

If we continue to heat the confined water-vapor system, it reaches a critical temperature where the water is completely transformed into vapor. Just before that the fluctuations between the two phases lose their local character. Bubbles can be any size, so can drops. Even the tiniest local state

change appears to be able to extend to the entire system, instead of being confined to neighboring molecules.

The phenomenon exists for multiple properties and relationships. A magnetized solid loses its property above the Curie temperature. The spins of its atoms continue to align in an external magnetic field, but lose their spontaneous alignment. Under the Curie temperature, alignment is spontaneous because it corresponds to the lowest energy state. Above, the agitation of the spins linked to the importance of free energy makes this alignment impossible. As with the water-vapor mixture, the transition between the two phases is gradual at first. There are fluctuations that cause alignment between spins of neighboring atoms to be lost or regained. On approaching the critical point these fluctuations lose their locality. A change in spin direction can cause disturbances at any distance in the solid. The delocalization of disturbances is exponential as they approach both sides of the critical point (by increasing or decreasing the energy supply).

Understand: this is not a gradual increase in the radius of effect of the fluctuation. This is *an abandonment of the distance rule for effect*. The distance can vary from zero (no effect on neighboring atoms) to the size of the system (an order of magnitude incredibly greater than that of the atom). Since there is no limit to the size of the system for the phenomenon to occur, it is virtually infinite in scope. The distance is fading.

The acme of the transition, or critical point, is the moment when the distance is no longer an interactive rule between the states of the elements of the system. The difference between individuations and everything blurs, until it disappears. The collection of elements has the same meaning, in terms of existence, as the merged whole. The levels of information are no longer separated.

We will see in the next chapter that everything can be defined as a mixture of the individuing part and the collectivising part (principle T <> D). At the critical point these two radically opposed poles disappear. It is possible to approach their fusion from the individuation side and the collectivization side. The critical point is both perfect individuation and all perfect. Certainly this extremely surprising phenomenon can help us to understand

other radical oppositions such as finite-infinite or continuous-discontinuous. I will come back to that.

Before leaving the critical point, there remains one essential observation about it. While this point itself seems a moment of madness of the real, where no more rules are respected, the way in which the real approaches it follows universal rules:

Denote by R the maximum radius of the effect of a fluctuation on the system. As we approach the critical point, R increases exponentially to infinity. But at what speed exactly? The acceleration is fixed for a system. This is a constant called 'critical exponent', denoted conventionally in Greek letters: α, β, γ, ν are the most frequent.

Frequent? Yes, here is the most astonishing: the critical exponent is identical for systems as different as water-vapor, magnetized solid or not, ordered state or not of an alloy, etc. It is called β and its value is 0.33. There are universal classes for critical transitions. Order is not completely absent from these moments of madness of the real. What explanation for the presence of universal classes? Let's keep this unknown close to the main one: the explanation of the emergence / separation of organizational levels.

Frustration phenomenon

A final 'ontological break' of causality occurs when two causalities compete for the same effect. Consider an element that can be in state A or not-A. The property studied prohibits two neighboring elements from assuming the same state. Everything is fine when there are two of them. If one is in state A, the other switches to non-A state. But when are they three? The elements move from one state to another as quickly as their structure allows, unable to find a balance. The 3 elements are said to be frustrated, unstable. But they, as a whole, form a stable entity. The reason ? Its structural process loops in on itself.

In a slower time scale the hierarchically superior entity appears as a continuity. The set itself acquires the status of 'element' and can interact with others with similar properties. The complex reality is a hierarchy of these organizations.

The higher level is not a negation of the conflict between the constituents. It is surimposed on it, without making it disappear. That is, a change in the conditions of the conflict eventually modifies the hierarchical 'decision'.

The phenomenon of frustration is found in a wide variety of physical (spin glass, oscillator systems) and biological (genetic, immune, neural) systems, not to mention social systems. It responds to various mathematical models.

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Ontological approximations

In thermodynamics, the formula of Boltzmann assimilates the number of possible configurations of a system and its amount of disorder (entropy).
On one side the particles can return to any previous configuration (no irreversibility), on the other entropy can not decrease (irreversibility). *Arrow suddenly grafted over time*.
Real forgot reversibility, as well as the less likely configurations. Two approximations.

Quantum incursion: the quantum theory of fields is both curious and reassuring. It fills the inter-atomic nothingness with lines of fields and a particularly teeming vacuum.
The term 'particle' is no more than an aspect of a mathematical object that can be point, wave, cloud: the *quanton*.
A quanton has no definitive property as long as it is not involved in an interaction.
These properties are a perfect example of relative independence: the measure of one of them makes the others impossible to know.
A quanton is the whole of all its possible states. Two quantons are all possible combinations of their respective states for a property. An interaction between them can reduce the number of combinations: entanglement.
The entanglement is independent of the distance between the quantons. It is their whole that holds the entanglement and no longer individuals. The whole is an additional level of existence. Authentic *ontological emergence*.
The entanglement exist away from the quantum level. *Social memes* cause similar behavior in separate humans, after interaction in a conversation.

By reasoning in terms of information levels, the border between hardware and virtual is gummed. The virtual is embedded in the reality of neural schemes that generate it.
Classically a probability has no reality as long as the fact has not occurred.
It's false at least for quantum facts.
And also in a macroscopic fact: there exists in the elements that form its probability of realization. The fact is the final organization of the surimposed constituent probabilities. Perfectly real organization, likely to disappear in favor of another during an interaction.
A thing or fact is an aggregation of real probabilities, and something more as this agglomerate. Fusion that corresponds to the substance we usually attribute to things and to facts.
The opposition between determinism and indeterminism disappears. Under the upward look, reality *self-constitutes* in an *indeterministic* way. Under the downward look *it is constituted* in a *deterministic* way.

The renormalization, in physics, has gone from the status of mathematical DIY to that of ontological processes.
It summarizes local elements behaviors in one, creating a more general level of the system. Model to adapt to the actual behavior of the system. The operation is repeated at the next step.
In a renormalizable model, the procedure can be standardized from one step to another.
The rules specific to each level of organization are erased. The complex dimension seems to open on a well that transcends it.
But the universality of renormalization is not so general. It is a privileged window on the organization of complexity.

Space is no longer a back drop. Spatial dimensions are *properties*. Generated by quantum vacuum such as field excitations. Ontological emergence.
Inflation is not a space creation but the increase in the values of the length / width / height properties in a purely mathematical frame.
Gravity thwarts the dilation of the universe. Not exactly equivalent in the opposite direction. The differences have created large cosmic structures.
Local interactions, strong low and electro-magnetic assemble the quantons in matter, fixing the spatial dimensions.
The interactions of the quantons are a permanent dynamic. The 'spatial location' properties change. *Movement*.

The space-time exists only as expressed by the interactions of reality. It can not be measured as such, only between the things that generate it.
Other organizations of the vacuum are possible, resulting in non-quad-dimensional worlds.
The 4D is the most complex. 1D and 2D self-organize easily. 5D and more are very unstable. 4D seems most likely of an elevation of complexity until mental consciousness.
An essential factor in the organization of reality is the existence of a specific time at each of its levels.
The measurable time is also an emergence. Interval property of each interaction. Complexity levels create a time scale.

Statistical thermodynamics

We briefly discussed the Boltzmann equation in the previous chapter. This formula simply counts the number of possible configurations of a particle system, and relates it to its entropy (its amount of large-scale disorder). The sleight of hand is astounding. On the one hand, particles can revert to any of their configurations; none of their developments is irreversible. On the other hand, entropy can never decrease; it explains irreversible exchanges such as heat, constantly transferred from the hottest to the coldest. An arrow is grafted onto time.

Why did I include this phenomenon in the ontological approximations? Everything happens as if reality forgot two things: 1) the reversibility of interactions, 2) the least probable configurations. Big sweep, and here is reality on the move! Creation of destiny. But have we really sacrificed anything? The answer awaits you further with a more complete reinterpretation of entropy.

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Quantum state

As the goats have never been observed in quantum fields
and that no one knows what they are grazing,
they might piss off coffee.

A race of aliens is watching Earth. The size and time scale difference with them is such that human activity seems to them a frenetic ballet of

infinitesimal grains, as random as dust in a draft. Impossible, for these ETs, to predict the movement of these grains except using an original method: they can, thanks to an impulse, materialize other particles on the surface of the Earth. Humans thus see emerging from nothing what is for them the most delicious dishes.

Humans rush to stuff themselves, then raise their arms to the sky and sing prayers of thanks. ET scientists watch the tiny grains come together and emit melodious waves. They marvel at this bizarre physics: the movement of grains is impossible to predict except when the impulse interacts with them. Even more amazing: the grains, independent in normal times, overlap in the same place, amplifying the unique melody. The ETs decided to call this phenomenon 'canticle entanglement'…

Quantum theory. Popular works make a point of emphasizing the shattering of our vision of the reality that it induces. But isn't knowledge a series of reversals of the same kind? Shortly before the fullness of material things had given way to an immense void, inhabited only by tiny atomic dots. Substance erasure. Absolute time has also proved to be an illusion. Here we are accompanied by our personal time, shared with neighbors only because they move at a speed relatively close to our own. The points of matter turn out to be a superposition of probabilities. Is it a much more terrifying evanescence than the previous ones? Reality is always palpable, our senses show us the same. It only got richer, thanks to amazing technologies. These are additional planes of reality that are created, not the preceding ones that vanish.

I even find quantum field theory oddly reassuring: it describes reality on its scale with incredible precision, and replaces nothingness with field lines and a teeming virtual quantum populace. Never has a void been so densely occupied! I am no longer surprised that it is exhausting to walk an entire day, even without apparent obstacles…

For physicists, behind the inconvenience of hard-to-grasp mathematics, the renewed confidence is obvious. Henceforth reality is freed from insoluble philosophical discussions on essence and substance. Everything takes place in mathematical spaces.

The particles of matter have become excitations of a field which is specific to them. Each is a wave of the smallest possible intensity in relation to the energy of the particle. It walks in its personal universe. In the absence of particles, the fields are always present, at rest, like a wrinkle-free pond when no breeze blows. But in fact they are never completely still, they oscillate slightly: quantum fluctuations expected by the Heisenberg uncertainty principle.

The term 'particle' is no longer suitable. Quantum individuation can be point, wave, cloud as well. Its properties no longer belong to it. They only appear in interactions with other fields. This only mathematically known individual is now called 'quanton'.

You are certainly familiar with the double slit experiment, the variants of which show the strangeness of the quantum world. A photon passes between emitter and receiver through 2 slits A and B. If it does not encounter any interaction, it is impossible to say whether it passes through slit A or B. It produces interference with itself on the receiver.

If any device interacts with the photon to see if it passes through A or B, the interference is destroyed. The existence of this information is enough. No need to show it. For example, polarizing the photon by passing through a mica plate, without trying to measure its polarization afterwards, destroys the interference. If the information about the path is canceled (for example the photon passes back through a 45 ° polarization plate which randomly changes its polarized state), the interference reappears.

This quantum phenomenon does not only affect elementary particles, but also molecules. NH_3 has two possible spatial configurations: the nitrogen atom above or below the triangle formed by the 3 hydrogen atoms. The molecule is in a superposed state of the two configurations until an interaction has clarified the position of N.

Conclusion: a quanton has no definitive property until it is involved in an interaction. Spatial location, angular momentum, spin… all properties are concerned. The measure of one of them determines it (collapse of

superposed states into a single state called eigenstate), but the others become impossible to know (Heisenberg's uncertainty principle).

Two quantons are each in their superposed states and together present all the combinations of these states. An interaction between them can reduce the possible combinations for a property. 'Entanglement': measuring the property for one of the quantons indicates the state of the other. The entanglement does not take into account the distance between the quantons. It is the set of 2 quantons that has the superposition of states and no longer the individual quantons. When the set has a definite state, those of the individual quantons are not. The whole is a level of existence independent of the parts.

We have here a perfect example of ontological emergence, which sounds the death knell for eliminativism. Why aren't micromechanisms everything? Because these are precisely a reduced, arbitrary vision of complex reality. The 'elementary forces' are also consequences of this arbitrary reduction. They must be stripped of their fundamental character. There are only *configurational forces* throughout the complex dimension.

For our quantons, the 'fusion' level of existence does not make the 'parts' level disappear. During quantum phase transitions, there is a renegotiation between the parts and their fusion. The birth of one level from the previous is continual. The primacy of the parties is undeniable in the exchange they maintain with their fusion.

The microscopic has introduced strange and unexpected uncertainties. It is tempting to think that fusion, as an emergence, is limited to the quantum level. This is the discourse that prevailed until the end of the 20th century. A macroscopic object is seen as the union of its deterministic elements and not as an independent fusion imposed on them. Be careful when looking for an example. In an otherwise excellent physics book I read in support of eliminativism: « The state of an office is the sum of the states of its individual components (materials, books, pencils…) and not a desk imposing its independent state to components ». Unfortunate example that is not a fusion. The office can be seen as a human organized system, but it is not at a self-organizing level. The organization only exists in the mind of its

owner. Simple collection of objects. A true example of macroscopic fusion is a bacterium, whose fate (movement, composition, duplication, symbiosis, etc.) is only understandable from its higher level of existence. Understandable as a functional fusion and not as an assembly of organelles (and even less of its molecules). While the fate of the office lies… in the attachment that its owner has for it.

There are authentic entanglements in the macroscopic world, very far from the quantum level. Human minds are entangled with social memes. These concepts cloned into mental structures make decisions about acts similar to humans, regardless of their location on the planet. Humans entangle their memes by having read the same book, or held a discussion that coordinated opinions. Memes are codifications of neural patterns with unmistakable physical existence. As with quantum entanglement, they have a distribution and not a spatial location. Existence independent of the place, which one tends to say 'virtual' because of pure information. But is not all material things the same as an information structure? The border between material and virtual is blurred. We could replace these terms with 'localized physical information' and 'distributed physical information'.

The dissolution of the border between virtual and real goes far beyond the quantum world. This radical paradigm shift impacts our entire view of reality. To understand this, let's first revisit the most common version of this paradigm:

When we think of 'probability' it is as a virtual possibility, one possibility of realization among many. A probability has no reality. Not yet. Not until the fact has happened. But we have just seen that this is wrong at least for quantum facts. All the states of a quantum particle are very real, each with its own rate of probability. The quanton is the superposition of all these states. None can be missing for a full performance. It is the whole which, during an interaction, decides its outcome. The whole organizes itself with that of other particles to form an outcome that is also a superposition of probabilities.

What about macroscopic facts? Before its occurrence, does not a fact already really exist, in the elements that form its probability of occurrence?

These elements are stacks of levels organized from the quantum level. Their own existences are proven. That is, their constitutive probabilities are stabilized in their present existences. An element, or a fact, is the final organization of the superposed probabilities. A probability is not then virtual, in the sense that it would not yet exist. It is perfectly real. It is simply likely to disappear in favor of another during an interaction. Like any other organization.

This is the astonishing paradigm shift brought about by the quantum world. Not really a theory in itself. Rather another way of looking at reality. The existence of things is what we know. The uniqueness of an element or a macroscopic fact remains the same. It is only in the constitution, the previous existence becoming an intimate structure, that the probabilities are introduced. Each element or fact must be seen as an aggregation of real probabilities, and something more as this agglomeration. Fusion which corresponds to the substance that we usually attribute to things.

Our paradigm shift extinguishes the opposition between determinism and indeterminism. It is their alternation that constructs reality. Reality seeks its possible organizational solutions by writing down very real probabilities. Phase of indeterminist relation. It chooses one. Deterministic organization phase on top of the underlying structure. When we look at reality in the complex dimension: by the ascending direction, *it is self-constituting* in an *indeterminist* way; by the downward direction, *it is constituted* in a *deterministic* way.

A valuable conclusion for our purpose: it frees us from making the choice of a determinist or indeterminist foundation in reality. A major obstacle disappears. Indeed, quantum theory is a probabilistic model verified from above, but impossible to verify from below. We have top-down confirmation but not the bottom-up. We do not have the necessary observation resolution stopped by the technological limit. It is impossible to eliminate the superdeterminist or non-local determinist theses as the foundation of reality. Regardless: we no longer need an ultimate foundation and we have dissolved the opposition between determined and indeterminated reality.

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Renormalization

In physics, renormalization started as a technique and then gained the status of a very fundamental aspect of things. It has gone from epistemic to ontological. Reality is renormalized by changing the scale. Let's see what this entails.

Renormalization was first a technique for solving measurement problems in quantum mechanics. In quantum models the particles are idealized: charge, mass, energy, are defined for each. Unfortunately these values are artificial. They are measured independently assuming the particle detached from its environment. Yet it is an excitement in the midst of a quantum 'vacuum' which is not. It is a rustling medium of very real particles, but so ephemeral that for convenience they are said to be virtual. The fluctuations of the vacuum modify the charge, mass, energy of the particle. The results of the experimental measurements do not correspond to the idealized values. They vary, for example, with the kinetics of the particle during a collision in an accelerator. Renormalization is the attempt to adapt the idealized model of the particle to its environment.

As a mathematical tool, renormalization analyzes the transformations of a model when you change its scale. Renormalizing consists of performing 3 operations:
1) Summarize the degrees of freedom of a group of elements by their preferential degree.
2) Change the scale so as to make the preferential degrees a new group of higher elements.
3) Adapt (renormalize) the interactive parameters of the higher elements so that the general properties of the studied system are preserved, and continue the change of scale.

However, to say a *renormalizable* model has a deeper meaning. This means that there is a way to standardize the adaptation of the model from one level to the next. Such a standard, when it exists, is a universal principle uniting the different levels of observed reality.

To discover this meaning is to go from an empirical technique to a principle belonging to reality. Renormalization no longer belongs to the same look.

The Spirit pole used it to build the Real pole; now it is the Real pole that owns it and self-organizes with it. We are well in the ontological direction of emergence.

The head to tail is decisive. Renormalization was seen by its own creators as a DIY to reconcile models with experiences. This is where it is associated with mathematical tools such as elimination of infinities, cutoff scale, regularization, fractional dimensions. Since the work of K.G. Wilson, it has acquired the status of an ontological principle, closely associated with those of critical phase and universality, as we will see in a moment.

Let us take an example of a particle, an electron, with this ontological perspective. 'Electron' is the name on a very tiny scale. But there are even smaller ones, where it is no longer a particle but a cloud of tiny entities: virtual photons emitted and absorbed, electron-positron pairs created and dissolved, etc. A very hyperactive 'vacuum'. With a good magnifying glass, the electron looks like a stirred pot of large broths. With a mathematical eye it is a slot machine whose reels go on endlessly, stopping only for a vague moment on each combination.

The set of interactions/equations aggregate, defining a place (mathematical rather than spatial) called 'electron'. The electron is the fused form of the whole. Renormalization is one of the possible ontological processes achieving this fusion.

How is renormalization associated with critical point and universality?

We might think that it is the reverse paradigm of the critical point. The idea behind renormalization is that large-scale physics does not depend on small-scale details. We find this idea in statistical thermodynamics, and behind the very concept of emergence: it is not necessary to know quantum mechanics to do material physics or biochemistry. The critical point, on the contrary, breaks the beautiful statistical allure of reality. On both sides, she goes on different paths. Knowing the details seems essential.

Surprisingly, it is by approaching critical points that renormalization shows a universal behavior of the observed thing. It is as if the relative independence of the levels of reality/scale is being erased. The

discontinuous character of complexity gives way to continuity. The properties cross the complex dimension without being modified, a flow of reality devoid of any organizational contingency.

Let's see this in detail. Let's go back to the renormalization procedure: summarize groups of elements, change the scale, adapt the interactive parameters. A model corresponds to each change of scale. Multiple ways of adapting the parameters are possible, with so many candidate models. But the need to keep the observed general properties forces us to eliminate most of them. We are guided on a path, from one model to another, changing scale.

The path can be visualized in a mathematical space where each parameter constitutes a dimension. The value assigned to each of the parameters by the model is a point in this space. The path is drawn between the successive model points during the change of scale. *Organization path*.

With certain initial conditions, the path remains a fixed point. *As if we were looking at a well in the depth of the complex dimension*. The settings no longer need to be adapted by changing the scale. Critical points are part of these fixed points. In other words: if reality is seen as a symmetry traversed by ruptures, in these points symmetry fully resumes its rights. Reality is collectivized. It is placed in position D of the conflict T <> D.

The example of Ising's model is the most cited: ferro-magnetic particles form a 2D matrix of spins that can take 2 values: up or down. The change of scale consists of grouping the spins into 3x3 blocks and taking the majority spin value for each block. Then the parameters of the new step must be adapted to match the interactions between these 'majority spins' to the general magnetic properties observed.

The Ising 2D model has three fixed points, corresponding to the following initial conditions: all spins are 'up', all spins are 'down', there is an equal mix of 'up' and 'down' spins. In all three of these situations, the parameters do not need to be adjusted by changing the scale. Majority spins interact like individual spins. The settings will remain, respectively, 'all spins up', 'all spins down' and 'equal mix'.

We have seen that the complexity is not transcended only in the critical points, but also in the way reality behaves when approaching these points. Constants, the critical exponents, appear. The same phenomenon appears in renormalization. The 5 exponents found in the iron-magnetic Ising 3D model are identical to those of percolation models, polymer chemistry, fluid dynamics.

Should we see in renormalization and critical exponents the transcendental principle that we seek to model complexity? Unfortunately no, the universality of the phenomenon is not so general. Models escape renormalization. Critical exponents are an observation and not an explanation. Certainly the renormalization seems to capture the behavior of reality in the change of scale, but the size scale is not the universal framework. I will justify this point later: spatial dimensions must be seen as a product of complexity and not its framework. If renormalization reveals a norm, this 'universality' concerns only the interaction between complexity and spatial dimensions. It is not shown to be transcendent to complexity.

Rather, renormalization appears as a privileged window into the organization of complexity. We will revisit this subject with attractors. Let us keep in mind the particular history of renormalization: what was initially a theoretical tinkering, a way of making the results of experiments stand up, ultimately turns out to be the true behavior of reality. Would it be, like our minds, handyman and fond of empiricism?

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Space-time as emergence

Space is no longer that 'backdrop' on which the elements of reality would be placed. The most promising theories today explain this as a property of the sub-quantum level. This is the basis of the *It from Qbit* collaborative project (It, space-time, from Qbits, elementary quantum units of information). The constituents of the quantum vacuum, whatever they are (loops, strings, or something else), create both the excitation states of the fields (quantons) and the space between them. *Spatial dimensions are properties generated by the 'vacuum'*. The event symbolized in the term 'Big Bang' is the vague beginning of a sequence of organization of reality. Beginning of space, and its continued expansion.

Expansion is *inflation*. It is not a creation of space, as the concept of 'backdrop' would suggest; this is an increase in the values of the 'length-width-height' properties for quantum pieces of information. The reason is unknown. Science observes and models the expansion of the universe, but does not know the explanation. A so-called 'fundamental' model is always its own explanation.

Gravity thwarts dilation. Its force is not exactly superposed in the opposite direction to the expansion, so that the local differences between expansion and contraction have created the great cosmic structures, stars, galaxies, galactic clusters.

Much more locally are other fundamental forces. The power of strong interaction increases exponentially with distance. In other words, it exponentially reduces the amount of space added between two vacuum excitations in proportion to the energy involved. Associated with two other forces, weak interaction and electromagnetism, it assembles the excitations in matter. In matter, the spatial dimensions become fixed. They are stable properties at this level, while they are only in gestation in the quantum vacuum.

The quantum vacuum has no 'size'. The separation between its elements is not spatial. It self-defines in a purely mathematical place. Explanation of phenomena such as quantum entanglement: the properties of quantons are correlated regardless of the distance between them. Is it the 'same' element seen from two different places or two different elements with twin properties? We will discuss this delicate issue later.

Matter is a local organization of the excitations of the quantum vacuum, sufficiently stable for additional complexity to build up over it, and sufficiently fluctuating that the results are never definitive. The very principle of self-organization, management of a perpetual dynamic, of conflicts between states. In the levels of matter, the main driver of dynamics is the variation in the 'spatial location' properties of each element, that is, *movement*. Movement creates or ends interactions. Sequences founding 'systems', that is to say communities of interactions. Before all other

intrinsic properties, it is the 'coordinates in the three dimensions' which decide the fate of the elements of matter. Space-time reigns over matter.

Space, as an emergence of a more foundational level, adopts the principles attached to the organization: several solutions are possible, depending on the context. Which means other possible theoretical spaces. Only one is currently being *realized* in front of our observation… where it settles. We will see later the most established model, the 4D Einsteinian. It is inseparable from our study of the concept of 'time'.

Making space-time a property implies that it has no real meaning until it is *expressed by something in reality*. This is what we observe: space-time cannot be measured as such, as a subject. Measurements are only possible between things, or events involving them.

Why 3 spatial dimensions and 1 temporal? There seem to be mathematical reasons for our four-dimensional universe. A 1 or 2 dimensional reality generates very few errors / conflicts to resolve. 5 or more dimensions make orders / stabilities very rare. It is for 3 or 4 dimensions that reality finds organizations while encountering new conflicts. The complex dimension grows, explaining among other things our presence. Interpretation that is not anthropocentric. It leaves the possibility that there are a variety of realities with other dimensions, but the others would be more loosely organized, and would not have generated such complex consciousness.

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Time scale

Universal time no longer exists. At least not elsewhere than in the intimate space of the phenomena specific to each of our consciousnesses. Historically, Universal Time was born out of social collaboration. The path of its genesis is that of the discovery of certain regularities: « There are beings who resemble me in the world. So I am not the whole of the world. If there is a world that isn't me, there is one that isn't them either. There is a world that belongs to itself ». The concept of time follows the same path: « I experience my personal time. My fellows use their own time, next to mine. The world also has its own time, which seems very different from ours. Its lifespan seems eternal. My parents contemplated the same. The world takes its time ». Here is rooted the very powerful idea of universal time. It means

that humans at the same time live in a larger framework with infinite time. When it comes to organizing all this together, the management of ephemeral congeners is not like that of the world. Two main categories of representations are separated in people's minds by time: the impermanence of the living and the permanence of the non-living.

Universal time is such a powerful concept that it still permeates almost everything we do every day, even those of physicists who have discovered its falsity. Universal time is very suitable for a world represented by our five senses. Assisted by watches connected to atomic clocks, we even have the impression of having universal time in our pocket. Yet it is its abandonment that makes us understand the variety of aspects of the world beyond the senses, and in particular those really experienced by our fellows. Indeed they are arbitrarily reduced to ours as each consciousness works at its own pace, and slowness is not synonymous with inferior quality of reflection.

Time is an interval belonging to each interaction of reality. We can make it *a real property of the interaction*. The benefits of this design are immense. There is no longer any need to wonder whether time exists or not. It exists as part of this interaction. When trying to recreate the notions of categorical or universal time, it suffices to collect together similar individual interactive times for the subject at hand.

This is how we can easily recreate the time of atoms, the time of cells, the time of humans. Times specific to each level that contribute in an essential way to create them. How could an element interact with another which changes a thousand times faster than itself? Inaccessible. The element could interact with a thousand others arranged around it, but not with a thousand installed *in the same place*, since this is what the difference in proper time means: for the element that does not change there are a thousand different ones at the same place of one that changes very quickly. Why would one be more involved than the others in the interaction? If the relation is possible, it can only take place with the integration of all these states in a temporally equivalent representation to that of the slower element. The thousand states must be organized in a way that creates another element of the same level. We say they have equivalent properties.

The elements of a system are brought together by their similar time. They can interact. The interaction takes place in a way that we can represent by a mathematical model. Whether the interacting elements are substance or information is irrelevant here; suppose the model is as faithful as if it were the essence of the element itself. Mathematical calculation, in reality, never achieves a result. What seems to end it, to our observation, is the fact that it buckles, or that its emerging properties are maintained. A zone of stability of reality has formed. Attractor. A new ‘element’ appeared, never definitive. Its internal structure, established on the computation loop, can change. Intrinsic or extrinsic data breaks the balance of equations. The duration of stability of the loop or attraction constitutes the element's own time.

As for its properties, they emerge from the particular organization of its constituents. They are latent within the context. Clean time and latent interactive properties fully figure the element in view of others. To fully define the element, it is necessary to add to this figure the entire underlying information structure, without which the figure could not exist. The essence of the element is the fusion of all this, the tree expressing the flower, the flower showing itself to everybody but not being able to appear without the tree behind it.

But let’s not encroach on our next chapter any further. Time will be one of the major subjects with the definition of a temporal existence implanted in the complex dimension, capable of bringing together physical and phenomenological looks.

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The hidden emergence in the information

The term 'emergence' contains a diachronism. Temporal scale difference between processes and emerging properties.
The mode of organization of the information determines their most significant parts. Subnet of important weight nodes.
These parts form emerging macroscopic properties. Macroscopic interactions select these properties as a function.

The function can reduce the information system to the most significant. Retro-causality.

Emergence shows up in information in several ways. We saw in the previous chapter the epistemic way, which allows us to manipulate information by representing it. The beginning of this chapter was devoted to the ontological way, how information organizes itself. Another way is hidden in semantics. The term ‘emergence’ contains a diachronism.

There is a delay between the beginning of the process leading to the emergence and the appearance of the properties of it, its clear, unmistakable installation. An emergence is not an instantaneity, except in the temporal resolution inherent in our instruments. An emerging property is a characteristic of the collective. Two or more independent elements, or an element and a context modified for it, have changed their state. There was interaction. Each element concerned is no longer isolated as before from the presence of one or more. It incorporates this presence, if only by having changed its internal structure, even when the interaction has disappeared.

It is in this sense that emergent property is always characteristic of the collective. Then this collective, if its organization gives it a certain stability, becomes an entity capable of maintaining itself even when conditions change. It is in turn an individuality, and can interact with others of the same type. Threshold of a new level of organization, emergence creating additional properties to the whole.

The time lag is accentuated between micro-mechanisms and the final emergent properties, with each additional level of interaction. Going from an infant's brain to its adult version requires decades of dynamic and interactive construction of neural codes; while the assembly or disassembly of an atom by quantum forces is almost instantaneous even for our most vivid instruments.

Another way in which emergence is concealed in information is the way that information is organized itself.

To define a system only by its elements and their relationships is a hasty summary. The universe of relationships is rarely homogeneous, often very heterogeneous. By making the system a network of its parts, some are nodes of greater weight than others. The main ones determine subnets containing more information (less uncertainty) than the whole system[25].

In other words, significant subnets contain, for the macroscopic eye, additional information to that of the entire system. This information has a representative function. It can be selected by the macroscopic context for its particular properties. It is likely to be protected by macroscopic interactions. Only this subnet of the initial system is affected. The system can shrink to the part in question, without its macroscopic status changing.

There is indeed a retrograde causality of the macroscopic function on the system, resulting from the heterogeneity of the underlying information. Common mechanism in biology.

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Attractors and models

Attractors focus on a system in space and time. The model is the formalization of system attractors.
An attractor gives rythm the interactions. Internal clock of the system.
The scale of resemblance, accuracy towards uncertainty, is divided by the attractors in 4 zones: accuracy (virtual center of the attractor), similarity (central zone where the deviations are negligible), hanging fringe (between the similarity and non-similarity), uncertainty (zone too rustling to talk about similarity).
The fringe or “poised realm" (Kauffman) is where the system is hesitating between two states, constantly subject to the pressure of a conflict.

A model manages to marry the reality even when it is approximate. Tolerance area where the model remains effective. Possible because the

[25] The emergence of informative higher scales in complex networks, Brennan Klein, Erik Hoel, 2020, https://arxiv.org/pdf/1907.03902.pdf

reality is itself approximation on its constitution (the outcome of the system is unchanged despite the constitutional differences).
Interest to be content with *faithful* models rather than *ideals*. Less discouragement before the impossibility of accessing reality per se. The reality self-represents the same way.
A model remains a simulation. Not a self-organization. It does not live its information.

Chaos is not a mess but a *sluggish order*, with stabilities difficult to delimit other than with temporary attractors.

What makes the flow of a fluid go from laminar to turbulent, from periodic to chaotic? Both are deterministic, linked to the simultaneous interactions of their multitude of molecules. The change from laminar to turbulent is not gradual. There is a threshold where the change is brutal. The chaos of turbulence is not devoid of order. We discover geometric shapes, strange attractors. This subchapter shows new aspects of order, how it builds levels of reality on information hidden in initial relationships. It thus achieves a real self-modeling on which our mental models are based.

The notion of order is associated with those of balance and stability. It involves boundaries to the parts of reality so designated, thus transitions between these parts and others, with preferences for one direction or the other. Equilibrium vocabulary: fixed point, zone of equilibrium, periodic orbit, attractor. Transitions: critical point, inflection point. Transition preferences: metastable (apparently stable system but that a disturbance can lead to an even more stable state), self-stable and super-stable (a self-stable system spontaneously returns to its 'legitimate' equilibrium in the event of a disturbance ; it is said to be super-stable when the return is very fast, more than when it finds this point of equilibrium for the first time). Here emerges the idea that several zones of equilibrium are possible, some preferred over others. It joins the notion of dominant and secondary attractors.

At a higher level, the organization of the set of attractors defines the stable and unstable, dominant and secondary. Supersystems understandable only by taking into account the complex dimension.

An attractor is a figure focusing the evolution of a system. It is therefore a *spatiotemporal* figure: point, space, pattern, set of points representing a particular topology. The temporal definition of the attractor gives it characteristics in this dimension: start, end, balance, inflection, crossing. The model of a system can be seen as the formalization of its attractors. For the downward look, the system is summarized by its attractors within its temporal limits.

The boundaries are blurry. 'Start' and 'end' are transitions to other systems that include the same elements. The separation may seem arbitrary, property of the observer. However, it is also about a self-delimitation of the system, by the existence of its temporal attractor.

For example, we conventionally define the beginning and the end of a human person as their biological birth and death. This is the position of an observing mind. For this observer, the limits of human existence are blurred: the person is characterized before birth by the genes that constitute her. The genes themselves have an older history. After death, the person leaves psychological, social and material traces. Lasting traces in her relatives, sometimes timeless in her works. However, from the position of the person herself, existence begins at birth and ends at death. It is a biological system that delineates itself between these two points.

We have here an ontology of the person, based on the interaction between her biological elements, on the succession of her mental states, which is also a representation of the absent existence of the separate elements. Individual existence is an emergence, a summary, a temporal attractor. It is perfectly anchored in reality. It is not a virtual representation, which would exist only in the eye of an observer located on another level of reality.

The figure of an attractor is more or less ordered. It can be a single point (a swinging pendulum is represented by the point where it will stop), a curve, a surface, or even a figure that does not belong to a whole number dimension, such as fractals. We speak of a strange attractor, a set of points drawn in a discontinuous manner by the dynamics of a system, for

example in the flow of a fluid. Figures can be chaotic (exponential dispersion of the attractor's orbits) or non-chaotic.

An attractor makes the interactions loop or rhythm. It determines an internal *clock* in the system. Whatever the proper time of the interactions, they create an independent, contextual time, which is the elementary time unit of this clock.

By defining the order in the previous chapter, we placed it on a ruler between exactitude/certainty and resemblance/uncertainty. Attractors are an important tool for manipulating this slider. They indeed identify many names used on the slider: benchmark, ideal, accuracy, certainty, virtual/real.

The center is what best identifies the attractor in reality: an area grouping together elements/integrated information. Integration means ignoring so-called insignificant information. As for systems, attractors self-define the limit of their importance in the relation of their constituents. *Power* finds one of its most fundamental definitions here: it separates important information from negligible.

Sometimes nothing known is located on this border. The separation appears sharp, brutal, *without thickness*. Sometimes things are there and create a kind of no man's land, a *fringe of uncertainty*. The boundary grows thicker. Beyond that is the realm of chaos, non-order from the attractor's point of view. It itself becomes 'negligible'. It stirs up disorder, participates in noise reducing the range of rival attractors possibly nearby.

Because chaos harbors many attractors. Depending on the context, the order jumps from one attractor to another. The system sometimes maintains its properties. Everything is stable over unstable interactions. Outside a tolerance range, the balance shifts: transition, crossing, disaster. The fringe of uncertainty has received different names: critical phase, edge of chaos, Stuart Kaufmann calls it the *poised realm*. The system hesitates between states. Pressure of conflict between several solutions. We could also say 'casting'… after all it is a question of the system choosing, among the candidate destinies, the most promising.

Some examples of attractors at different levels of *Diversium*: Social: famous people, great discoverers, idealists. Individual consciousness: parents, outstanding educators, reference books. Biology: the different cell varieties. Biochemistry: self-replicating molecules. Etc.

A most interesting example concerns neurons and goes to Walter J. Freeman[26] : The neurobiologist created phase portraits depicting the activity of neural patterns in the rabbit olfactory bulb. In the absence of a known scent, this portrait looks like a strange attractor. The patterns oscillate in an uncoordinated but not random manner as well. They do not form a stable representation. When a familiar scent is presented to the rabbit, the live portrait becomes orderly, stable. An undifferentiated representation becomes differentiated. Freeman makes these pattern-to-pattern shifts the intermediate level of information between unitary neural activity and the brain's overall synthetic activity. Concept that goes perfectly with *Stratium*. The stratified functional brain multiplies the stages of these intermediate levels of information. It is their integration (synchronization of patterns) that forms the higher concepts.

Examples of poised realms also exist at all levels. In Shannon's communication, it is about the border between the part of noise which still leaves the codified information comprehensible, and that which makes it inaudible. In consciousness this is the moment when the range of possible choices presents itself for a person about to decide on a behavior. Which one will she switch to? In a social relationship it is mediation between interlocutors, before one of them succeeds in asserting her position or correcting it.

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Model and reality

A model is a virtual representation. It serves the observer to manipulate a level of reality to which her mind does not have direct access. But, and this is an essential point on which we will insist several times in this book, the

[26] Freeman, W. J. (1991) The Physiology of Perception. Scientific American, Vol. 264 (2), p. 78-85

model succeeds only because it espouses a very real representation in the level in question.

The model would be useless if it only said the initial conditions and set the interactive rules. It is useful because it provides a *result*. It gives the propositions on either side of the sign "=". The result is the representation of the *realized* interactions. It has particular properties not included in the initial proposal. Reality has well constructed a representation of a part of itself. It has built an extra level of its existence when the outcome surimposes itself on the interactions, that is, the outcome holds while the underlying interactions continue, sometimes slightly different, but the outcome does not change.

This is where reality undoubtedly approximates. It approximates several of its parts, different interactive sequences, under the same representation. A human existence agglutinates an innumerable quantity of mental states in a unique existential representation in the person: « I am the same individual ». Each mental state is itself the agglutination of a myriad of neural biological states. Etc. Each of these states, each of these existences, is the fused approximation of a multitude of contents.

Each of the states is a system which is self-delimited by its own relations and self-represented by a temporal attractor. This self-representation is what our mind tries to reproduce with its models. Here I propose a paradigm shift: *portraying reality through a mental representation is no longer a specific approximation to our mind; it is to continue what reality itself does: to represent itself through approximations*.

Our mind creates, of course. What it creates is the most faithful reproduction possible of 'real models', that is, approximations established by the elements themselves. It is in the approximation that it is possible to understand this a priori astonishing phenomenon: an imperfect model works, and often it works perfectly within certain limits. If we are not aware of these limits we even declare it *ideal*. In doing so we simply forget that any model is only an approximation, including for reality itself. There are no ideal role models, only devotees. A poorly faithful can work because its approximation is not too far removed from that of the perfectly faithful.

This transforms the pejorative view we may have of the incompleteness of our models. We work on isolated systems when they never are, both spatially and temporally. Initial and final conditions are unclear. When we study one level of information over a period of time, we assume that the underlying constituent levels, much more frantic in existence, remain unchanged. We pragmatically blind ourselves to these small approximations, but an irritating gleam in our minds reminds us that they seem to prevent the model from perfectly molding the essence of the real.

Well that embarrassment no longer needs to be. Reality does the same. It approximates. Triumph of pragmatism. It is becoming lawful to keep your nose in your model and to laugh at what-will-be-say-about-it? The role of the model is to manipulate reality to the level where we want to do it, *as it already does itself*.

We use the same process as the universe being self-organizing by self-modeling. To construct a level of reality is to establish a representation of its constituents, a shortcut of their history, a discontinuity of time surimposed on the underlying discontinuities. The real represents its own essence, in an elementary emergence which becomes a new *plane of essence*.

Our mental representations are mimetic of those of reality. Mimetics means that it is the same integrated information, carried by a different medium: on the one hand the elements of reality represented, on the other our neural networks. *Word-of-real* espoused by our *word-of-mind*. Word-of-real and model are made of embedded information that is similar or has a similar meaning, on different physical media.

Our universe finally becomes truly monistic, self-representing and thus creating new information planes. The surimposition of a considerable number of these planes gives it access to a sophisticated representation of itself in our individual minds. It does this primarily through mimicry and conflict between these minds, which build additional social information planes. The sequence is never over. We are now applying transformations to our own minds, seeking to replicate them and extend them to other media. We are pursuing the enterprise initiated by material reality. Nothing

more expected: we are an integral part of it. At least, in this vision, *it is no longer necessary to separate from it*.

Defining models as more or less faithful approximations but belonging to the same global reality opens up new perspectives. It is possible to classify them according to different dimensions:

1) According to their fidelity in the approximation: the models range from *decryption* (search for patterns, punctual regularities, attached to a temporal attractor) to perfect fidelity (all the integrated information of the word-of-real is in the model).
2) According to the temporal dimension: *dynamic* models describe the transitions from one temporal attractor to another.
3) According to the complex dimension: *autopoietic* models: organizing their own representation, the only category of 'whole' models, surimposed, since including the essence of their constituents. Only an autopoietic model is able to reproduce human intelligence, to create AIs with the same skills.

The limitations of our models come from their approximations, but it is because reality also makes approximations that our models act on it. They are empirical and obliterate intermediate levels of reality. They need only be a faithful approximation to be effective. Fidelity concerns the initial conditions. Such a chain avoids straying from the march of reality. It is *as a sequence of approximations* that our mental representation becomes a perfect simulation.

However, a model remains a simulation, *not a self-organization*. Initial and final states are frozen images in our neural patterns and technological instruments, unable to transform into each other. Lacks the self-organizing drive.

A model is the conflict resolution it portrays. It's stable. It describes the initial conflicts without harboring them. The self-organizing drive arises from the presence of conflict *in essence*.

Does chaos really exist?

Chaos is not a set of random interactions, but a series too complex to be modeled by a simple algorithm, that is to say an incompressible quantity of information, equivalent to the number of these interactions that they describe. This is how order is defined by the extent of the possible compression of data, while disorder is represented by their incompressibility. The existence of real chaos is uncertain, because it is impossible to verify that any apparently chaotic system cannot pass again after a possibly very long time by one of its past states, and resume the same cycle of interactions. Perhaps we should in fact limit the definition of chaos to an organization plane: this one is exposed to breaks in symmetry from other planes, which can be said to be 'random' within the framework of local rules, but we cannot be sure that the entire stack is chaotic and severely unpredictable. Determinism is not dead, it is out of reach.

Chaos harbors stable or unstable attractors. Stable attractors persist over time of observation, without limit as long as conditions do not change. The compulsory energy dissipation of the system (never perfectly isolated) means that it must receive a continuous supply of energy (classic example of Benard cells).

Unstable attractors are temporary, disappear from observation and then reform. They generally relate to uncountable systems. The number of possible states is so large that the estimated duration of the universe is insufficient to review them all.

A typical example is the earth's atmosphere. It is said to be chaotic: the flapping of a butterfly's wings definitely changes its destiny. But its other face is that of regular phenomena: high and low pressures, tropical cyclones, monsoons, etc… Evolving attractors. Impossible to predict the precise location and shape of the next one, but their return is certain, seasonal. Order exists in chaos. The immeasurable number of possible states of the atmosphere makes it less predictable, yet it recurs, that is, states follow one another instead of exiting a probability curve. This is not a mess but a 'flabby' order.

Should we not then abandon all Manichaeism between order and disorder? Let's keep the 'more order' and 'less order' signs in our toolkit. All these rulers are expressions of the T<>D conflict, as we will see in the next chapter. In this sense, the abandonment of Manichaeisms does not make reality more vague. On the contrary, it unites. The sliders come from the same kit.

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Entropy

Heat = energy transfer (upward) = *work* (downward).
The thermodynamic definition of entropy retains the notion of substance, while the *statistical* definition keeps only information. Entropy becomes equivalent to the *measurement of* entropy. Look out the confusion.

The measure of uncertainty of Shannon or *Informational Entropy* (Ei) quantifies the knowledge of a question by the distribution of probabilities (p) of each possible answer.
Ei minimal = all p have the same value. Ei maximum = All p are 0 except the certain answer (p = 1).
Information is everything capable of changing this distribution.
As representation of a distribution, the Ei is an emergence, a compression of the information that does not make them disappear.
It is a *particular* emergence in the complex dimension. When different levels follow the same entropic law, it is because of the similarity of the elements and the equiprobability of the states, and not because entropy would be a transcendent principle.

Ei equations and thermodynamic entropy (Eth) are identical.
What separates them is the addition of a 'hardware' unit to the constant of the equation for the Eth. The information becomes 'energy transformation'.
The Eth has thus become the application of the Ei at certain levels of material, after having historically been the first described.

The second principle formulated as "entropy can only increase" is an approximation of reality. Fluctuations in entropy allow temporary decreases. It is its average value that only increases.

Probabilities hide certainties at the limit of large numbers.
An unlikely state becomes impossible by a realistic approximation.
The radical contradiction between random and determined dissolves.

The second principle is epistemic. It is for the downward look of the macroscopic observer that entropy can only increase.
The first principle (conservation of energy), on the contrary, deserves the status of ontological law. Both looks agree to see in energy the fundamental essence of the real.

Heat, work

'Heat' is in thermodynamics the description through the downward look of an ontological principle: the transfer of energy. Stirring of molecules. But what is the cause of this agitation, more fundamentally? If we go down the rungs of micromechanisms, we are helped by other descriptive tools, which are forces, without being able to stop there. How are forces more fundamental, other than our inability to descend lower?

We have gone through many levels of information. No original source of the agitation of the molecules was identified by the downward look. This one does not know how to say what heat is, with the only framework of information.

Heat is something more. This is the *change*. The principle of change cannot be described in terms of information. It is underlying it. *Heat is an ontological principle that escapes information*. Can it be likened to energy? Not to energy as a constant or symmetry in the information structure. Energy is constant while heat is its movement. Movement of its free fraction. The bound fraction is a store of energy but not of heat. Heat is the result of the release of energy, not the energy itself. Heat is change added to energy.

Separation of low interest at our stage of knowledge. Dismembering a fundamental concept is only of interest if we have its even more fundamental constitution. Keeping the concept of 'tension' within 'energy' doesn't change anything about the subject. But it is worth pointing it out. Indeed, semantics is often at the heart of our difficulty in understanding the fundamentals. Downward and upward looks compete to designate them.

Everyone uses their vocabulary. Two terms with seemingly different meanings refer to the same thing. Examples:

Mass and *Higgs Field*: Matter appears as 'mass' to the downward look and 'interaction of fields' to the upward look. In the middle, what is looked at is a remarkable stability of the organization of the real called by common accord 'matter' or 'concrete reality'.

Organization and *information*: Reality appears organized to the downward look and a simple collection of information to the upward. In the middle, what is looked at is a regularity of the sequence determining its own unit of time, independent of its micromechanisms, called 'element', 'individuation' or 'entity'.

Work and *heat*: What to do with the notion of work in thermodynamics (and elsewhere)? Work is only seen through the downward look. For the upward it is heat, a transfer of energy linked to the unfolding of processes. Work = heat + intention, the latter only existing for the downward look. There is therefore no need to introduce work into an ontological description of reality. The upward concept is 'heat' or 'change'.

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Discouraging entropy

The most intuitive way to define entropy is to think of it as the absence of information.
The more entropy increases, the more the absence of information increases.

Entropy is a concept that instills great discouragement. The universe would inevitably evolve into disorder. Any little order we could give it would produce more disorder elsewhere. But in the end, isn't order that, a greater imbalance between disorders?

Why despair has become embedded in the concept of entropy can be explained as follows: entropy arose in a restricted view of physical reality: the modeling of the work done by heat exchanges. Systemics has extended the concept of thermodynamics to other levels of reality. Ex-flux of heat, can it succeed in its conversion into a transcendental principle, like energy? Not so simple, as we will see.

It is possible to state the second law of thermodynamics only with reference to *energy*: free energy turns into bound energy, while the opposite is not possible. The measure of *entropy* is the ratio (free energy[27]) / (bound energy). When there is a gradient between two bodies, whatever its type (heat, electric charge, pressure, kinetic energy, etc.), an entropy flow runs through this gradient and systematically decreases it. The flow runs in one direction. Another formulation of the second law: in a closed system any change in entropy is an increase.

The thermodynamic description uses two categories of concepts: the category of substances associated with their movements (energy, current, flow, direction), and the category of measurements (quantity, increase, decrease) i.e. information. The statistical description of entropy, on the other hand, *only uses information*. The elements concerned (particles, molecules, cells, dice, automata, living beings, etc.) are no longer important; only the information contained in their appearance matters.

This generalization is a source of frequent confusion in your reading on the subject. In the thermodynamic description it is essential not to confuse 'entropy' and '*measurement* of entropy'. Entropy is substance just like energy. It has immediately noticeable physical effects. It factors the temperature to give the amount of heat energy. The entropy *measurement* accounts for the *evolutions* of the substance. Information is not the substance of the thing. While in statistical description, information *is the substance* of entropy. 'Entropy' and 'measure of entropy' are synonymous there.

The same kind of incident is encountered with regard to energy. In a classic physical description, it is imperative not to confuse energy and its

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[27] From a structuralist point of view, the terms 'free energy' and 'bound energy' should instead be reversed. The "free" energy available for work, that is, transformation, is compartmentalized energy. It comes from the immiscibility of the parts of the system. Whereas "bound" energy is that released by diffusion within the system. This reversal of terms better corresponds to our intuition of a constrained energy to perform work and the free energy intrinsic to the system, which we cannot enslave for our own goals.

measurement. While their assimilation is inherent in the structuralist vision, where all is information. Semantic imprecision: the thing is called after its measure. We must be alerted to the presence of this amalgam, otherwise the equivalence of the descriptions is incomprehensible. The generalization imposes to say the descriptions 'equivalent' and not 'similar'. It is important not to overshadow the paradigm shift.

Informational entropy

Shannon's information is a digital encoding of the state of knowledge. This state can be represented as the attribution of a probability p to each conceivable answer to a question. Knowledge is complete when $p = 0$ for all answers except one, where $p = 1$. Information, in this context, is anything capable of changing the distribution of probabilities between answers. Shannon's measure of uncertainty, which he called 'entropy' (we will say 'informational entropy' *Ei* to differentiate it from thermodynamic entropy *Eth*), is the quantification of knowledge about a subject by the distribution of probabilities. We will decipher its mathematical formulation later.

The Ei is an emergence, for two reasons: 1) It is the *representation* of a distribution, emergence hidden in the sign "="; entropy is synthetic. 2) It obscures the contents of the 'knowing', 'question' and 'answer' elements. It can be simple numbers or composite information. Even simple numbers applied to reality are in fact representations and hide composite information. Mathematical models deal with composite elements.

Another limitation: the Ei assumes that all the possible answers are known (perfectly known initial conditions), while the reality is less generous. In fact the Ei presupposes that there is a foundation perfectly known to reality (not necessarily deterministic), ensuring reliable initial conditions.

Ei is therefore part of the principles of complexity, as emergence, and contributes to its discontinuity, reducing itself to independent organizations for each level of complexity. Shannon's information is essential for understanding the communication between elements of the same properties constituting this level, and for their instrumental measurement. However, when several levels follow the same entropic laws,

it is because they have the same characteristics in terms of similarity of elements and equiprobability between states.

The Ei is not a *transcendental* measure with a complex dimension, except in finding a relation between successive measures from one level to another. But precisely there is no proportionality between the decrease in entropy of an organized system and the compensatory increase produced elsewhere. No universal exchange value. Like information, it has meaning only through the related elements. How do you compare its rates when the elements are radically different? As a measure, its effectiveness decreases as the scale of complexity increases, as composite elements become less alike. Humans have disparate behavioral 'properties'; the Ei only applies to their communication codes taken separately.

To understand the principle of Ei let us first look at it in the levels where its efficiency is maximum: matter and in particular thermodynamics. It is essential to go back to the mathematical descriptions of Ei and thermodynamic entropy (Eth), to understand why they are equivalent, and how through Eth we can manipulate energy.

Relationship between informational and thermodynamic entropy

In practice, the Ei (S in the equations) is calculated as follows for a question Q associated with a knowledge X:

$$S(Q \mid X) = -K\sum p_i \ln p_i$$

K is a scale constant. The 2nd factor is the sum, for each possible answer from 1 to i, of its probability p_i multiplied by the logarithm of this one.
S is minimal if one of the p_i equals 1 (and the others are 0). S is maximal if all p_i are equal.
The information ***I*** contained in a message is the difference between the entropies before and after the message (knowledge X has become X'): ***I*** = S(Q/X) - S(Q/X')
Shannon's measure is also defined as the number of decisions needed to sort a mixture of possibilities and extract the only certain one.

While Eth is the measure of a conversion between thermal and mechanical energy. This is the Clausius equation: between 2 states X and X', the entropy variation S - S' is:

$$S - S' = \int_{x}^{x'} \frac{dQ_r}{T}$$

This is the addition of each increment of added heat (dQr) divided by the absolute temperature T.

The Shannon and Clausius equations are shown to be identical, justifying the common name 'entropy'. The mathematical frameworks of Ei and Eth are similar. However, Eth is a measure of energy transformation. What is the relationship between entropy-information and entropy-energy? Should we assimilate them?

The explanation lies in the choice of the constant K. Commonly in communication, K = 1/ln2, S then measures 'bits' of pure information. This choice is dictated only by the numbers and not by any characteristics of the elements involved. The smallest amount of measurable information is an element that may be in two different states for a single property, for example a magnetized or non-magnetized magnet, or a gas molecule present in one chamber or the other after opening a communication between the two. If we do not know the state of the element, S = k*ln2. Providing minimal information (the molecule is in chamber A or B) eliminates uncertainty (S = 0). One bit of information is therefore worth k*ln2. It is devoid of the slightest *material* unity.

In thermodynamics, K = kN where k is the Boltzmann constant (1.38×10^{-23} joule/°K) and N the number of molecules in the system. The smallest measurable change in thermodynamic entropy is 10^{-23} joule/°K. Thermodynamic entropy is thus expressed in joule/°K which makes it a material value, and no longer just a measure of pure information.

The obstacle to connecting virtual Ei and material Eth comes from the fact that historically scientists have described a perfectly physical phenomenon (heat exchanges) without realizing that it was based on a universal statistical principle.

Ei is purely mathematical and can be applied to any uncertainty. Eth is its application to the 'atom' and 'molecule' levels of matter. It is the attachment of a unit of energy to the constant K that 'materializes'

information into *substantial* entropy. Shannon's Ei is intended for virtual codes of communication while Eth describes modifications of matter. Their dissimilar appearances derive mainly from the volumes of information involved in thermodynamics, which have nothing to do with those of Shannon's communications. But there is no contradiction between the two entropies, nor with those used in other fields, as long as the questions asked are *realistic*, consistent with the essence of the systems studied. All of these entropies are applications of Ei to hardware systems, the quality of which appears in the addition of a hardware unit.

The relationship between information and energy is then this: information is a description of energy, without knowing the essence of what is being measured since it is already, at a minimum, composite information. There is no need to bring in the notion of substance here.

Information makes the link between the quantitative and the qualitative, but not between the qualitative, because of the organizational disruptions of reality. It is not a description of the complex dimension, only of its most individualized levels.

Entropy thus meets its best success, as a measure, at elementary levels of matter. The stacking of the underlying levels is weak and the models are very realistic, in their conformity to the essence of what is described, and in the approximations made on the initial conditions, the limits of the system, the independence of the system. level. Things change as we rise in the complex dimension: too much information is neglected, the initial conditions are overly simplified, the level independence is very relative, the elements are considered too arbitrarily similar, in summary: the approximations are no longer realistic.

Can entropy only increase?

Second principle: « Any transformation of a thermodynamic system is carried out with an increase in the overall entropy including the entropy of the system and of the external environment ».
Entropy is fluctuating enough to spontaneously decrease. It is its average value that keeps increasing. Validating the second principle involves

choosing a time scale that is much larger than that of the micromechanisms. The second principle, in reality, *is an approximation*.

The same is true for informational entropy. The additional information increases the Ei to the certain response (maximum Ei). But as in thermodynamics this is only true for a sufficiently large time scale compared to the elementary time separating events/information. A one-off decrease in Ei is possible.

Take the example of a repeated roll of two dice to find out the average sum they display. The series can begin with a repetition of the number 8 which lowers the Ei (the probability of 8 becomes greater than the other numbers). But 8 is not the final answer and its occurrence decreases in subsequent draws. The Ei initially drops and then rises again. The results raise a Gaussian curve more and more centered on the 6. We have indeed seen a temporary decrease in the Ei, which can be repeated, with an amplitude which decreases as the number of casts increases.

Let us not forget in the definition of the second principle the term 'transformation'. Before being itself causal, the second principle has a cause: the transformation of the system. Where is it from ? This is a change in the constraints on the system. Additional symmetries are permitted. Amplified degree of freedom. The second principle appears when there is a change in symmetry. Symmetry is the underlying more transcendent principle.

The second principle translating the diffusion of the new allowed symmetries, with evolution towards the most probable state, we can say that it is simply a reformulation of this principle of diffusion. Indeed it is not necessary to create an additional principle to say that a system without constraint evolves towards its most probable state.

Behind the second principle we therefore find those of diffusion and symmetry, which are more fundamental. We are indeed dealing with a hierarchy of epistemic concepts. A principle thought to be "fundamental" is an emergence over others. The least dismemberment of them is perhaps only temporarily.

Interpretation of entropy for a macroscopic entity

We have just seen that the realistically formulated second principle does not prevent entropy from decreasing. It is purely statistical. Let us return to its ascending definition: in an isolated system in equilibrium, the probabilities are equal for each of its accessible microstates. For the classic example of chambers filled with two gases placed in communication, the molecules are distributed homogeneously throughout the available space. It is wrong to say that the system cannot return to its initial state. No, this is an accessible configuration. But the number of microstates where the molecules of the two gases have all returned to their respective chambers is a tiny fraction of the enormous set of all possible states. So much so that this part is *really negligible*.

The vast majority of states are a homogeneous mixture of the two gases. Their macroscopic properties are so similar that when passing through them, the system appears to be 'in equilibrium'. Note: if the system goes through a more heterogeneous state (imagine that it miraculously returns to the state of two separate gases), there is nothing to encourage it to stay that way. The phase of the system is not changed. The odds don't change. It is the capital difference between an order devoid of superior control (called 'chaos') and an order inserted in a self-organization, that is to say maintained by a retro-control resulting from the new properties of the whole that it created.

So entropy does not mean that reality 'forgets' that it can revert to a statistically improbable configuration. Assuming that the context is maintained, the system is an infinite sequence containing each configuration in infinite number. Reality explores them all in the time dimension. However, for really large numbers, the time required for this exploration is an eternity compared to the duration of a macroscopic system. Entropy says that from the point of view of a macroscopic entity, the system will never be able to revert to its initial state if it is improbable. The improbability actually hides a certainty. The certainty is not that the improbable state necessarily fits into the infinite sequence of reality: on the contrary, it is that « I », a macroscopic entity, *will never be confronted with this*

state. Approximate certainty and yet it has the force of reality. A 'simplification' is well registered in the physical reality.

This conclusion has profound consequences. Certainty hidden in the probabilities at the limit of large numbers. This dissolves the radical contradiction between random and determined. They too are connected by a slider, the size of which within a system is proportional to the number of its elements. They transform into each other by changing the timescale. Leap of organization.

Entropy evolution

The foregoing reflection makes the second law an epistemic concept rather than an ontological principle. It is from the point of view of the macroscopic observer, and its limited time scale, that entropy can only increase.

The first law, that of the conservation of energy, seems, on the contrary, to be strictly ontological. Energy sticks as closely as possible to the fundamental essence of reality. The law of conservation suits it very well. Essence independent of transformations over time.

That the two laws of thermodynamics do not belong to the same view explains the contrasting seduction they exert on theorists. Together they are the cornerstone of physics, but physics hesitates at the threshold of the complexity of the world. Would the second principle be blocking, because it is epistemic, like the 'Earth center of the universe'?

The second law indicates that there is a loss of the information contained in the transformations. The universe would be born with a capital of information and see it wither away. On the assumption that the universe is only information, the two laws become incompatible since 'entropy = loss of information' would also mean loss of global energy.

By maintaining the independence of the concepts of energy and information, as well as the validity of the 1st law, 3 situations are possible:

1) Energy is conserved but information decreases (informational entropy increases). Contemporary vision of physicists. Default: it is based only on the elementary levels of matter. Certainly by their extent they represent the majority share of the overall volume of information in the universe. Nonetheless, this is a reductionist view. It neglects the complex dimension.

2) Energy is conserved and information increases: creation of order, which more satisfies what we observe on the arrow of time (soup of quantum fields evolving into minds capable of abstraction). The second law is reversed by taking into account the complex dimension. This forces us to accept the anti-reductionist idea that one piece of information can be surimposed on others.

3) Energy and information are conserved: possible if creating order in one place takes it away from another. For example, the manufacture of a manufactured object causes heat dissipation: the appearance of additional order at one level is compensated by a loss at lower levels: molecular if a chemical process has been used, particulate if it is. is electricity. Each level of organization would constitute a reserve of order that could be consumed by other levels. The entire information would be kept. We do not have an information metatheory to refute or confirm this speculation.

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What is energy?

In summary: Energy is a fundamental identity brick of reality in the spatio-temporal framework. It is impossible to know the nature otherwise than through the information. However, its independent existence is attested as a substance of the conscious experience, which can not be reduced to a sequence of information.

Usual responses to the definition of energy:
Energy separates the effective reality from possible realities.
Ability of a body or system to produce work.
Energy is what, during the transformations of reality, does not change.
Contradictory definitions because they mix energy, measure, transformation, transmission.

In the end no one knows what energy is. Concept too foundational on which a single mental tool seems to bite: the information.
Energy is exercised through the entire complex dimension. Each discipline sees a specific form (atomic, mechanical, chemical, biological, mental).
Joint point: the division between *bound* and *free* energy. The free is alone available for work. But the bound can be freed.
Is energy *change* (work) or *its absence* (conservation law)? Do not confuse energy and transformations, involved in any change.

The bound energy is a paradoxical *locked-in motion*. Reserve for the part of the movement that is no longer effective for work.
The organization is the transformation of the free part to the bound part of the energy, by levels of successive complexity.
The remaining free part therefore decreases by climbing the complexity. Does the work that this energy can provide decreases in parallel? No, because the complexity builds an information structure that channels this energy to make it more efficient.
Remarkable retro-control on the stack of bound energies. The concepts of atomic theory, of insignificant energy, were able to release the fantastic bound energy of the atom.

'Interaction' may mean 'interact' or 'be interacting'. Flow of energy trading, or equilibrium.

The move of energy (its *tension*) is not the language that describes it (the information).
Whatever its form, the energy of one thing is the multiplication of two factors, *in-tense* and *ex-tense*. The in-tense is specific to the form taken by energy. The ex-tense is the amount of this form represented in the thing, its value scale in the form considered.
A system model is accurate only if there is a way to combine the settings so that something remains constant over the evolution. This something is energy.
Crucial difference between saying that energy "is constant" or "is *a* constant". *It is* (regardless of the model) or *is not* (is only model information).
Dilemma between energy-substance and energy-information.
In favor of energy-information: energy is only reflected through interactions, either information. Bound energy is an information structure.

in favor of energy-substance: the information is intrinsically hierarchical ("forms" of information), not energy (there are no energies of energy but also forms). Energy reflected in the conscious experience, which is not a pure assembly of information. Fusion and no sequence of mental events, propelled by an *impetus*.
Solution in *Surimposium*: the substance proven by one thing is the surimposition of its levels of information.
The dilemma loses its importance. The substance is defined *inside the accessible complex dimension*, not at its speculative ends.

Energy is a subject as essential as it is tedious and complicated. For those who do not have the courage to engage in this long subchapter, here it is summarized in a few lines:

Energy indices:
-The energy is conserved over time.
-Uncertainty over energy is closely related to uncertainty over time (according to Heisenberg's quantum uncertainty principle).
-Mass and energy are the same thing ($E = mc^2$)
-The energy is related to the information by the Boltzmann equation $E = k*\log(n)$, n being the number of bits changed by the calculation of the interaction involving the energy E.

From these clues, energy is seen as a fundamental identity brick of reality in the time dimension, impossible to know other than through information. However, since every real entity is made up of energy, all experience energy as their substance.

Abstraction or substance?
Let's tackle this tricky question with some classic answers:

Energy separates the actual reality from the possible realities.
The energy concretizes a reality among all that it could be if it had no rules / no intentions. Without doubt the oldest and most general formulation possible. Energy reflects the choice of one reality among others. Includes the psychological aspect of energy realizing a personal

world view. This definition borders on that of reality in essence, a common thread that is self-fulfilling among the possible.

The capacity of a body or a system to produce work.
More physical definition, which derives from the previous one. Energy is present in every element of reality capable of influencing the course of the world. Empirical definition, based on constituted reality, regardless of the origin. Do physical theories manipulate energy through a multitude of information, but say nothing about what it is, substance, illusion born of numbers? In physics the mysteries are called constants.

Energy is what does not change during changes in reality.
It thus approaches the notion of substance. The shape changes, described by the information. The substance remains, immutable. In physics: energy is the quantity conserved in temporal translational symmetry.

All definitions of energy speak of *forces*. All these influences are brought back to the *fundamental forces*. The fundamental forces are reduced to *interactions*. Hierarchy of terms constructed to describe a *tension* between elements of reality. Tension which animates the unchanging thing called 'energy'. Constant examined from a particular angle at each level of observation. The constant energy is ontological. As for tension, is it also ontological or is it only the succession of our mental states that gives the impression of unfolding?

No one knows what energy is.
This is the conclusion after reading the classic answers. Concept too foundational to still be divisible by others. To say, for example, that energy is 'change', 'movement' or 'work' is to add the notion of transformation to that of energy. We have already moved away from it by looking at its mutations and not just its essence. The great works on energy speak only of its forms. The discourse on the essence of the concept is very short. The rest is *disciplinary*, whether it is science or mysticism.

Be careful not to confuse energy and its measure. The notion of power relates to the *quantity* of energy and not to the energy itself. Only its aspects

vary. Information describes energy and is itself assembled by other information. Which one appeared first? Chicken and egg story?

What all disciplinary descriptions have in common is the division between bound (potential) and free (kinetic) energy. Varieties of bound energy: nuclear (energy maintaining the structure of the atomic nucleus), chemical (stored in atomic and molecular bonds), mechanical (elastic tension, compression of a spring), gravitational (correlated with elevation and mass of an object). Varieties of dynamic energy: radiant (electromagnetic waves), thermal (heat correlated with molecular agitation), movement of objects, sound waves, electricity.

Observation: energy is a universal notion but this universality omits the qualitative of its various aspects.

If it is impossible to say what energy is, let's try to narrow it down by specifying what it is not. As philosophers we know that it is not possible to access the essence of a thing, only to mold it through representations. Energy intuitively seems close to the essence of the world. Is it a faith or a substantiated idea? Let's collect clues.

Mistake 1: Equating energy to the sum of its forms. As if in Darwin's day we had defined heredity as the sum of the observations of transmission of phenotypes within species. No, the level of definition of inheritance happens to be the gene (unknown to Darwin).
Clue 1: *Today the true level of definition of energy is unknown to us*.

Mistake 2: Saying that energy is 'nothing' (substantially), because it is only a mathematical quantity. It is to reduce reality to its structure. The energy is behind all the magnitudes that are applied to it. It is the only thing that could be other than informative, independent, a substantial thing to which information is applied, an impulse mobilizing information.
Clue 2: *Energy is the closest thing to a substance*.

Mistake 3: Reducing the definition of energy to physics. Ubiquitous weakness of eliminativism. Physics has not identified a foundation of

reality, knowledge of which would unwind the rest of the observable like the thread of a spool.
Clue 3: *Energy is a principle exercising through the entire complex dimension*.

In physics, energy is assimilated to the elasticity of space-time itself (energy-momentum tensor). In other words, it is a measure of the degree to which a spatial and temporal distribution of matter can vary (representing the capacity of this physical system to perform work). *It is a purely mathematical magnitude*, not a substantial *thing*. For example when you do your shopping at the supermarket you can buy several items of the same value, which have nothing in common by nature: tomatoes, book, toy, soap… The price of the items, in this analogy, is the equivalent of energy in physical models. It is an *exchange* value, independent of what is exchanged.

However, this is a definition of energy anchored in the spatio-temporal framework, which encloses the essence of our observable reality. Descriptive framework for the *movement*. This framework is not ultimate. It is reducible to the mathematical spaces of quantum field theory, and then undoubtedly to others. The reduction explains neither the origin of energy nor its transformations in the complex dimension. The gentle push of a finger on the button of a nuclear accelerator can unleash tremendous energetic power.

Another physical definition is much more general: energy is what does not change over time when anything else has changed (1st principle of thermodynamics). Here we are in front of the confusion caused by the contradictory axioms proposed at the beginning !! Energy is seen as both change and its absence! It is essential not to confuse energy and its transformations, the latter immediately involved in any change. The confusion is all the easier as in the structuralist worldview that dominates today, transformations are enough. You don't have to add any substance to it anymore. Everything is information. No support to sculpt. The ‘matter’ of the world is replaced by a sum of bits. Extremely pixelated image of the universe, but there is no screen.

The success of the ‘energy = function’ approach by no means eliminates the possibility of ‘essence’ energy. The calculation will always be powerless to

decide. It's *locked* into information and we're talking about something *foreign* to information. We can only *conceive* of energy in its digitalized reflection of information, the only way that it accesses our intellect.

It is therefore wrong to say that energy is an abstraction. We conceive it possibly as such, in a pure structuralist theory of reality. But we *don't experience it* as abstract. This experience being the only essence of reality that is authentically accessible to us, it would be reductive to hide it, to reduce what we are to a partial representation of reality and what it says about us. Get out of the equation yet we're making it? Mischief of flattened thought…

There is a fundamental difference between energy and information: the first is constant while the second has multiplied, from the origin we assume to the universe. Who would venture to certify that if all information disappeared from reality, there would be… nothing left. Probably most of us, specialists and laymen alike, would agree that… pure energy persist indeed. Perhaps in a form that we do not know how to define (the space-time framework is no longer valid) and which corresponds to the context on which the Big Bang is *affixed* (the principle of succession must be removed here).

The concept of the Big Bang helps us separate those of energy and information. All the energy of the universe concentrated at an infinitesimal point. What can get the brain going again after such a staggering idea? Here is a proposition: that the dimensions of space-time be a property displayed by energy, like any other information about it, and not a frame imposed on it.

Energy divides, in everything, into free (Ef) and bound (potential, Ep) energy. Ef is an effective momentum; Ep is a potential momentum. We thus define them in a level of organization overlying space-time, derived from its elasticity. This division of energy into 2 components is considered ontological.

But like all ontology it is actually a derivative view of the epistemic. It is because our mind defines a fundamental spatio-temporal framework in

reality that we can "trace" an ontology to this level. We must admit our inability to find an origin for the upward look, and not idealize ontology. In its authentic version it remains permanently inaccessible. It is the downward look that invents a basement for it, preparing a solid foundation from which the upward look seems to rise in an obvious and natural way. Reductionism is a pseudo-ontological tool, an epistemic digging shovel. That's why he cannot tell us what energy is.

We must therefore recognize that we define energy from a physical framework for lack of anything better.
The difficult question then is: does the free-potential energy separation (Ef-Ep) exist before energy constructs a space-time frame? Is it an organizational meta-principle freed from the framework? How to define it independently of the movement?

The meta-principle is the subject of the next chapter. Let us first resume our pseudo-ontological investigation from the physical framework we know:

Energy and complexity

Interactions between elements take place (states change in the time dimension). The unfolding results in areas of temporal stability (the spatial structure of the organized elements does not change over time). This stability corresponds to the somewhat paradoxical notion of '*still movement*' and it is potential energy. While the remaining movement of all the elements is free energy.

The organization of the elements is therefore a *storage reservoir* for the part of the movement that is no longer effective.

It is more difficult to organize something very free than something already organized. We will not detail here the justification of this relatively intuitive principle. The main reason is that a very *organized* thing is very *limited* by its underlying structure, otherwise it would quickly cease to exist in that form. It is thus easier (at lower energy cost) to find an organization with things of the same type, subject to the same contingencies.

We can thus link the two fundamental notions of energy and organization: *organization is the transformation of the free part to the linked part of energy, in successive stages*. Its effectiveness is exponentially decreasing: highly effective at elementary levels, while a universe fully unified by a higher organization is unlikely.

This vision explains that the more organized a thing is, the stronger its bound energy and the weaker its free energy. Biochemistry uses less free energy than single atoms forming into molecules. Body movement uses less free energy than biochemical processes. The high complexity of consciousness uses less free energy than the unconscious processes. Etc. Each level of organization marks a transformation from residual free energy into bound energy.

Is this a parallel decrease in the working capacity of the higher level? No, because this capacity is qualitative. We say 'efficiency'. In 'efficiency' enters the notion of structural information. The transformation of free energy into bound energy is accompanied by a modification of the informessence of the new elements which will express the residual free energy. The ability of this residual energy to do work becomes finer. Insignificant retro-control in terms of raw energy power and yet capable of dramatic effects. It can mobilize phenomenal amounts of bound energy.

For example, a few theories that consumed insignificant neural energy have released the fantastic energy of the atom. Of course, it is not this neural energy that is directly responsible. It retro-controls a chain of organizations through the musculoskeletal system, then instruments designed to mimic the fundamental levels of matter. The very powerful energy finally mobilized is that present at the bottom of the complexity. Causality, in the complex dimension, is bidirectional.

Energy and interaction

Is 'interaction' synonymous with energy transfer? It is important to define the terms. 'Interaction' can mean 'to interact' or 'to be in interaction'. Initiate or perpetuate an interaction. 'Interacting' involves two ideas between the elements involved: 1) The interaction is descriptible as a

source/receptor energy flow diagram. 2) For each element it is an energy input/output flow diagram.

Once the interaction is engaged, the flows can balance out and no longer represent a transfer of energy. The elements 'interact' without changing their own energy.

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Energy and information

As the subject is difficult, I start by reiterating what energy is and then introduce the information, with their respective historical perspectives. We will finally see what synthesis is possible.

All change is a transformation of energy. Tension which, when two elements present themselves to each other, causes them to interact to achieve different states. Without the energy, information would be like books in a library, arranged side by side, useless until someone grabbed it for use. This is the downside of equating information and energy. Information is the reservoir of energy expression, but its very movement, tension, is an independent concept. There is a certain common point between information and energy: the two marks are so fundamental that they cannot be written with others. They emerge from the unknown at the base of our conceptual pyramid. This is not enough a priori to confuse them, without descending further into this unknown.

A good example to describe the transfer of energy is a wave on water: the wave looks like something is moving sideways on the water, but in fact the water molecules just oscillate vertically. The movement is thus passed from sets of molecules to their neighbors, then they (macroscopically) find their initial positions.

Energy is change and change is measured. Energy is at the heart of changes in a system and is defined locally by the way in which activity is measured. It is divided into free energy, effectively employed in the work of the system, and bound (or potential) energy contained in the elements of the system but not available for work.

With our common thread of a layered reality, we immediately grasp the correspondence between this separation and that of the organizational levels. Bound energy is that contained in the intrinsic organization of the elements, which could be released in the event that they lose their structure. Free energy is that contained in the non-organization of the elements between them, the conflicts that they can generate and which have not yet been resolved.

Total energy is the sum of free and bound energies. The term ‘energy’ did not enter scientific vocabulary until the 19th century. Previously it was only described by its local forms, without unification. Its generalist ancestor was the *movement*. The mechanistic vision pervading science seemed to be able to reduce all transformation to a movement. Controversy on how to define the energy of motion: is it the *moment* (mass x speed, mv)? Or is it *kinetic energy* (1/2 x mass x speed to power 2, $mv^2/2$)?

Let's illustrate the difference: a 3kg rifle shoots a 3g bullet. The exploding cartridge exerts identical pressure on the rifle and the bullet, in opposite directions. Its energy is transformed into *moments* (mv) of roughly the same value and in opposite directions. Since the bullet is a thousand times lighter than the rifle, its speed is a thousand times higher. The *kinetic energy* of the bullet, $mv^2/2$, is therefore five hundred times greater than that of the rifle, with the potential effects you know. The rifle can sore the shoulder it backs onto, the bullet will severely destroy any shoulder in its path. Kinetic energy best reflects the amount of free energy available for a work.

At the same time, there was the idea that everything being transformation, nothing is lost. Paradoxical implication: to measure the importance of a change one needs a constant benchmark. However, the movement is exhausted, in various frictions. What does it turn into, if nothing is lost? In heat. The study of heat variations in thermodynamics has found a solution in the principle of conservation of a fundamental constant, energy. The fundamental substances of matter are effaced in front of the different forms of energy.

"Different forms" means that energy is defined and measured according to the properties of the elements of interest. I would be happy to speak of

dimensions rather than properties, with the risk of confusion with spatial dimensions. But is the confusion innocent? I'm trying to familiarize you with the idea that location in spatial dimensions is a property just like any other.

The dimensions involved in the definition of energy in pure mechanics are mass, distance and time. They can be deduced from each other, thanks to the global conservation of energy. This can thus appear as a force acting according to distance, a tension correlated to the surface, a pressure exerted according to the volume, an acceleration force on a mass. All of these forms correspond to the same amount of energy.

Whatever its form, the energy of a thing is the multiplication of two factors, in-tensive and ex-tensive[28]. The in-tensive is specific to the form the energy takes; the ex-tensive is the quantity of this form represented in the thing, its scale in the form considered. The ex-tensive depends on the scale, for example two batteries in parallel add their charges to double the electric power, while the in-tensive, the voltage, does not change. We must understand 'in-tensive' as 'internal tension' intrinsic to the form of energy (and not to the thing); 'ex-tensive' is the 'externalized tension' of this form of energy caused by the presence of the thing. Some examples :
-Gravitational energy: the in-tensive factor is the altitude of the thing in relation to the earth's surface, the ex-tensive factor is its weight.
-Electric energy: the in-tensive is the voltage, the ex-tensive is the charge of the thing.
-Thermal energy: the in-tensive is the temperature, the ex-tensive is the entropy of the thing.

In the history of science, the in-tensive led to believe in the existence of a diffuse backdrop for the form of energy considered: an *ether* on which things were inscribed ex-tensively. Everything has been turned upside down by reductionism! The in-tensive itself appears as an effect of an organization. It is no longer a continuous backdrop but an information structure. Everything is an individuation in this structure, a particular

[28] 'In-tensive' is not used in the sense of 'intense' but of 'internal tension', hence the hyphen. 'Energy' is here synonymous with 'tension'.

organization which defines new properties for it, novelties however in close connection with the underlying processes. The thing is paradoxically independent and closely linked. Identity respectful of its constitution, but also additional information for other things similar to it. The in-tensive is no longer a 'backdrop' but remains a layer of organization on which things rest ex-tensively.

Classically, free energy is related to a *gradient*, and to the possibility of a *current* through this gradient. It is this change that allows free energy to do work. However, the currents gradually decrease in gradients and free energy becomes scarce. This is how many systems strike a balance: there is no more free energy available.

The available free energy can, however, be used to construct another gradient. For example, electrical energy is used to generate a chemical gradient in a rechargeable battery, which can then decrease again while returning electricity. Conversions are not perfect; a fraction of the free energy is lost. Lost? Transformed into bound energy, since the total energy is constant. It is also the fate of free energy in a balanced system. Free energy turns into bound energy, while the opposite is not possible, says the second law of thermodynamics, at least about a closed system. This law is inseparable from the arrow of time, from the irreversibility of most physical systems, from the historicity of nature.

Energy is defined by what does not change in a physical system through the many ways of describing it. If the equations handling the parameters of the system are correct, there is a way to combine them so that something remains constant as the system evolves, and that constant thing is energy (Noether's theorem[29]). Quantum mechanics bends this principle in brief details of its process, but physicists save the law of conservation by explaining that energy is not measurable in these fleeting moments.

There is a fundamental difference between saying that energy "is constant" or "is *a* constant". In the first case, the energy *is*. It exists, regardless of the

[29] *Noether's theorem*: Energy is the mathematical quantity conserved due to time symmetry in physics (regardless of when an experiment is performed, the result will be the same: translational invariance in time).

forms it may take. It is the tension that generates them. In the second case, the energy reduced to a constant *is not*. A constant exists only as information, description, possibly the property of the sole observer. Herein lies the choice we make about the existence of real substance or not. By saying "energy is a constant" we can confuse it with information. All its forms are information, but so is its essence since we make it a simple constant. Reality becomes integrally a mathematical structure. By saying "energy is constant", we are making it a fundamental substance. But then we have to introduce a dualism in order to explain reality: what then is this information that shapes the substance without changing its essence? Two radically different philosophies.

The philosophy of substance energy sees change as a flow. The differences are gradients, which decrease or increase, or are hidden (potentials). Reality moves, waves, strengthens, energizes. It is a philosophy of intention and continuity, represented by the unalterable constancy of energy.

The philosophy of information energy sees change as a mass of self-sufficient calculations. Everything is appearance. No need for origin or substance. Even when matter is reduced to a ripple, there is nothing that ripples, only a mathematical curve. Philosophy of a platonic universe, where equations arise without an intention presiding over them.

The two philosophical universes are a kind of primordial ocean, but the one expresses itself, bustles with animation, the other makes tapestry, *is* language. The first obviously appeals more to human consciousness, itself full of intentions. But isn't this precisely an anthropomorphism inappropriate for the Whole?

Let's resume our discussion of energy based on this substance energy, which is the most widely held view. So we are faced with a paradox: energy is constant, invariable, and yet it produces change, a great variety of forms. Certainly only free energy is capable of this, but it is indeed part of the total energy, which is constant. Isn't it problematic to call by the same name both the unchanging reservoir of the forces of reality, and the process that sets part of that reservoir in motion? We need a reservoir / use dualism. We need constant *intention* backed by the constant energy fund.

Can this intention be confused with information? Is the intention energy or its form? Neither is a satisfactory answer. Intention supposes a conflict, an opposition between two existing ones, one wishing to change the other. Perhaps the intention is precisely this conflict between energy and its forms. Perhaps the energy is a great lady not knowing how to dress in the morning, in the middle of a huge wardrobe, choosing and rejecting caloriferous and magnetic clothes, free in all her appearances but retaining the same dissatisfaction with inside?

The structuralist vision does without the great lady. Energy only manifests its existence when there is an interaction. Maybe it's just an epiphenomenon that our minds add to the interaction to give it some life. Does potential energy really exist since it always has to go up a gradient to manifest? Why assume that there is more than access, the exchange of information? Even a particle as simple as a photon only shows free energy when it interacts with another particle. And bound energy is always defined by assemblages of particles, by organizations.

Let's argue the reverse: Structuralism cannot say anything about energy, other than making it the mystery of a constant. It cannot say anything about it because it itself is a pure information edifice. With what to judge the existence of something behind the mask? Information and energy differ as the container differs from the content. Information is inherently hierarchical. It is by categorizing forms of information (human, biological, physical, etc) that we recognize its qualities, the surimpositions of forms on forms. Energy is not inherently hierarchical but only through the information that describes it (the forms of energy).

The energy shines through in conscious experience, the first there is. We do not experience ourselves as a pure collection of information. Consciousness has contents, of course, but it is also impressions, fusion and not a sequence of mental events. A fusion driven by a momentum. Nothing in a structuralism immobilized in a block universe allows us to account for this experience. Should we then, as with consciousness, resign by treating it as an illusion?

For the moment let's be satisfied with a consensus synthesis. Energy "is constant" but we do not know what it really is, if there is energy *per se*. If it "is *a* constant", it can be equal to zero. Reality then becomes a pure amalgam of transformations. Not only fully describable by information, but *entirely constituted* by it. No way to decide, since we only have access to the description. Let's focus our attention on it to make it a unique canvas, which is already not that simple.

We must indeed unify the energy-substance vision, typically resulting from thermodynamics, and the energy-information vision, typically represented by information theory. The two have each defined their entropy, their definition of order and disorder. But the paradigms are different. Each applies with remarkable utility to its field of reference. How to bring them together? We have seen that the statistical definition of entropy found by Boltzmann makes the mathematical connection. But is this just a correlation? In this hypothesis, what is missing?

Surimposium offers an original solution to the energy/substance/information dilemma. It defines the substance experienced by things as the surimposition of their levels of information, both concrete in matter and virtual in neural networks. The higher this pyramid, the more the experience of the thing "thickens", enriched by a multitude of organized planes.

This solution corroborates and consolidates the master idea of *Surimposium*: theorizing reality only from its accessible section in the complex dimension. Not from its speculative ends. No assumption about them. Everything must hold together. Our intimate experience and the messages of observable reality together form the fabric of *Surimposium*. A staggering discovery such as relativity or quantons can reconfigure the mesh, but not the principle of weaving itself. *Surimposium* is relational between the Spirit and Real poles, which attempt to position themselves at the known ends of the complex dimension.

Indeed, defining substance as the surimposition of information levels avoids any need to rule on the existence of energy per se.

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Epistemic reversal of ontological information

The true ontological look is impossible. Inaccessible origin of reality per se. The upward look is a substitute that installs an arbitrary foundation to the real (quantum vaccum) to start. Pseudo-ontological look.
Why does the information appear qualitative downward and only quantitative upward? If it is intrinsically qualitative, as a fundamental brick, it must appear ontologically.
But precisely the upward look is not truly ontological. It sees only the structure, no substance to be addressed. The structure holds alone, by quantitative links. Does it account all the reality?
No, because of our conscious experience. The qualitative is inherent in mind. Mind at the origin of the upward look by its Real Pole. It is therefore the upward look that is artificially rid of qualitative by its reduction to quantitative representations.

Reality makes approximations. The part of the mind that is most faithful to it, the Real Pole, works as well. It approximates parts of one thing in a single thing. This constitution may vary.
The real does the same. It approximates two intricate particles in quantum duet, or the states of a particle at a single point during decoherence.

We come to one of the most important conclusions of this book: Ontological information is not what it seems. So that its understanding is complete, let's take a look at its main ingredients:
-The double look: part of the mind describes the processes of reality, another gives it meaning. Upward and downward looks.
-Information: ascending, it is quantitative (resulting from common micromechanisms). Descending, it is divided into an infinity of different qualities specific to the individuations that it forms.
-The true ontology is inaccessible: we cannot access the authentic informessence of the real. The upward look is a substitute that needs to lay an arbitrary foundation to reality to get started. Currently, it is from the quantum vacuum and elementary fields that it constructs a pseudo-ontological look.

Let us now return to our problem with information: Why does a quality appear to it with the downward look while only quantities are seen by the

upward look? Both eyes are focused on the same thing: an information structure. Information being the fundamental building block, does it inherently have a quality or not? If the downward look is the only one to see it, the upward can claim that it is an illusion.

Indeed when I wanted to affirm the existence of the levels of reality, I had to show how they appear to the upward look. It's impossible to be satisfied with the practical advantages they offer to the downward look only. This ensured them a virtual presence, mental, but not ontologically inscribed. Likewise, the existence of a quality in information, added to its binary nature, must appear from an ontological perspective. How to do ?

The third ingredient provides the solution: the upward look is not truly ontological. It just applies a shape to something that it essentially cannot grasp. That is, purely quantitative information, which we have declared ontological, is not. It always refers to an unknown gestation of reality, towards which we only know how to launch mathematical hypotheses.

Our mind not knowing what to give a form to this exegesis, it abandons the notion of substance. The information is purely quantitative for the upward look because it does not know what to add to it. You don't have to add anything to it. The information structure holds up on its own. But does it capture all of reality?

No. Absolutely not. It just does not take into account the qualitative, which it is impossible to get rid of for a first reason: we experience it as consciousness. It is our most fundamental experience, the one that has never changed as knowledge underwent a long series of changes. Which are not finished.

The Real pole changes, the experience of the Spirit pole remains. The strongest anchor is there. Paradoxically, it is the origin of the downward look that is the most reliable and permanent, while that of the upward look claims to be more fundamental but in fact navigates to these depths as science advances.

So there is something missing from quantitative information to fully describe reality. Form is a plating of the Real pole on the essence of reality. It forgets something. With its qualia, the Spirit pole is closer to this essence… since it is part of it. We are monists. If the mind feels, so does the real. It's not just a string of numbers.

The conclusion then is this: we must not separate substance and information in ontology from the real. The real is one. The separations are there only to allow our mind to catch it, to shift from it. The form owns the Real pole. It is indeed the appearance of the real to the mind and not the essence of the real. Quantitative information is a reduction of the real to its appearance. If we had an authentic ontological perspective, then something more would be added to this quantitative information. It is this something more that the downward look translates into qualities.

The ontology is well qualitative. The upward look misses what is shaped. It obliterates it behind notions such as heat, energy, change. Which have no ontological explanation. No force, no field, no algorithm allows to define them.

It is by giving every real thing the opportunity to experience its quality that we become truly monistic.

The paradox is that we strip the qualities from reality by exclusively using the Real pole of the mind to describe it. This uses information as a descriptive tool, a purely virtual logical technicality. By dissociating itself from the Spirit pole, the Real pole reduces reality to its structural aspect. This is eliminatory materialism. It can only describe reality by eliminating its own experience. Which makes it a false monism, and an authentic dualism between concrete reality and a world of illusions.

Epistemic reversal of ontological information: it is indeed the spirit, through the Real pole, that reduces ascending information to a quantitative language. The conception of information that dominates science today is subjective. It can only be objective by reintegrating its qualitative part. Indeed any observer who determines this quality, whether it is a human

mind or qualitatively identical things, is included in the same monistic reality.

The upward look is only a conceptual foundation and is deceptively ontological. This is also true for the downward look. It's actually anchored on a conceptual foundation about its own mental functioning. It is deceptively epistemic. It is not conscious fusion that judges its parts, but conceptual parts that judge conscious processes. Direction ascending within the mind itself.

The only real top-down view is the experience of the processes. It is experiencing the functioning of the mind, the sequence of surimposed processes in the complex dimension. The analysis of the process is always bottom-up, its experienced result is always top-down.

Heidegger said: « Science does not think ». The philosopher thus translates the idea that science is a pure ontological approach. He is wrong. Science thinks from the representation it places at the base of the complex dimension. While non-scientific representations (art, religions, fictions) occupy the top. Scientists are heavily constrained by the essence of reality, but all are products of the mind.

The history of science is that of a religion overturned by radical changes in dogma. The essence of reality has never changed. It has to have been imagined for its appearances to have changed so much. How could its mask be modeled without some fictions? Science is a permanent interaction between the Spirit and Real poles, just like philosophy.

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Does reality make approximations?

Espagnat separates two types of objectivities for realism: strong objectivity (examples: two particles of opposite charge attract each other) and weak (phenomena where the model replaces the real interactions because of their incalculability, which is also called *coarse graining*; example: statistical thermodynamics). Strong and weak objectivities separate our representations into two camps: the precise and the vague, or the faithful and the approximate.

Objectivity thus seems strongly subject to subjectivity. *The mind makes approximations*. Here is the starting point of which we are certain. If we remain monistic and consider the mind integrated with reality, including in its mental productions, it is because there is at least that part of the real which makes *realized* approximations. The mind acts and transforms the world from these approximations. But then where is the border between reality which interacts in an objective way and that which does it in an approximate way? Doesn't looking for it plunge us back into a new dualism? How to escape the dilemma?

How does the mind approximate? It models the appearances and reactions of things around it. The Spirit and Real poles, the subjective and the objective, are jointly at work. The Spirit pole exacerbates what seems *interesting* to it in the thing. It is a sum of intentions, which seek their way into reality. The Spirit pole seeks to *transform* its world. Its approximation is to select what goes in the direction of its intentions.

The Real pole, on the contrary, tries to be faithful to the thing. Make sure that it is indeed it. Do not confuse a cat and a tiger. But the Real pole is still forced to make an approximation too. Because most things move, evolve. Something in motion is transformed. Are these restless limbs part of the thing or are they independent? Representations of the Real pole are so natural that the mind stops asking the question. But it asked itself when it first started out.

The Spirit pole approximates by reference to its intentions, the Real pole by reference to the properties of the thing. The final performance is a mixture of subjectivity and objectivity that takes place in our inner world. Consider this finding, however: even the objective part contains approximations.

It is very important. Indeed the role of the Real pole is to simulate as closely as possible the behavior of physical reality. When it makes mistakes, it is because of some tampering, not a *desire* to make them. In its normal functioning, the Real pole is the perfect reflection of the self-representing reality.

No need for neurons to self-represent. Everything that is real interacts in the environment with other things whose properties it is able to recognize. By the sum of its interactions, the thing is indeed its personal representation of reality. This is the set of characteristics of the environment that the thing is capable of perceiving, at its level of existence. *This is an approximation of reality*. The thing disregards the constitutive levels which do not concern its way of being, even when it possesses the same ones.

When the levels of reality are close, it seems possible to reduce an interaction to its micromechanisms and be convinced by eliminativism. The approximation would then only be apparent, linked to insufficient knowledge of micromechanisms. It's wrong. It is the reduction itself that is approximate, removing the presence of the whole surimposed on the parts. We have demonstrated this abundantly in this chapter. One example suffices: the behavior of two entangled quantons is understandable only at the 'duo' and not at the 'individual' level.

Another fine example of approximation of reality on itself is the organization of the quantum states of a particle during an interaction, called decoherence. This quantum mechanics surprises us. Isn't it the fact of discovering that reality behaves like our mind, when we thought we were its only fanciful elements? Here we are even better integrated into this monistic reality, without having to give up what we are.

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Synthesis

We looked for ontological clues of the complex dimension. They are numerous. The strongest argument is that the real splits up by building approximations about itself. It is self-represented by synthetic information, qualitatively different from that represented.

Renormalization shows that large-scale physics does not depend on small-scale details. It is possible to build the model of one level of reality without knowing the previous one. The reduction to micromechanisms loses its essential character. A level of reality effectively screens what built it.

This is the basis of the epistemic/top-down perspective: it is possible to build a theory of complexity without knowing its origin or its outcome. Relative disadvantage: impossible to say that there is an origin. That a theory is a candidate does not indicate that this is the origin. It can mask another level of complexity.

Mathematics, the language of ontology, makes approximations. For example, it defines 0.9999… as equal to 1. The equations thus keep their consistency. If this language is intended to be the closest reflection of reality in itself, this is an argument for it to also *realize* its own approximations. Details in the Metalanguage chapter.

Let us summarize what it is possible to understand about the energy-information pair, prior to a first general synthesis of *Surimposium*.

Energy *is not* information. Energy is a *constant tension* to which information is applied. It is possible to relate energy and information in a framework, which is itself information. That is, information reframes itself. It thus produces *complexity*, a hierarchy of information planes.

Energy is what a vector measures. This measurement is the *momentum* of the vector. It determines properties in a frame. For example 4 vectors in the Einsteinian 4D framework determine the motion of the point of intersection of the 4 vectors. With the definition of the moment we are already leaving the field of energy to enter that of its measurement. We're in the information. By applying the Einsteinian 4D to our 4 vectors, we add an information plane where motion is defined. Each plane is an iteration of complexity.

Each transition is an emergence. Information levels have relative independence. It is impossible to do better than to establish a correlation between them, because of this irreducible independence. Information that is meaningful in one level is not necessarily meaningful in another. The upper level approximates the previous one.

There is no transition between the energy field and the information field. Because it is not possible to define a fundamental reality at the point where

a vector applies. What is this point in terms of energy? Particle, wave, fluctuation, these response attempts are fruitless, since they already involve information. The fields of energy and information are fundamentally intertwined and irreducible to each other. All reality participates in both.

But if the two fields have relative independence, how do they interact? Container and content. Information is the container that holds part of (bound) energy, the rest being (still) free energy. A new container layer in turn attempts to encompass the remaining free energy. The whole is unstable, each layer dependent on the strength of the previous one.

Isn't free energy also describable by information? Indeed. However, it is not *compressible* information as in bound energy. The container is not in place. The disorder dominates. There is not yet any whole overcoming this free information. No individuation of the whole.

All reality is energy modulated by information. The whole energy+information is *Diversium*. Information is organized in a stack of levels forming a complex dimension. This pile is the structure of reality: *Surimposium*. An information framework brings together a varying number of information levels, determining a section of the complex dimension. The best-known framework is the Einsteinian 4D and defines the 'matter' section of *Surimposium*, or *Matterium*.

Neural networks create a higher section in complexity, the one occupied by our minds: *Stratium*(s). The 4D framework no longer applies. The concepts are independent of space and time. Real virtuality. Finally, the level of information processed by our brains about exchanges between individuals is *Societarium*.

The different sections are separated in *Surimposium* and integrated into *Diversium*. *Diversium* is a monist reality. A thought is also a network of synchronized neural excitations, also a configuration of molecules, also quantons, and above all also an energy modulated by the information of these multiple planes of complexity. All of this information and the energy it encapsulates is needed to determine what a thought is.

It is impossible to say what separates energy from information, since we can only understand the first through the second. But we experience the first. Incompressible duality, experienced in the first person, which comes from the presence of the complex dimension. We are intimately two ends of this complexity, an energy modulated by a very high pile of information, and the synthesis carried out at the top of this pile, the conscious Observer.

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Interlude

The confusion between energy and energy transfer is reminiscent of that between information-communication and informessence. In fact, if energy is a constant, the transfer of energy can be reduced to pure communication of information. The elements exchange information that varies their share of energy-essence in a whole that remains constant. The minimum share of energy that an element retains corresponds to the concept of *zero point energy* (Cf).

Everything remains constant *in its overall essence* and not in the level of information of the system, which can even interact with other systems. The energy-essence fulfills the role of ground substance, something which cannot vary. This characteristic, 'which cannot vary', is not in reference to information. It abstracts from information. No dimension of information can apply. The substance is "under" the information, at least under that which is accessible to us through mental representations. The substance remains integrated into the complex dimension. It has to be somehow linked to information, otherwise we just invented a new soul…

Popular talk has chosen the definition of energy not as its substance but as its transfer, its impetus! I keep this "energetic" definition for energy. I give the definition of substance to the surimposition of information in an individual thing. It is also the closest to common sense. The substance of a thing is what we see added to what constitutes it and what we do not necessarily see.

As for the energy-essence, this constant everything independent of information about it, I can call it 'God' as well as otherwise. Do you have a suggestion? 'God' has the disadvantage of having been heavily trafficked by religions. It is also inherent in our history. It is the oldest and most universal reference to this concept. Too bad religions don't like humor about it. Humor is one of the best ways to approach a concept beyond reason. So how is a god concerned with the mockery of dust inside Him? Scandalization is very human and not divine.

Let's continue thinking about this energy-essence, which others may call 'vacuum' or 'nothing' or 'zero energy'[30]. Whatever the name, the concept remains that of a backdrop. Even calling it 'nothing' it's a blackboard for information to be written. The very principle of the *transmission* of information requires it. If there is separate information, establishing relationships between them, it implies an irreducible quantification of reality in the form of these units of information. Pixelated reality. It is not possible to define a pixel without a background. Otherwise, what separates it from another? The simple notion of difference implies a background on which this difference operates. In the history of a frame made of information and itself serving as a support for new information, it is not possible to go back to the absence of a frame. To eliminate any background from supposedly fundamental information is perfectly arbitrary. Here we are manipulating a concept as inaccessible as that of information. No tools… no words. Let's be silent.

God could be called *silence*. The silence has a lot of humor. The many lines that I have left empty are there to give you time to listen to the good words of silence, in the middle of these chatty paragraphs…

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[30] Assumption that the total energy content of the universe is zero. The total energy-mass, potential energy, kinetic energy, is exactly balanced by the negative gravitational potential energy.

6
Foundation and Empire
The complex dimension

To discover is to discover the following question.

As a medical student, I was concerned about discovering the complexity of living organisms, which you may have shared: how could such delicate mechanisms, exposed to countless disturbances, manage not to continually go out of order? I was surprised that it was not imperative to take your organs and fluids daily to a technician to readjust the confused parameters. The same amazement touches researchers invested in the anthropic idea: the slightest variation in physical constants would have prohibited the miracle of life on Earth. The demands assembled for this result make humanity so unlikely to overturn agnosticism. Enthroning fundamental laws to defeat reality brings out the Great Cosmic Watchmaker, who holds the reins, the scales and the whip.

Big sacred task! Should this Watchmaker watch the dance of each atom, the balance of each cell, the moods of each organism? No wonder He has little time left to moralize human affairs. The anthropic idea (the universe inevitably had to create us) is circular and terribly hollow. Wicked corset strangling the universe, which nevertheless gave birth to romanticism and humor. Didn't the real want to show us that it is more than a *definite* mechanism? Laws have replaced divine beliefs for generations of scientists still impressed by the omnipotence of Nature. What if the universe takes care of it on its own? Not as that robotic, immutable process portrayed by scientific classicism, but driven by the evolutionary principle of its own complexity. There is no such thing as a 'conscious universe', but a 'universe of consciousnesses'. Self-made. Attributing its paternity to 'chance' is not a hypothesis but a refusal to comment. Something intentional lies at the origin of reality, which has transformed into the consciousness we experience. Intention to which we will be careful not to apply the slightest anthropomorphism. Intention crude, extremely simple: it has only matured to our own, in the complex dimension.

The theory of a world that owns its identity remarkably alleviates anxieties about its disorder. Objects and organisms are no longer fragile equilibrists constantly on the verge of rupture; they are entities seeking to exist and maintain themselves. Paradigm overturned. Does a brain suffer ischemic injury? Neurons tend to recreate their organization. DNA spoils under radiation? Enzymes fix it. A vital nutrient becoming scarce? The body seeks a new balance where it becomes incidental. Time reveals what *persists*. The world never goes wrong; it *explores*.

Success is not always there. The term 'seeking' seems too loaded with intent for a priori soulless processes. Nonetheless, these explore possible solutions, and the absence of moods ends with a steady state. The process is not indifferent to what it encounters. Intentions are born in the little things.

How to shape a general theory of this self-organization? We have seen that it is reductive and ultimately sterile to seek original laws from which the rest of reality would unwind. It is to deify nature itself, without doing better than religions to extract from the mystery the nature of the divine. We are not looking for an origin but a principle, a common thread connecting the successive steps. A link whose omnipresence suggests that it continues towards the origin and towards the future.

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Preliminary remarks

Can we demonstrate the possibility of a general theory of reality?
Many negative arguments, but a positive, major: *reality is one*. It is the unified theory of itself.
The general theory must be valid from the point of view of any real entity, not just the human being.
Each double look direction must be satisfied. Science and philosophy granted.
No universal and imprescriptible framework. The frames belong to the isolated epistemic look.
The only transcendental principle is structural.
No arbitrary limit to the structure, the whole not being a knowable.

The difficulty of finding a transcendental principle makes it replaced by paradigms.
A paradigm identifies the transcendental principle in part of the structure of reality. Example: Refutability in the study of matter.

Is it possible to just *envision* a general theory of reality?

Many arguments are raised against such an ambition: circular reasoning, incompleteness theorem, knowledge is not essence, metaphysics being lost in its own myths. The dogmatic attempts are cloistered around their postulates. The open attempts to experiment are partial and unsatisfactory. Eliminativism is a failure. It survives only by the pragmatic separation of the branches of knowledge. We change our paradigm when our interests shift from one to the other. Each connection is local. No general rule emerges, even if math and certain concepts (information, entropy, probability) readily colonize all branches.

However, an argument for the existence of a general theory erases all its opponents: reality seems one to us. Using incompatible paradigms does not transfer us from one universe to another. All information is linked. Is it our perception which thus deceptively merges reality? The same seems to be the case with any entity, living or not. None of them escape reality, except in the myths that we easily conceive about them, failing to know them enough. Does the transition from micro to macroscopic lack a clear explanation? It doesn't make it go away. It happens daily. Reality has its unified theory of itself. Can it suggest it to us?

I use the ‘we’. This is *our* reality. ‘My reality’ is included in ‘our reality’. Alone, it is suspect, not for ‘me’ but for that part of me that represents ‘us’. ‘We’, if we are to have a truly general theory, must include more than human beings. The pronoun must bring together the pre-being, all that is capable of representation. Do not arbitrarily reduce this set to entities with a brain, or even to what is living. Unacceptable reduction, since we are looking for a truly general theory. What it covers was put in place long before the first Homo. Before the first cell. Before the first self-replicating molecule. The oldest known manifestations of reality must embrace this theory, as naturally as contemporary humans.

What are our guides in the search for a general theory of self-organization?
1) Beware of terms.
2) Say nothing 'fundamental'
3) Something to fill the terrifying void created by (1) and (2): an order is present.
4) Find a transcendental principle.
5) No imprescriptible framework (neither imprescriptible space nor time).
6) No origin or outcome.
7) A coherence defining its own limits, suspended in a Whole which is not knowable.
8) A bidirectional link between what looks and what created it. Double look.

What is the difference between paradigm and transcendent principle?

A *transcendental* theory is maintained at any level of the complex dimension. It explains the origin of complexity, its perpetuation, whatever the level of information considered. There are no official ones. Reductionism is a microscope for studying the complex dimension, but it is not a theory of it.

A paradigm tries to overcome this deficiency. A principle famous in a level of complexity is extended to its neighbors. Mimicry. Its success suggests that it correctly identifies the transcendental principle in the phenomenon under consideration. The generalization effort may meet with only personal or community enthusiasm: we speak of *belief*. Or it meets with widespread success, at different levels of complexity, resists criticism: we speak of a *universal principle*.

The best example of a famous paradigm is Karl Popper's refutability, which inspires most scientific disciplines today. However, refutability has its limits. No prospect of validating models of our personalities with it. Our thoughts are teeming with presumptions. The opinions are not refutable and yet firmly expressed. Subjective in the eyes of reality, they are perfectly objective in the minds of their owners.

There is therefore a threshold, between the biology and the psychology of Homo sapiens, where refutability loses its power. Where is that threshold? Why does the effectiveness of the paradigm end there? It becomes again an incomplete tool, hinting at a more transcendental principle in the shadows.

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The basic concepts of *Surimposium*

The complexity has *two organizational dimensions:*
Horizontal: systems of elements likely to interact together, defining a level of reality.
Vertical: hierarchy of surimposed levels.
Matter and mind occupy both ends of vertical complexity that we are capable of apprehending.
Two starting points defining two contrary approaches. Double look, upward and downward.

A downward and upward joint approach makes it possible to replace laws and forces by *dispositions* of reality.
That the dispositions seem more authoritarian to the root of complexity is possibly an anthropocentric illusion.

A hierarchy of reality levels is not a depth of information. Depth lacks a qualitative definition.
A level of reality is not a section of the complex verticality with strict borders but an attractor of the elements interacting in neighboring systems in this dimension.
A level of reality establishes its own rules of organization, which hide those underlying its constitution.
The level self-experiences as constitutive of its own information: it is the *qualia*.
It is also merged representation of this information: it is the *concept*.
A level of reality is a qualitative leap in the information.
The addition of the levels thickens the resulting qualia. Our abstract thoughts, based on a high hierarchy of neural codifications, provide very rich qualia.

Each level of information has its *paradigm*.

An analysis begins in the error by investigating with other paradigms.
Which identify the exact paradigm. The analogies contribute. But it is in intricing this paradigm to the lower and upper in the complexity that its accuracy is consolidating.

Crossing separates two levels of reality, can be crossed in both directions. Blurred border.
Crossings are correlated with spatio-temporal and energy levels in the material.
The impulse creating additional reality levels is the *conflict*, in the material as in the mind.
The complex crossing is not a move, only a new information surimposition.

The bidirectionality concerns the vertical relationship between complex levels, constitution in one direction, representation / retrocontrol in the other.
The representation has relative independence. It exists by default, seeks its confirmation in its constitution.
It is root of subjectivity over the objectivity of the constituent elements.
Its persistence is actually making a measure on the constitution. Root of an observer effect on a system.
The retrocontrol is obvious for complex levels, and their large time scales.
It must be searched for microscopic, where the time scale is very small.
Bidirectionality is asymmetrical.

The relative independence is defined in the opposition / entanglement between the constitutive part and interactive share of a complex entity.
Neither independence nor dependence, in their radical forms, report this contradictory reality.

Dimensions of complexity

Surimposium is an approach to complexity as a two-dimensional universe of organization. The horizontal (complex) dimension groups together systems whose elements are sufficiently similar to interact together, if their spatio-temporal locations allow it. The vertical (complex) dimension groups together the independent levels of reality formed by the organizations of each of the horizontal planes.

You are already familiar with the basic concepts of *Surimposium*. These are current concepts revised with the double look from the extremities of vertical complexity, spirit and matter. Some describe the same thing in a complementary way, by the two directions of this look. I will specify the orientation of each.

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Disposition

Upward concept.

There are problems with declaring 'fundamental' forces. They are only so for the model of a level of reality based on them. Emergence of a deeper reality. How can we be sure that they are not themselves made up of something else? The theoretical as well as technological access to such a composition is hypothetical. Without this knowledge, we systematically need experimentation to fit models. The results are often remarkably precise, but never absolute. They leave a doubt on the perfection of the models. Are they great approximations?

Nevertheless it would be excessive to say the purely epistemic laws, as Nancy Cartwright wanted to do[31]. They are the mirror of a truly ontological order. Two approaches will help us to manage the fundamental problem:

First step, downward: the mind constructs its representation of reality pragmatically, that is to say according to its own needs. In my vocabulary: the mind forms its Real pole, independent of the essence of things. The effectiveness of the Real pole is judged to remain a coherent whole. The mind has no difficulty in juxtaposing fragments of knowledge; it only struggles to connect them. It organizes contradictory fragments into higher concepts defining their own rules.

In this context, declaring fundamental laws places an unbearable constraint: the totality of knowledge must be able to be deduced from them. This is to declare them in fact transcendent. But they are not. At least they are only so with the shrinking of the mind called eliminativism.

[31] 'How the Laws of Physics Lie', Nancy Cartwright 1983

Shrinkage such that the mind itself no longer has a place. It becomes an illusion. This is a posture that I encourage you to quit. The mind is the only thing we experience in a completely objective way, without an intermediary.

The fundamental forces are held in the most foundational level of information that we can reach, currently the quantum fields. Their explanatory power quickly collapses as they move up the complexity ladder. We have to design *interpretations*. It is the mind that builds all of this, and no longer the real. The mind only compels itself to follow the form of the real, without predicting it. It builds its Real pole with a downward approach.

Second step, upward: what is this form of reality that the mind can follow? Let us stop deifying 'laws of Nature' and talk about *dispositions* of the real. A force is born in an order. This order is the amalgamation of one level of organization. In fusion, the elements show their collective aspect; under fusion, they show their individualistic aspect. This phenomenon can be observed at all levels of reality, including humans. Isolated, an individual is unpredictable; in society she follows collective laws.

A disposition is therefore a powerful clue of what one thing will do in relation to something else, within a collective. This is not an absolute prediction. Reality itself makes approximations. The certainty of a model is also an approximation: statistical certainty and not absolute. There is an inalienable part of randomness in the behavior of reality, because no model is anchored directly in its ultimate origin (if there is one). No model is truly ontological.

What encouraged us to believe is that the further down the vertical complexity, the more fundamental and authoritarian the models seem. The accuracy of quantum mechanics is excellent, predicting human behavior by 'psychic laws' is erratic. Isn't this an anthropocentric phenomenon, an illusion of the mind? Perhaps quantum entities are more complex in reality, and the precision of the measurements comes from their coarseness, as if one were satisfied with the 'alive/dead' criterion to measure the behavior of a human?

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Hierarchy

Downward concept.

The hierarchy cited here is that of complexity. It is its vertical dimension, seen from its top. Does it mean *depth* of information? No. The depth of integrated information does not, on its own, create the *quality* of the hierarchy. Take the example of the Quora forum, intended to connect scholars and laymen.

Answers to questions on Quora have a hidden order. Their classification does not use a single criterion, for example the number of upvotes, but several criteria processed by an algorithm that may be modified at any time: number of responder followers, frequency of responses by domain, expertise noted by the responders. moderators, upvotes and thanks, requester declaring the correct answer, etc. If the algorithm simply adds the scores for each criterion, the depth of its result is 1. If it integrates certain criteria together before combining them with others, its depth increases.

Quora's algorithm has sufficient depth to make it impossible to guess. It is possible that he incorporates a random factor because some answers surprise by their position in the lead. The end result is this: You are unlikely to find the answer ranking satisfactory, and the same is true for most visitors. Algorithm error? No. It is cleverly designed to force the reader to go through the list of answers without stopping at the first ones, if they were always the most relevant.

Relevance is a very different qualitative hierarchy from depth of information. Putting it in place involves validating the organization of the criteria at each level. Impossible on Quora. Very restrictive protocols should be imposed on responders and visitors: first give the fundamental concepts used to respond, organize them into intermediate concepts and then into the final response. Each step would be noted independently by the visitors. The total relevance would not be based on the sum of the intermediate scores but above all on the absence of a low score, which could collapse the whole.

A relevant answer, according to the hierarchical principle, is the superposition of organizations all famous in their individual qualitative level. This is indeed a qualitative principle and not only quantitative as the depth of information.

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Reality level

Just as an attractor, in horizontal vision, is a regular figure which federates information of the same nature, a level of reality, in vertical vision, is an attractor which federates information of a sufficiently similar nature so that they can collaborate on properties of the local organization.

A major effect of a reality level is to limit or even cancel the underlying organizational rules. An astonishing example is the passage from subatomic particles to the atom. The quantons are in a superposition of states, impossible to identify other than by a single property at a time. Fleeting, elusive. While atoms have such remarkable stability that they seem to spend an eternity frozen in a fragment of matter. Yet quanton and atom are both mathematically well defined. The equations differ but are precise. Are these qualitative judgments that I have just made on quantum and atom then just an illusion?

The labels 'fleeting' and 'eternity' emanate from my personal human time. Poetry that the particles concerned would laugh at? Not really. They are like me, human, experiencing what matches their own time. They oppose a polite indifference to the temporal scales too different from theirs. 'Polite' because we should never anger our constituents. Their disappearance undoubtedly leads to ours :-)

The change in the level of reality is a *qualitative* leap. Mathematical language does not indicate this explicitly. The equations are close to the equations. None seem superior to the others. On what criteria would it be, if we have not yet observed its correspondence in reality? There is no metamathematics applied to the chaining of levels, which makes it possible to formalize a hierarchy of equations.

The physicist is better able to experience a qualitative hierarchy between the mathematical descriptions of each level. Her mind is immersed in the

microscopic universe. It combines energetic and mathematical levels. The hierarchy is that of its mental pyramid connecting the models. In the physicist there appears a *flavor* of equations, which resembles the qualia we experience in speaking of more ordinary subjects. Our emotional experiences, at the instinctive level, do not have the same mental flavor as our abstract thoughts.

The addition of the levels of representation *thickens* the resulting qualia. Even an abstract thought such as that of the physicist, when it hierarchizes its levels of information, enriches the quality it provides. It is thus possible to bring it closer to the experience lived by the thing represented.

However, the physicist cannot *experience herself as* a particle. Mathematics remains a language, a set of codes which are *surimposed quantifications* and not *surimposed qualities* — qualia. The qualitative comes from the change of code and its surimpression to the preceding ones. Even if the physicist had the universal code for moving from one level to the next, it would still be a mental construct. However, to experience a particle would, on the contrary, be a destruction of the superior organization of the physicist, very severe if she has to regress to the state of particles!

A human being *integrates* the particle state into her conscious surimpression. But there are so many levels of reality above that this state is invisible at the conscious top. Some are much closer and already invisible: the unconscious levels. Like any representation, the independence of consciousness is relative. It would collapse if the particles or the subconscious were to disappear. Its remarkable altitude in relation to the particulate organization does not make it any less fragile. A little too energetic event within a single atom of the brain would be able to destroy it instantly.

This leads us to take a closer look at the particular properties of the complex dimension. How do organizational levels relate to each other? Can we draw principles for the complex dimension?

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Paradigm

Each level of information creates its specific order. Its *paradigm*. Once this is recognized there is no longer any question of arriving at an unknown level of information with the same look. The first thing I need to be aware of is that my mind is not equipped with the right paradigm. These are representations foreign to the target order that will study it.

So I start by being wrong. The first ideas that come to me about how this level works are wrong. How is it that it comes to me, since I am facing the unknown? I reason by analogy. The order before my eyes is like others. I must not hastily conclude that it is similar. On the contrary, I postulate that it is dissimilar until I find evidence to the contrary. Analogies are very useful. Errors that surround the subject. It is by organizing the conflicts of analogies that the unknown order is discovered.

This order is inserted in the complex dimension. It is specific but intimately dependent on the underlying and overlying orders. My own conceptual pyramid must mimic this hierarchy as closely as possible. My Real pole is a mirror, but a particular mirror in the sense that it is the multiplication of the layers of reflection of the real which gives an increasing fidelity to its image.

My Spirit pole, it integrates my biological, organic, psychological, biographical paradigms. It opposes my identity to that of reality. My consciousness is the place of conflict resolution, the place where my identity strives to subdue reality, where conflict generates intention, and resolves into action. The effectiveness of the action depends closely on the fidelity of my Real pole. Each action favors a particular level of information in relation to the target in reality. It is the quality of my paradigm at this level that makes the action successful.

A right paradigm can be surrounded by others that are wrong or absent in my conceptual pyramid. My action will be crowned with success without my having a full understanding of what I am dealing with. However, an isolated paradigm is always approximate. The risk that it will be caught out is constant. The reinforcement of my Real pole comes, even more than from

the juxtaposition of paradigms which seem individually correct, from their entanglement in a meta-representation of reality.

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Crossing

Interacting elements form a whole endowed with persistent properties. This zone of relative equilibrium is defined by its spatial limits. A new scale of time and space emerges, creating an additional level of reality. This is the *crossing*.

The crossing is done in both directions. Shifting interactions out of bounds destroys equilibrium and its special properties. The threshold is called a 'critical point'. The crossing sometimes seems instantaneous (in the unit of time specific to the system), or it is readily hesitant, alternating, progressive. A host of stories nestle in these moments. Whimsical and exciting news, contrasting with the gloomy balances of the material. The researchers were not mistaken. They created a variety of terms and notions around the limit. Poised realm, catastrophe theory, critical fringe, equilibrium on the verge of chaos.

A crossing is more than a change of spatio-temporal scale. It is more fundamental. It is a leap into the complex dimension, the elementary constituent of which is information. The spatiotemporal framework is only one emerging aspect of information. Certain assemblages of information can create additional levels of reality without changing the spatiotemporal scale.

The spatio-temporal scale makes spectacular leaps for the levels of matter: quantons, atoms, macromolecules, physical and physiological environments. Whereas neurons create a large number of levels of mental organization in a smaller and more finely stratified space-time.

The crossing in complexity is also done in both directions. A complex entity passes or oscillates between two levels of complexity. A brain gains or loses intelligence. These levels are attractors and the transition zone is blurred.

The emergence of organizational breakthrough is linked to pressures. The type of pressure is related to the properties of each level of reality. For

matter, the determinants are mainly spatio-temporal. Containment of a system is the major pressure that causes it to become part of a more complex organization. The organization of matter progresses in the arrangement of a planetary system, through gravitational effects and particle flows.

However, there is a more general way of defining pressures, which applies to matter as well as to the mind: it is *conflict*. Confinement is the spatio-temporal form of conflict: many individuals compete for the environment. Complexity progresses on a planet through the diversity and density of the conflicts that occur there. A mineral planet sheltered from great cosmic conflicts does not climb the ladder of complexity. While the animated history of the forces at the origin of the Earth (cosmic shocks, axis tilt, lunar satellite, variety of materials etc) has produced life and humanity.

In the mind, the pressure of conflict is rooted in concepts that are contradictory or foreign to each other. The conflict arises from the diversity of possible organizations. The mind builds its complexity on the solutions adopted. Succession of crossings.

As a corollary, let us only look for our fellow human beings in places that are 'suitable for life' if we are talking about a life of the same order as ours. While we will find our true *complex equivalents* in places of conflict, rich in unstable balances. Conflict is the engine of self-organization.

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Bidirectionality

The crossing is a concept purely defined in the complex dimension. There is no physical displacement. The related things took no movement, only created additional information. Information that these things do not see. It only exists on the other side of the crossing, which represents things in relation. What represents is an additional plane of consciousness, based on the representation, surimposed on the previous levels.

Bidirectionality is a notion addressing the *vertical* relationship between complex levels, as opposed to the *horizontal* relationships that constitute them. Indeed a complex level only exists on top of the previous one. There is a constitutive, upward relation from the preceding to the resulting. There

is also a representative, downward relationship from the resultant to the precedent. Both form bidirectionality.

The action of the upward relation is the constitution. The action of the downward relationship is *retrocontrol*. Bidirectionality has essential consequences:

The representation of the upper level 'expects' mandatory information from the lower level. It *has to be* organizing something. Among the possible solutions of the lower level, there is one which is chosen by default. This is where another important concept is born: *celebrity*.

The role of the upper representation is to provide consistency by default to all information at the lower level, regardless of changes in this set (within certain limits). The representation exists in its own right, it does not necessarily follow an always similar data schema. If we call 'objectivity' an always similar data schema, then the independence of the higher representation is the root of 'subjectivity'.

Superior representation, by its very persistence, is a measurement of the underlying organization, since one cannot exist without the other. Here we have the root of the effect of an observer on a system: the system comes together to produce an emerging organization, and that organization observes the system in return. Intertwining of the two directions. *The system's constant attempt to organize itself can result in a stability which is its own observation as an organized element*.

Is the retrocontrol from the higher representation evident? Are relationships in the complex dimension always bidirectional? Retrocontrol is evident when the distance between levels of reality is great, for example natural selection guiding genetic evolution, or the human mind modifying the fate of matter. Retrocontrol is less evident in the inanimate. Does the representation of an atom control its particles? No doubt, because when it is modified by the presence of other atoms, taking into account the atomic representation is necessary to know the fate of all the particles included.

The conclusion is that retrocontrol should be actively sought on levels where it is least apparent, in the microcosm in particular, where 'natural selection' occurs in incredibly short spaces of time.

Bidirectionality is asymmetric. The complex relationship is fundamentally unbalanced since the lower level is preliminary to the higher level. Information from the lower level can destroy the upper level without itself being threatened, while the opposite is impossible.

Let's observe bidirectionality through some examples:

The relative independence of levels is the basis of *mental hallucination*. A subjective representation is activated while its objective constituents are not necessarily present. However, the same principle also ensures stability of the mind, by repeating famous behaviors, and by filling gaps in the conceptual structure when some of the necessary data is missing.

Bidirectionality implies that the human mind tests its environment using its representations but is in turn changed by it. It is therefore *as much a product as an actor* in inventing its original behaviors. Some brains are more actors than others, for two reasons: 1) The good accuracy of their representations: the fluid communication between representation and reality ensures the obedience of the second. 2) The gap of a subjective representation observing the objective data. The shift makes representation an *intention*. The mind emancipates itself from reality, manipulates it by attaching itself to the universe of possibilities. Taking a distance makes one tend asymptotically towards free will.

The importance of bidirectionality is evident in speech: suppress auditory feedback on her own words and the human begins to raise her voice uncomfortably, unable to verify if her speech is correct. The demonstration dates back to the early days of the telephone, when the first devices did not send microphone sound back to the user's ears: people would yell.

Purely unconscious reaction. One of the non-conscious stages of *Stratium* is voice feedback. Feedback is necessary at all levels to ensure consistency between the proposed data processing and the result. *All* levels ? Except

one, necessarily: the one at the top. The pinnacle of our conscious integration. Evaluating our own behavior. No retrocontrol at the top. Even when we are convinced that we can represent our own behavior, the judgment stops at this: *What evaluates this capacity for self-evaluation*?

Stratium is part of *Diversium*. Above continue the levels of social organization, from which the assessments of the individual come. So there is something that assesses our own capacity for self-evaluation. *Diversium* continues to develop in a less personal way to the individual. The organization leaves our envelope of individual entity, passes to a larger one: human society. I named these levels *Societarium*. The principle of bidirectionality continues there.

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Relative independence

Relative independence is a notion already present in 'interaction': two things are alike on the one hand, enough to interact, but remain independent on the other hand. The independent part is called: constitution, data, informessence. The dependent part is called: relation, algorithm, communication.

It is an extremely mysterious and difficult notion to grasp. The contradiction it contains is major. Is it possible to erase it, to pretend it doesn't exist?

The first Turing machine is based on a simple principle: Let us call the elements of a system 'data' and the constraints on them 'program'. The 'computation' leads to the organizational solution. Turing then decided to no longer differentiate between data and program. This second machine, treating programs as new data, is universal.

The first machine symbolizes the functioning of a single level of organization. The universal seems to transcend levels, making the program itself a datum to elevate calculus to a higher level. Is this really a true description of self-organization? Does the higher calculation in return influence the course of the basic calculations? How do they agree on a stable outcome, if they are independent? Why is the superior not predictable, if it is dependent on the base? How does a universal machine

define the qualitative, the particular? Neither independence nor dependence, in their radical and exclusive forms, are satisfactory explanations. We need the notion of relative independence, despite its inherent contradiction.

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The justification of complexity

The presence of complexity requires to move physical systems to biological *entities*, which are surimposed complex levels.
Without paradigm change, the power of the ontological models weakens.

The complex verticality is necessary for the separation of the qualitative and the quantitative.
Similarly, the difference between information and property only makes sense in a staged complexity.
The quantitative locks inside a quality to no longer see it. Sets of numbers can claim to describe the entire real.
Relativity / quantum unification stops because of the non-separation of the complexity levels described.

Verticalizing the complexity requires a meta-logic.
Finding its principle is peeling an onion. Under the organization, the conflict. Under the conflict, the opposition between individual and collective part.

It is an absolute truth that there is no such thing as absolute truth. This paradox is almost enough on its own to declare the presence of the complex dimension. A principle can be true in one level of reality and false in integral reality. The principle of non-contradiction establishes the logic of one level but does not extend to the others, forcing the creation of a paracoherent logic.

Let us be very careful when declaring a principle transcendent to reality, especially ontological reality. It is a sanctuary that prohibits any competing paradigm. Religious truth for the Real pole, the mind that models. No matter how close the link connecting it to reality, a principle remains an

element of communication, of representative language. The mind, as a translator building its independence, cannot access what gave birth to it, any more than one can experience in the minds of one's parents. It is through a *representation* that we communicate with the real. *We are* our representations. This is how a materialist hastily declares herself fused with the essence of reality. She is eliminated as a process that represents. To shift away from this essence is the first philosophical step. We are entering the complex verticality.

System and entity

How does horizontal thinking analyze complexity? It's dealing with systems. It separates the physical / chemical from the biological. Physics are systems of really large numbers of mostly similar elements. Biologics contain fewer numbers of biomolecules and cells dispersed in countless different types and properties.

The mathematization of physical systems (statistical mechanics and hydrodynamics) cannot be transposed to biologicals. A *function* appears for the biologicals that is not detected in the physicals. Where does it arise from? Why can we no longer be satisfied with modeling electromagnetic and kinetic properties? Horizontal thought encounters a metaphysical rupture. But it is content to empirically seek new models for biologicals. Without a paradigm shift, precision and predictive power weaken compared to physical models.

A biological system is a horizontal pseudo-system. It surimposes several levels of organization linked to the variety of elements present. The model applied is a forced synthesis. It analyzes inputs and outputs, initial conditions and outcome, but ignores what is going on inside the 'black box'.

Vertical thinking comes to our aid. It prefers to call a cell or other biological assemblages an 'entity' rather than a 'system'. Unlike physical elements, the spatio-temporal grouping of elements does not force them to belong to the same level of reality. Their functions separate them in complex verticality. In this dimension they belong to (relatively) independent

systems with a coherence that the spatio-temporal framework is incapable of providing on its own.

The staging of the complex dimension

Do the levels of reality have any existence other than epistemic? I showed their ontological existence in the previous chapter. But how could we do without it? Suppose we treat reality as a purely ontological information structure. With this exclusive upward look, the qualitative disappears. Information boils down to numbers. So let's ask how much information makes a steam engine work.

The machine contains potential information, linked to its material structure (walls, piston), and kinetic information, linked to the influx of heat and the compression of gases. How are we going to total this information? In order not to forget anything, it is necessary to include the work of the researchers, the data of metallurgy, the manufacture of the tool, the supply of energy, the training of the workers, etc. Impossible task? Indeed. Information is intertwined, disseminated, virtualized. Some of its aspects are completely invisible in the physical structure of the steam engine and yet it could not exist without them. The investigation cannot be undertaken without giving independence to the levels of information, at the risk of forgetting most of them.

Examples are found in all fields. The very structure of scientific disciplines shows the staging of reality. The physical inscription of the complex dimension is essential. Let us cite two other examples, one generalist and the other specific to anthropology:

The general argument is the impossibility of describing reality in a purely quantitative way. It is futile to reduce the universe to a system of quantum excitations. How to explain the observed heterogeneity? Why is a particular set of these excitements walking around among the others and starting to write these lines? Impossible to reduce the qualitative to the quantitative. The double look is necessary to separate them. The quantitative is an upward principle, turned towards collectivization: it measures the intensity of a characteristic common to several things, for each of them. Quantification of a relationship. The qualitative is a downward principle,

turned towards individuation: a quality is on the contrary the meeting of several characteristics in a single thing. To separate quantitative and qualitative we need the double look, of their origins as real as each other at the ends of a complex verticality.

The separation between quantitative and qualitative is the same as that between information and property. Why is a qualitative property a barrier between two immiscible information planes, the one that produces the property and the one that uses it? Each of the plans responds to an algorithm, it is easy to hide the qualitative leap in an '=' sign or the term 'correlation'. This reductionist sweep is hardly scandalous when it comes to transforming heat into molecular agitation. But it must revolt us when it claims to annihilate the quality of our consciousness. Let's camp in it to affirm the reality of complex verticality.

As a particular argument I have chosen this, in the midst of a crowd of others of the same type: All human communities have passed through the same successive levels of organization. Identical civilization characteristics developed on different continents, without any contact. They reached the same stage of complexity. The solutions are all the more similar as the underlying processes resemble each other: common inter-individual relationships, themselves linked to the similarity of the human body and its needs.

Horizontal confinement of the quantitative

The quantitative calculates and compares its results with experiments which provide the same type of figures. In this research the qualitative disappears. The study locks itself *inside* a quality, without worrying more about it. This is how one can think of explaining everything with quantities.

Within numbers, fundamental physics diligently seeks the unification between two great theories, relativistic and quantum. On the pretext of covering from the ultimate small to the ultimate large, unification deserves, for some physicists, the title of Theory of Everything (ToE). Blind eliminativism, making reality a pure set of quantities, stripped of its qualities. Unification does not widen the perspective, it narrows it to a

physical level, erasing the complexity that surrounds it. Some theologies make their ToEs as acceptable as the multiverse of physicists. If ToE is based on a plane isolated from reality and does not explain the others in any way, why elect the quantons rather than the human minds or the mysticisms they build? Why choose science over another religion, when it behaves like a religion?

Note that the two take a common path. The number of tools shrinks in thought as it approaches the immeasurable. Reductionist thought, like religious thought, leads to mystery. Theologies do the courtesy of human to install her in the real from the outset, while equations do not care. So what is she doing there? She is neither predictable nor calculable, nor is her mind. Unify quantum and relativistic theories? This great achievement would improve our understanding of the cosmos, but nothing of the small space delimited by our skulls. Our minds must open up to a more ambitious logic, capable of transcending complexity.

The task is repulsive. The complex base is attractive, agreeing to strictly conform to mathematical models. But the top squirms to evade prediction, making models of the mind rough guesswork. Isn't it an easy solution to look for an origin equation and let it figure out the rest? Is this not attributing to the egg the power to create the animal, without knowing from where it arises?

How to verticalize the study of complexity?

Asking meta-logic to take hold of an incalculable process seems an unreasonable demand. One way to get it started is to segment the process. Logics proceed in this way. They cut reality into slices, into partial results, then try to reconcile their postulates to reestablish continuity. Is there one that claims the transcendent, compatible with any paradigm, accommodating all postulates?

Given the diversity of systems and their solutions, meta-logic must be as little differentiated as possible, in fact reduced to the root principle: the *organization*, itself stripped to the *conflict*, which underlies it.

Does conflict have this ultimately fundamental value that we seek? After all, aren't there different varieties? Conflicts that resolve themselves, others that endure? What proof would we have that *everything* is conflict?

The conflict that can claim transfiguration is not the conflict of elements between them, of elements *confronting* each other. With such a departure, a host of questions already arise: Where do these elements come from? What is their interaction made of? Why doesn't the conflict end when they find a balance? Or if the balance does not exist, why does the conflict not continue in the same way? Why is its complexity increasing?

The definition of conflict presented in this book is very specific. Called T<>D, conflict between individuation and collectivization of everything, it contains its own dynamic, independently of any preliminary situation. No need for elements involved. A single individuation is enough. It is everything, but still defines itself as the other in relation to *nothing*. It's not '1' in the middle of '2', but '1' rather than 'zero'. Poetically the real started from a conflict of nothing at all… The T<>D conflict is intrinsic to all self-considering individuation. It is the tension between the individualizing part and the collectivizing part within the rest. The rest ? Others, or perhaps nothing, if we go back to the origin. But to consider nothing is already more than nothing…

The *tension* is omnipresent, unavoidable. No aspect of reality is devoid of it. Energy in many forms. Still, in a system, at the root of an organization, can we identify this conflict between a similarity and a non-similarity. I am Me and I is not Everything. The reduction of this tension, a state of lower free energy, is sought through the attempt Me = Everything (T=D). It cannot succeed, but the attempt, which approaches it, serves as the new Everything. Provisional. It quickly finds itself surrounded by a new rest, with elements capable of interacting with it. The T<>D conflict in its impossible attempt to resolve itself (a founding principle seems incapable of dissolving itself), creates an increasing diversity of Everything(s) competing for this inaccessible trophy. From the One, in the midst of nothing, is born the multitude.

Have we left physics, and even science, for mysticism? It's deliberate. The question that will grab your attention is: *Where did we leave them*? I will of course detail the T<>D a little further, from a more pragmatic angle.

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Genesis of the complex dimension

From three examples, I show that a level of reality is an approximate representation that establishes an additional information plan, embedded in reality.
A *representation* is a level of reality in the fact that it carries out an approximation of the underlying complexity. Definition of the level by the downward look.
The complex dimension is based on the fact that *everything represents* something else.
A *regularity* forms a level of reality in the fact that an interactive sequence is perpetuated between the constituents. Definition of the level by the upward look.
The complex dimension is also based on the fact that everything shows a regularity, at the price sometimes to wait for an eternity. But eternity has a definition only in a level of this dimension.
A *symmetry rupture* changes the regularity of a level of reality.
A *perturbation* is the effect of symmetry rupture on adjacent levels.

The self-organization is an alternation between 'collection becoming a whole' and 'whole becoming part of a collection'.
The 1st half of the alternation is the exploration of states by the system, candidate *solutions*, and within them: final *intent*.
For the final intent / the representation of the system, the other solutions are errors.
In the 2nd half of the alternation, the representation covers enough states of the system to be stable with respect to other individualized representations. Formation of a higher system.
Alternation is also between diversification (multiple solutions) and selection (final representation).

The representation, as an approximation, is born in the temporal shift between its properties and those of its constituents.

For the upward look it's not a gap in a common time frame but the creation of a proprietary time. Only the downward look arbitrarily assimilates them in a common framework.

The self-organization constantly recreates its own story, revise it, checks its path or change if the context is different. Order stored within its own scalability.
The representation exercises a retro-control by its faithfulness to the system it represents.
The retro-control is so powerful that it can stabilize non-optimal parts of its own structure. It is not necessary to explore all the solutions.

Alternation under double look causes duplication of codes. A 'color' is a qualia for the downward look and a wavelength for the upward look.

A level of reality is an attractor in the complex dimension and not a closed space.
It self-defines by the common interactive properties of different complex elements.
The evolution of renormalized models shows that there is a critical state where the complexity levels are aligned, like chaotic trajectories aligning in stable orbit.

The interactions exist between remote reality levels by several mechanisms:
The frank disturbance of a level impact those constructed over it.
One level can simulate the information of another.
The stability of the laws of a level makes it more or less impervious to those of its neighbors.

Interest of the concept of *organized entity*: individuation of a stack of levels of complexity since the origin in the real per se.
Entities reaching a comparable level are capable of communicating their solutions.
They exchange an impression by communicating by complex symbols (language) or simultaneous exchanges at several levels of information. The impression remains an analogy with the personal and not what experiences the other.
Interactions are possible with entities having part of the complex structure or simulating it.

But pay attention to shortcuts: the controversy about the qualia is re-explained here. A level of reality is an attractor in the complex dimension and not a well-defined dimensional space. In the same way that a system is self-determining by the interactions of its elements in a relative spatio-temporal isolation, a level of reality is self-determining by the interactions of its constituents in a relative isolation of the complex dimension.

Complexity born in *real* approximations

In the previous chapter we saw that reality makes approximations about itself, without the intervention of any human mind. It thus creates additional levels of information, the staging of which is defined as the complex dimension. Let us summarize this birth of complexity with the conjunction of three examples.

The impossible does not have the same definition in the macroscopic and microscopic universes. For example there is a theoretical possibility that I, a macroscopic entity, cross a wall on which I would have rushed. This is what the models of physics say. Nevertheless the case is very particular: all my particles and those of the wall, without exception, must be in a specific position with respect to each other. An eventuality so improbable that it is bluntly called 'impossibility'.

Second example: the possibility that an alpha particle (A) leaves the nucleus of an isotope is non-existent according to classical physics. The energy potential required is greater than the kinetic energy of A. The theory differs at the quantum level. Tunnel effect: the probability that A crosses the potential barrier is tiny but exists[32]. But quantum states are linked together at an incredible speed, to the point that the event takes place under the slowest human observation. The very large number of atoms in isotopic material means that alpha radioactivity, emission of A, is a phenomenon that can be measured on our scale. The impossible returns to everyday life.

Microscopic / macroscopic separation, then, is it only a matter of large numbers and times? The ladder radically transforms the possibility that a

[32] Radioactive Decay in the Causal Interpretation of Quantum Theory, Klaus von Bloh, 2008

break in symmetry is transferred from one level of reality to another. In the first example, the breakthrough 'I'm crossing a wall' is erased from reality. In the second, the 'alpha out of the nucleus' break, affected by equally tiny probability, becomes reality. The predictions are reversed. *A reality level acts as a filter*. It makes the 'I can't walk through a wall' approximation realistic, when the possibility exists. It makes the 'crossing a wall' phenomenon *unreal* while the 'alpha radioactivity' phenomenon is *real*.

Another surprising consequence: the second example created what we call a 'random phenomenon'. Indeed, the interval between two emissions of alpha particles cannot be calculated from the previous ones. It can be assigned an average frequency, but the improbability of each broadcast is such, in detail, that each seems independent of the history of the system. The *inaccessibility of details* makes the show seem haphazard. The hazard is thus defined as a break in symmetry determined but hidden in large numbers.

In these two examples, the systems have a really large number of possible symmetries. They are separated from their macroscopic organization by the impressive difference in scale between the number of elements, their energies, the proper times. The breaks in symmetry of the microscopic manage to emerge because of these really large numbers. But there are also macroscopic systems with a small number of symmetries (very ordered). How does a break in symmetry manifest itself for them?

Our third example is a thought experiment rather than a physical one. We need an ideally straight, homogeneous metal bar placed vertically on an ideally homogeneous and indestructible floor. Increasing pressure is exerted at its top, ideally distributed over its section and ideally in the axis of the bar. When the pressure exceeds the resistance of the bar, will it fall apart or twist? In which direction ?

The symmetry imposed on our thought experiment is contradictory to the absence of any degree of alternating symmetry allowed in metal. Its atoms have only one possible arrangement in their inter-atomic arrangements. We cannot tell at the reality level of the metal in which direction the bar will twist. The disruption of symmetry occurs at the level of subatomic

interactions, which differ from atom to atom. A link will appear weaker at a level of measurement that is inaccessible to us. And the bar bends.

The important conclusion for our topic is this: A very ordered system is a level of reality which achieves an approximation: all inter-atomic bonds are equivalent. This approximation is really 'realistic' under all circumstances when in theory it is not. Our thought experiment is unrealistic but suggests a real possibility that the approximation would be wrong and a break in sub-atomic symmetry would occur.

For all of our examples, which include really large and small symmetrical systems, the conclusion is the same: a reality level is an approximation. In this sense, it is authentically an additional level of information, inscribed in reality. This level is not reducible to its constituents.

In this book I call *representation* a level that achieves an approximation.
The complex dimension is based on the fact that *everything is representing* something else.

The macroscopic order sets in for a simple reason: from its level of reality, the microscopic order seems to have an eternity to recur specific states which then become *regularities*. The macroscopic level is based on these regularities. They constitute its stable elements, capable of interacting together, because they have similar properties. An additional level of reality has been created. As an approximation it holds even when the underlying patterns change, within certain limits.

The separation of elements into systems leads to different organizational solutions. Diversification. With order being structured over an increasing number of levels, the possibilities for organization are increasing exponentially. However, not all solutions have the same stability, the diversity remains relative, rather than explosive.

Breaks in symmetry are not transmitted as they are in the self-organization ladder. They are amortized. The improbabilities they represent fade and disappear. However, they induce effects. Let's call them *disturbances*. It is therefore to define the *rupture of symmetry* as the name of the phenomenon

in the level to which it belongs, and the *disturbance* as its effects on the overlying levels. The disturbances are the root cause of the diversity of the underlying organizational solutions.

Note that this definition of symmetry breaking makes it a similar phenomenon on all levels, while the usual way of thinking divides it into different concepts. *Probability* is a mathematical concept, *chance* a philosophical concept that the sciences are starting to get rid of, *luck* is a psychological concept. All of them are just different aspects of the principle of breaking symmetry, of transmission of perturbations, the presentations of which become kaleidoscopic with increasing complexity.

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Self-organization: an alternation

Complexity is an order based on self-organization. Why is this order maintained rather than dispersed under the effect of the incessant changes of the context? There seems to be a motor of complexity to weave this order into intricate levels, without the weaving action itself being destructive. This engine is an alternator: it assembles parts/whole into whole/part, one level after another. Alternation of collectivization (constitution of a system) and individuation (representation of the system as an element).

Here are several ways of looking at this alternation: as an intention creator, as a complex diversification, as an addition of time planes:

The alternation of indeterminacy / intention

Unpredictability is inherent in the process of self-organization. It is one of its alternations. The process explores the possibilities, with no other intention initially at work than that imposed by the existing structure, which cannot be denied. An additional layer of information appears a posteriori, by the creation of the representation. Due to its primitive indeterminacy, the process makes "errors". An error is meaningless to the upward look. It only takes on meaning for the a posteriori representation, the source of the downward look.

In detail: The process goes through different phases, whose duration of stability is variable, closely associated with the contexts. It builds a library of possible states, each retro-organized in a more or less persistent way.

These states can be assimilated to different candidate *solutions* to represent the level, among which is the most stable, the *intention* which will prevail.

These notions of indeterminacy and intention are found at every level of the self-organization of reality. In human society they are our classic notions of freedom and will, luck and power. The intention claims to be exclusive to biological life. However, there is no precise starting point for the alternation of indeterminacy / intention in the construction of reality. It already exists in the germ of life.

The alternation of diversification / selection

Diversification comes from breaks in symmetry, or mutations. Then the success of the different entities produced leads to a selection in favor of the most famous. There is a back and forth around each level of organization, between diversification/individuation and selection/collectivization. This oscillation is a marker of the transition plane. The plan itself is created by a new invention, defining a change in local conditions, for example the cell lipid membrane. This invention is the culmination of an organization, its most famous solution, and creates the conditions for a new organization between entities of the same level.

Mutations can occur at a more or less low level of organization. The lower this level, the more threatened the general stability of the new entity. These fundamental mutations are often lethal. While those at the higher level respect the underlying organizational pyramid, which has already been proven. They are more likely to survive and gain better fame than existing champions. Analogy with the game Jenga, a tower of stacked wooden blocks: if you remove a block from the bottom, you are more likely to collapse the tower than by removing a block from the top.

The temporal alternation of organization / retro-organization

The representation, or fragment of consciousness, is born in the time shift, which is of three types:

1) Time scale shift.

2) Start shift: the representation "becomes" aware of the organization it represents. Even when this delay is tiny, as in quantum interactions, it does exist. The impression of simultaneity comes from the insufficient definition

of our instruments.
3) Reverse organization shift.

Surimposition includes this time shift between levels of information. For the upward look, this is not a movement within a general time frame. I conclude in the analysis of time that this general framework only exists for the downward and reductionist look. It arbitrarily merges the times specific to each level, to each surimposed fragment of consciousness. The time shift is creative, an essential factor in the constitution of the additional level. This "escapes" the underlying temporal plane.

This question of time is difficult. The time of an interaction between two elements is incremental only in our models. Ontologically it involves everything that participates in the interaction. The context is the entire universe (some forces have infinite scope). Best argument for thinking that time is not a frame with its own existence. How would it store all of this information to *apply* to the interaction? Time is indeed a mask belonging to representation. Undoubtedly one should see "interaction" itself as an attractor in a complex continuity, where time has no meaning. This in no way diminishes the importance of the place of this attractor in the complex dimension.

When we model this sequence by mathematical operations, we must not neglect the two dimensions, horizontal and vertical, of the calculation itself. When writing our acronyms, the space between them is important. A multitude of others nestle in these apparent voids.

Recreation

An essential characteristic of autopoiesis ensures both its diversity and its continuity: it is the permanent revision of its genesis, of its own sequence. The process recreates its own story. A star reproduces part of the original sequence of the universe. An embryo reproduces the evolutionary path of the species. Accidents are possible. Symmetry breaks. An alternative is born, tries its luck in the face of the usual sequence. Advantageous, it becomes the benchmark. When the range of possibilities has been reviewed, innovations become scarce. Rules at this level tend towards immutability. The pyramid stabilizes in order to continue to rise.

The power of retrocontrol

As it rises, the complex pyramid multiplies the possible organizational solutions. The former is less and less likely to be the best. The organization collapses before it strikes a balance. Reason for increasing instability at the top of the pyramid. At the peak of our mental organization, our conscious thoughts are chaining and crisscrossing at high speed, dropping to cruder levels before ascending to the flashes of genius that are definitely taking hold in mental patterns.

Another factor comes into play: the strength of the retrocontrol. Effective, it can stabilize the entire pyramid. The power of representation is that it can mimic any level of information. Human have thus learned to control her material environment. She saves her organism from lethal physical conditions by building shelters. Reverse control of mental information levels (individualized as intentions) over material levels.

Within the mind itself, there are levels that stabilize others. Humans form social organizations. These rules stabilize ill-conceived levels, such as aberrations in individual behavior or physical disabilities. Without social organization, at the top of the pyramid, the individual would not survive. Power of the retrocontrol.

Duplication of codes by the double look

Each level of reality being seen by constitution and representation, the codes designating it are duplicated. Take the example of colors. By constitution, the data are wavelengths, coded by 4 types of rhodopsin. Then the signals from the receiving cones are synthesized in a color palette. The development of this palette depends on the use that higher integration networks make of it. A human living in a lush forest develops a great finesse in the palette of greens.

Through representation, data are qualia, fusional impressions associated with words of language. The variety of language matches that of the color palette used. Qualia are specific to each consciousness. It is learning that uses the same words to designate qualia associated with the same wavelength ranges. But disagreements easily arise at the limits of these

ranges. Find two people who make the transition from ‘blue’ to ‘green’ at exactly the same wavelength : impossible mission. Because the codes of constitution and representation may designate the same thing, they do not understand each other.

One look is that of the collection towards the whole, the other is that of the whole towards the collection. The same set of codes (wavelengths) escalates mental complexity. A code specific to the individual (color qualia) goes down.

How to precisely define a level of reality / of complexity?

Take the example of a chaotic system where an element orbiting an attractor according to a multitude of trajectories, the common point of which is the definition of this attractor. A change of context can transform the trajectories into a stable orbit. Let's call it the critical state. Let us now leave the spatial framework and enter the complex dimension. The models of the different levels of complexity of the system follow a multitude of trajectories. They can be related by renormalization. The renormalization reveals the common point between the modeled levels, which is the definition of the complex attractor.

The evolution of models renormalized to the critical point approach is perfectly superimposable to the evolution of trajectories to the critical state approach defined above. A reality level is a complex attractor which behaves like a spatial attractor in a chaotic system.

In physics, the levels of reality are embodied by the nonlinear evolution of entropy as a function of an input of energy. The system goes through transitions, phase or more generally organization. Entropy varies massively in one direction or the other at each of these levels.

Interactions between levels

The term ‘level of reality’ can create confusion: it may lead to believe that exchanges take place exclusively within a specific level of organization and that two distant levels cannot interact directly. No. On the contrary, interactions are common even when the levels are very far apart in the complex dimension. A sunset triggers emotions when it is a purely physical

phenomenon. The coagulation of a few microliters of blood in a cerebral arteriole takes away mental function. The mixture of interactions between a part of a level A organized in level B then C… and "free" elements of level A is also frequent. This is the case, for example, with hydrophilic and hydrophobic monomers organized in hydrophilic / hydrophobic polymers, then in micelles: the free monomers interact directly with the micelles.

These remote interactions in the complex dimension have several reasons:
-the evidence that an overlying level can only be maintained on the stability of the underlying ones (coagulation in the arteriole destroys the neural organization in its region),
-the possibility of simulation from one level to another, with different interactions (the sunset is a mental representation simulating the physical phenomenon, but associating it with other representations to lead to the emotion),
-as for 3D degrees of freedom there are degrees of freedom for each level of reality, some levels being more impervious than others to interactions with their neighbors. Hence the interest in having defined the levels of reality as attractors and not isolated planes.

A level of reality can thus function as a society with its neighbors: several successive "social layers" link them. There are many organizational solutions. The model capable of describing them is difficult or impossible to find. No possible compression of this complexity.

This gives another possible meaning to 'simple' and 'complicated': when a level of reality is very independent of its neighbors, impervious to elements which do not have the properties defining this level, its model is simple. All the elements conform perfectly. But this simple level can mask a great deal of underlying complexity. For example, the standard model of quantum physics, mathematically tyrannical for quantons, could be built on a level of reality less independent of its neighbors. This level would then be more complicated. Would it always respond so precisely to a mathematical codification, as reductionism leads us to believe?

Conversely, a society of virtual strata such as that of the brain appears difficult to fit into a personality model. Humans are so diverse that

modeling is impossible. But this complicated conscious level can eventually result in a simple organization. A model of all of humanity might turn out to be simpler than that of one of its members.

The meaning of 'simple' here is not 'easy to understand' but 'easy to compress into a template'. Quantum equations seem complicated to a layman, but they are 'simple' to a quanton, whose very essence they describe. If calculation is difficult for an untrained mind, it is only because it has not appropriated the mental simulation of quantons. It should do a rough translation into terms it knows. The quanton, on the other hand, does not need to calculate. The equation is inherently natural to it.

Paradoxically, the mind finds it less complicated to understand its peers, while they are much more complex. But other minds are like it. It is a natural simulation of them. It models and predicts them better than any mathematical calculator.

Organized entity

These observations lead to the definition of *organized entity*. An entity is an individuation made up of a stack of levels of complexity from the origin of the real per se. This self-organized pyramid, during encounters with other entities, reacts in a coordinated manner through this intrinsic structure. The other entities may have reached the same level of complexity or be of a different level. However, it is only with entities of a similar level that there is competition between organizational solutions. The reason is simple: only systems with identical properties "see" meaning in the alternative solutions used by others. These solutions are as foreign to the underlying levels as the differential equations to a child having no mathematical basis. The solution of the parent entity can only be implemented if the structure of the child entity can accommodate it. An informed teacher knows that it is illusory to make a student assimilate a course for which she does not have the basics.

Surimposium creates three perspectives for a complex entity: structural (the *body*), retroactive (the *function*), temporal (the *biography*). To be brought closer to ontological, functional and evolutionary definitions.

An entity is a system with a stable identity. The difference ? A system simply *stretches* over time while an entity *endures*.

Communication between complex entities

Communication between entities takes place either in a single level of information (interaction between precise physical properties, mathematical language) or by the exchange of symbols representing surimposed levels (spoken language, arts). An impression is not really transferable. It is a fusion belonging to each entity. But since communication can operate on several levels of information simultaneously (oral and body language), the communication acquires a depth that approaches a transfer of impression. Each entity amalgamates what it feels with what the other feels.

Communication is best done between similar floors of the information pyramid, however shortcuts are possible when part of the structure exists. Free monomers cannot directly form micelles. But if polymers have already started to form them, monomers can aggregate there directly. Ditto for our mathematics teacher: she is not necessarily understood from her speech, however the existing knowledge of the student is sufficient to build in a few hours or a few days the missing conceptual level. The following reading of the course shows that it has been integrated this time. Sometimes there was no intermediary work. The mind spontaneously self-organizes. Sometimes the teacher has been obliged to detail her explanations: she brings the underlying concepts, simpler, which are lacking in the digestion of the developed concept.

The case of qualia

An example of confusion linked to these shortcuts between levels of organization is the question of *qualia*. A typical qualia, as defined by some philosophers, is for example the 'red color' impression. It can be defined as a wavelength of visible light between 625 and 740nm, but this gives no information about conscious sensation. My mind doesn't tell me when I see red that light is a wavelength of 660nm; it said to me: « it's red! » The qualia are therefore presented by philosophers as irreducible notions that defeat reductionist science. But how to find another explanation for the qualia, which would free itself from this science? Where could they come from if not from neural matter? From an unknown metaphysical space? The

philosopher hesitates to join her old enemy the mystic… The mystery continues to surround the qualia. Refusal of the reductionist explanation and not an alternative theory.

At this point in your reading you now understand the qualia. They have a rigorously authentic existence to the downward look, while they are invisible to the upward. Philosopher and reductionist are both right… in the isolation of their unique look.

The reductionist uses, with her definition of red at 660nm, a severe shortcut in the complex dimension. In reality, photons of this wavelength hit a rhodopsin molecule, capable of recognizing this precise value and transmitting a specific signal to consciousness through surprisingly rich neurological pathways. The signal is codified by an impressive array of intermediate neurons. A complex meaning is surimposed on the wavelength. It is finally translated into 'impressionist' language as being 'red'. The difficulty for the reductionist to admit this transformation of a wavelength into 'impression' comes from the fact that the notion of impression is absolutely not part of electromagnetic theory. Nothing in the specific characteristics of the photon and its behavior gives information about the 'red' impression.

What usually happens in the horizontal world of the reductionist when faced with such a situation? When properties emerge at a higher level while they are not contained in those of the lower level, it uses correspondence / correlation laws which translate them into each other. For example 'heat' in thermodynamics is the translation of 'molecular agitation' in microphysics.

Our common sense spontaneously uses identical shortcuts, learned a long time ago, deeply buried in unconscious automatisms. It is not easy to recognize them for the 'red': the levels of information separating the photon from the 'red' impression are far more numerous than between 'molecular agitation' and 'heat'. We lack awareness of the rules of intermediate translation, which cause the light signal to evolve step by step in impression. They are there but we do not perceive them. Unconscious work. It is easier to spot the use of a correspondence when the transformation is entirely manipulated by our conceptual logic (for

example the mental solution to a rebus). Here the process is fully accessible to consciousness. But this is not the case with 'red' and a multitude of other impressions, which are given to us 'ready for use' by the unconscious, unmodifiable.

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Surimposition, surimpression

The concept 'depth' of information does not say anything about its integration.
Example of sound waves, which reflect a depth of language, but are not integrated information. The waves convey the speech; they do not speak.
Surimposition and *surimpression* designate the same phenomenon: integrating information levels into one thing.
Surimposition is the phenomenon seen by the upward look: building integration by stacking levels.
Surimpression is the phenomenon seen by the downward look: representation of the levels' merging.
Difference with superposition (simple mixing of information layers, all is their addition): the *surimposition* is the integration of a layer of information to the previous one, devoid of meaning without it, which transforms it into a radically new whole.
No loss of information with surimposition. The preservation of information is verified inside a complex level.
The concept 'surimposition' is close to *disparation* (Simondon) and *symbionomy* (De Rosnay).

We still need a bit of vocabulary to handle the complexity. How is the information installed there? It's impossible to be satisfied with a concept as narrow as depth of information. Despite its title, it is a horizontal concept. Something is seen as a mixture of information that can be pulled together in different ways, like throwing a hook that specifically attracts a particular species of fish. But how is this information organized among themselves. They are structure, but do they have a structure?

This is the concept of self-organized information. How do you differentiate it from mere depth of information?

The overlapping sound waves are a good illustration of the depth of information. They can transmit elementary or complex sounds; they can support all the codified stratification of a language, from vowels to sentences, from simple words to words synthesizing sophisticated concepts. However, this is the stratification of a distribution system, not a self-organized system. Pure communication (except for phonons), sound waves do not meet the definition of complex entities. Their information remains purely virtual without the sender and receiver to exploit it. Waves do not organize themselves from elementals into complexes. Their rules are common. Complexes *do not interpret* elementals. A language is not in itself a self-organized entity; it translates it.

Now consider the brain, an assembly of neurons. It may appear to be a physically homogeneous medium, neighboring the molecular assembly which propagates sound waves. Does neural communication respond to the same notion of depth of information? Is it a virtual stratification of the same order? Many descriptions of the brain make it a machine for communicating and predicting. But who receives the communication? Who uses the prediction?

The neural assembly is self-organized. It contains its own observer, its decision-maker, its information forwarder. It transforms communication into *constitutive* information (informessence). What does this metamorphosis consist of? Do not answer 'altered synaptic weight' or 'dendritic growth' because these terms are not in the vocabulary of information. They are qualitative descriptions. Informessence appears as the sedimentation of the processes underlying the thing observed, whether it is matter or a mental concept. We need a term to characterize the surface of these sedimentary layers, which takes into account the hidden thickness.

Both 'surimposition' and 'surimpression' refer to this phenomenon: the entanglement of the levels of reality in an individual thing. *Surimposition* is the ontological/upward look at the phenomenon; surimpression is the epistemic/downward look. This double notion is essential to characterize a complex entity.

Surimpression is manifested in a painting: outline drawing, detail of the subject, addition of colors, environment, relationships of objects, possible general meanings. Some of this information only makes sense if other information is already there. Together, surimposed, they have a holistic meaning that does not exist in the mere addition of the layers. It is in their *fusion* that it appears, that it responds to an equally fusing concept in our mind. What is special about surimposition is that the holistic meaning only exists on top of the layers. Only one is missing and it is gone.

Surimposition is not a *mechanism*. With this neologism I am not inventing any process or equations new to reality. Surimposition is there, in front of our eyes. Take precisely, in front of the eyes, the nose. The nose is *at the same time* a quantum system, an assembly of molecules, cells, an architecture of bone, cartilage and soft tissues, nerve endings which are a tool of perception. How do you bring all these aspects together? Semantically it's easy: the meeting is called *nose*. Conceptually no one knows how aspects fit together in the same place, from quantons to perception. And yet the nesting is *realized*. Surimposition is a basic reality. To call it that is only to give it a different look.

Surimposition replaces the more classic notion of 'superimposition of emergences'. This is a property of the organizational dimension, restored to its verticality, after having been flattened and declared illusory by reductionists. Surimposition is the opposite approach to reduction: it restores its height to the organizational dimension, by granting relative independence to the levels of reality. There is another example of an entanglement similar to surimposition, this particular mixture of rules that merges them without destroying their independence, and this other example is not open to debate: it is the dimension of *time*.

Time harbors a similar phenomenon of fusion between 'before' and 'after' which does not dissolve the existence of either. At first you may think that this is a succession and not a fusion, but in doing so you are making a mistake: in succession there is already 'time'. You seek to define time by applying it to itself. If we look at it as a *dimension*, for example in the same way as a *thickness*, then the before and after are two thin layers, the second

perched on the first, but inextricably linked. The same entanglement mechanism, exactly, as that postulated in the organizational dimension.

Especially since what separates the properties in an surimposition is a *delay*, the same unit of existential 'thickness' as for time.

Nobody gives up on their past, not even the material. It cannot exist without the sequence of interactions that have brought it to this moment. Reality results from a temporal organization. At least in the height of *Diversium* that we know, because it can take root in foundations where time is not yet one of its properties.

« What is surimposition? » is a question from the Spirit pole to the Real pole. Let the latter respond: « Information surimposition *is the nature* of my reality. I exist that way. My own question is: *How do you, Spirit pole, manage to cut the fusion of my reality into independent levels?* »

The answer is clearly *in the way the mind is shaped*. It is designed to separate representations. It cannot simultaneously see the same thing one way and another. Neural configurations compete with each other. Neural impulses do not borrow them randomly. One is more famous than the others, although this status is not final.

While neural representation *is an surimpression as an experienced idea*, it only represents one level of information. It mimics some precise regularities communicated by reality. Order linked to others, through the hierarchical neural tree. The brain unwraps and then reweaves.

A concept thus increases its depth of information, in a manner sufficiently similar to the subject represented to give the impression of knowing it. However, whatever its fidelity, the concept remains a mimicry of part of the surimposition forming the essence of the real subject. The entirety of this essence remains inaccessible.

This theory leads to a prediction: Algorithms electronically simulating the activity of neural patterns will reproduce exactly the information they process (the meaning of the ideas will be the same), but the experience of

their own functioning by the algorithms will be different from that of biological neurons, due to the different nature of the support, which participates in the surimpression of the levels of information concerned.

But let's come back to this structure of neural networks which makes it possible to segment reality. Let us use as an example a famous painting: The *Vegetable Gardener*, by Arcimboldo. Look at it. You discover several vegetables piled up in a bowl. Your mind has already gone through a great number of mental operations to generate this result in your consciousness. It analyzed the regularities of the image, put its parts together, classified them into two categories (vegetables and a bowl). The whole could be called a 'vegetable composition'.

Now flip the image. An additional meaning emerges: it is a rude face, that of the *Gardener*. The same image becomes something else. And yet it's still the same set of vegetables. The most important thing is that the image cannot be both things at the same time. If it is 'Gardener' in your mind, then it's not 'set of vegetables' anymore. *The mental accommodation of the image is unique*.

But in this unique accommodation it is clearly possible to put different content, in this case either 'Gardener' or 'set of vegetables'. What is the structural mechanism that allows, in a field of neurons, to establish fixed locations for different conceptual contents? To complicate matters, concepts are always fixed both in terms of neural location and content. As quickly as an image changes on the retina, one cannot imagine the concept of 'red' for example walking through groups of neurons, to settle here or there.

There is only one possible explanation: the fixed symbolization provided by a particular neural group can relate to any criterion or entanglement of criteria, from the simplest to the most complex. In this case, the Vegetable Gardener's unique mental accommodation relates only to one location in the field of vision. It didn't say anything more. It is through its connections that it becomes either a 'vegetable' or a 'gardener'. It started from a more complex representation that inhabits conscious space and which will sometimes be 'vegetables' and sometimes 'Gardener'. The neural group

‘visual location’ is not itself directly in conscious integrating space, but it imposes a unique box on what is perceived there.

Otherwise we could have a conscious surimpression of the vegetables and the Gardener in the same place. This is not the case ; it's one or the other. And yet the information ‘set of vegetables’ is present in ‘Gardener’. This is the difference between superposition and *surimpression* : a superposition is a simple mixture of layers of information; the whole is their addition. Whereas surimpression is the integration of one layer of information into the previous one, meaningless without it, which transforms it into a radically new whole. A concept that is more than its parts. This ‘more’ sits in the very particular assembly of parts. In this case it is the similarity of the arrangement of vegetables to the features of a face. This new information, the ‘more’, also seems to exist because it is not isolated. It occurs in a world where there are others of its kind. Information exists through its relations with its fellows. Together they create a specific level of reality.

I didn't choose the *Vegetable Gardener* by chance. If the example had been a usual human face, you would not have grasped the stages of mental processing so well. The mind quickly synthesizes the facial features into eyes, nose and mouth in the middle of an oval to make a face, known or not. It doesn't stop at the ‘eyes+nose+mouth’ step and eventually continue to ‘face’, like you did for the Gardener. Integration occurs instantly in the face, and even in Mr. or Mrs. So-and-so if that face is known. Again your mind does not end at ‘this is a human face’; the symbolization of Mr. or Mrs. So-and-so is directly activated. Neurological highways used often enough that the path of influx is not discussed.

Surimposition does not require a mathematical translation. In particular, it does not automatically imply the presence of a metamathematic principle. Not if we take the cautious attitude that mathematics is a descriptive language and not reality per se. That they describe systems with remarkable precision does not implicitly make them the formalism to link them. Of course, we have to look for a metamathematics if we postulate that mathematics *is* the structure of reality per se. But otherwise it is not embarrassing to ignore why a model transforms into another when crossing a level of reality, as long as the correlations are always verified.

We'll see in the chapter metalanguage that the transition equations conceal correlations which are not direct causalities. The level model follows the principles of direct causation and equivalence, while the transition is an arbitrary equation, without explanation.

No loss of information with surimposition. It is a principle of additional information, added to the constitutive one, which does not erase it. What can disappear is the level of information itself. Loss of organization, a level of complexity. Conservation of information takes place within a complex level.

Vocabulary around surimposition

Joël de Rosnay's *symbionomy* is an interesting neologism applied to the merging of organizations. It is derived from *symbiosis*, a notion of individualities associated in a synergistic manner. However, symbiosis does not systematically create a higher organization. It is just one of the ways seen in real life to achieve this. 'Fusion' reflects more this formation of a new entity that does not erase the organization that creates it, even stabilizing it. We could then call the unified science of self-organization the *fusionomy*. To a friend whose life is obviously very poorly organized, you will offer your services as a good *fusionomist*…

Gilbert Simondon's *disparation* indicates how two twin sets of information are captured in a single higher degree system. There is not an underlying unity but a 'link through differences'. The 'tension' between these differences can produce a higher degree that does not erase the elements in tension. Simondon thus sets up all the ingredients of *Surimposium* and his 'tension' is my 'conflict'. But it does not explicitly give birth to the existence of the complex dimension from these ingredients. He does not dare to merge his two philosophies, the technical and the psychological, in a monistic reality. Neuroscience is still lacking, in the last century, to finish bridging the material / spirit gap.

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Special principles

A system is closed only for the downward look. Representation that facilitates the sequencing of reality. Not the reality per se.
For the upward look a closed system is a limit case of the open system.
Similarly, the distinction between bound and free energy belongs to the downward look.
For the upward look it's a single energy, some of which has organized, the rest not yet.
"State of minimal free energy" becomes locally the lack of need to organize more.
But the environment still contains free energy. It is decreased by the successive levels of organization that linked energy concentrations ("elements").
It is the engine of the complex verticality.
A level or system is thus crossed by a flow of free energy, which decreases according to its organization.
Conversely its organization is maintained in a range of flow variation.
The range is a *complex attractor*. Incentive area that is the birth of *intention*.
The attractors are structural of reality per se. Mathematical language is the translation of their presence.

The distinction between entropic material and negentropic life is only a rarefaction of closed systems by climbing the complexity. The living mixes and copulates frantically.
The material is entropic only within an organization level. The universe is not a vast single system, except to obscure its complex dimension.
The boundary between entropy and negentropic corresponds to the reversal of power between upward and downward look, between entropic processes and negentropic intent.
Life and death are redefined in the complex dimension, life as a rise / oscillation on the complexity scale, death as collapse / stagnation.

The second principle, search for the state of lower free energy, is very present inside the reality levels but do not connect them. This is the persistence of a conflict that creates them.
The reduction of free energy makes it decrease exponentially with the elevation of complexity.

But conflict diversification maintains the creation of additional organizations for lower free energy. It is a fractal evolution.

The equilibrium under the upward look is an interactive loop keeping the properties so constant that it seems stationary to our observation criteria.
An organization far from equilibrium is an interaction that does not curl but orbit around an attractor.
The equilibrium can be redefined then as the limit case where the state of the system is confused with the attractor.
The equilibrium under downward look is stability. Different types: unstable, neutral, autostable, superstable, metastable.
Different stability areas are different potential representations of the system, which symbolizes it as part of an upper interactive system.

It is the downward look that defines an interactive loop as closed.
The system is self-representing by closing its interactions and maintaining general properties that make it a higher order element.
The self-representation is complete in the relationship with other elements with similar properties. Representation layer. Consciousness is born in the layers.
The retention of the interactive sequence defines the elementary time of the representation (upward look).
The existential time of an element is based on the surimposition of the elementary times of its constitution (downward look).
Passing through an equilibrium, an interactive loop can open up to a larger system that is surimposed to it. Extension in the complex verticality.
Which defines the formation of a complex entity: stack of information whose final equilibrium is not defined yet. Surimposition of defined equilibrium whose summit experiences possible choices.

'Paradigm' is a horizontal concept, anchored in a level of which it reflects the organization.
'Trans-range' is a vertical concept. This is the vertical range of paradigm in complexity.
The trans-range is independent of the paradigm strength. It is correlated to the fact that the paradigms of adjacent levels are less rigid.

'Comperaction' is a neologism reflecting the interaction at several levels between complex entities.

A model of comperaction takes into account the interaction between levels of information instead of being the simple set of their respective models. A *comperactive model* is a model of *interdependence*.

The representation is embedded in reality as well as the constitution. The result is not a simple assembly. It is an emergence that becomes constitutive itself.

Free energy drives complexity

What is the difference between closed and open system?

Closed systems exist only for the downward look. They are always open for the upward look, which constantly sees the entirety of reality, experiences the totality of relationships. We call 'closed' a system to which our observation can determine limits and whose state depends purely on its intrinsic interactions. This is a special case of an open system where the context is neutral. The closed system is generally simplified by the downward look: its elements are assumed to be stable, or their mutations are also the subject of an efficient model. The 'closed system' is an analytical tool and not a reality in itself. It is a representation that facilitates the sequencing of reality.

The closed system, stabilized in its minimum free energy level, cannot provide any. Whereas an open system, such as biologicals, is in an unstable equilibrium. It needs a constant influx of energy to sustain itself, and provides some. Pseudo-equilibrium is located at the moving interface between these two flows. The two important properties of open systems are the transformation of energy and the ability to do *work*.

However, this separation between 'closed' and 'open' is artificial, as we have just said. The 'closed' does not exist for the upward look. Ontologically it is only an extreme case of the open. These are not two different modalities from the real. The processes of complexity apply equally to all systems. Is the distinction between bound and free energy really ontological? No, it's the downward look, again, that differentiates the appearances of these two states. Bound energy is the building block of the elements, free energy changes the system. 'Elements' and 'system' belong

to the downward look. For the upward it is a single energy, part of which has organized, the other not yet.

Free energy under the upward look

The 'state of minimal free energy' becomes, under the upward look, the absence of the need for further organization, because the context has (provisionally) made the states of the system equivalent. The process of reality is in loop. The 'closure' of the system sits there.

Extended to complex verticality, the principle becomes this: free energy is diminished by the successive levels of organization that the concentrations of bound energy (the elements) find together. Free energy is transformed into bound energy by self-organization. But there are always some, for no system is completely closed to the rest of reality, and the individuation of bound energy creates new qualities of conflict, at a different level of energy.

This principle of reduction of free energy by successive levels of organization, which is ontological, must be associated with the 'fundamental laws' of systems, which are epistemic.

If there is no real ontological difference between closed and open system, it is necessary to redefine 'equilibrium' purely in an open system, which is the general case. The *equilibrium* is not "to reach a minimum free energy level", but "to remain in the same state for a certain range of free energy flow".

The free energy flow corresponds to the variations in the arrangement of the elements and the system in the environment. The intrinsic organization of the elements can change, storing a varying amount of free energy. The supply of free energy by the environment can change. The extrinsic organization of the elements (the system) in turn attempts to minimize free energy. The end result is flow.

The organization of the system tolerates a range of variation in the flow. Outside, it is no longer valid. The system is changing state. For example, homeostatic equilibrium is the stability of the energy flows provided by the different metabolic arrangements, within a range within which it can be

maintained. This range is defined under the downward look of the biologist by physiological constants. Outside the range, the body breaks down and dies, that is, reverts to an unorganized state of its constituents.

The notion of a stability range is valuable for understanding order. In dissipative systems, approaching the limits of this range creates an abrupt change of state: the system goes from one order to another, radically different, in a possibly very short system-wide time. Catastrophe! said René Thom. In other systems that are generally less organized, the transitions are gradual. Classic open systems rules apply. Where does this difference come from ? It relies on the existence of an organizational attractor. In its vicinity, an order appears, specific to the presence of the attractor. It creates a range of stability with particular properties, with spatial limits, resistance to changes in the context, an effect on its environment, relationships with systems of the same order. At the limits of this range there is a fringe of uncertainty, where the system hesitates between two states. The existence of attractors is the root of order stability. The fringes at the limit of their influence are the breeding ground for the dynamics that they build together.

Attractor and intention

Intention arises in the complex attractor. This creates an incentive zone around it. Anything that enters there relates to the attractor. The intention materializes in this range of stability surrounding the attractor, which seeks to perpetuate itself (this is the pull towards the T of the T<>D principle). Here is also born the notion of 'work', an effort to transform the surrounding reality at the liking of the attractor.

When several attractors confront their intentions, a new organization is likely to emerge. A new T<>D conflict plane is created. New information plan. New *energy* plan. Let us differentiate here the qualitative definition of energy from its quantitative manipulation. Energy is qualitatively stratified by the successive planes of its organization. Each level defines its own quality of energy. There is a priori no fundamental energy (we will discuss this point again later) but layered definitions of energy, each surimposed on its underlying definitions.

Attractors can be considered as structural of reality per se, and mathematical language as the translation of their presence. Mathematical formalism discovers the presence of these attractors rather than predicts them, although there are frequent overlaps that are equated with predictions.

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Entropy matter and negentropic living

For Schrödinger the characteristic of life is a perpetual imbalance. While the entropy of physical systems only increases, that of living organisms decreases or remains stable. Life is synonymous with *negentropy*. In fact this distinction disappears with what we have seen so far. No clear separation between entropic and negentropic systems. What differentiates them is the rarefaction of closed systems by increasing the scale of complexity. They are less and less isolated by remoteness and difference in energy level. The living mixes, interpenetrates. There is a frantic copulation between systems, which produces their increasing diversity as the organization increases in complexity. Planetary space is a border, but is itself large and contrasting enough to stimulate this diversity.

Can we say that reality is entropic? Only by obscuring the complex dimension. Only by making it a large closed system. Reality is entropic within an organization level. It is entirely for a reductionist who assimilates it to a bath of particles. The reductionist's downward look is radiographic: he sees only the backbone of reality, not its tissues. By reintegrating the complex dimension, reality is on the contrary negentropic. The border between living and non-living disappears. Like the Earth for the living, and before it, the universe is large enough for the non-living to constantly encounter new confrontations.

The distances are such that many local systems in the universe appear closed. So-called ‘dead’ stars because they achieved stability long before they had climbed the complex ladder to the living. Not enough variety, or too much, in conflicts. All free energy is organized into a single system, which can be chaotic. No individuation possible allowing the creation of new elements and their confrontation. Stopping the progression of complexity.

For the upward look, therefore, it is the diversity of changes in the environment that creates the conditions for a complex elevation into the living. An opinion exactly opposite to that of the downward look, which classically makes the presence of the human a miracle extraordinarily orchestrated by divine intention.

The border between entropy and negentropy is blurred exactly at the same place as that between non-living and living. It corresponds to the reversal of powers between downward and upward looks. As long as the downward look still manages to see intentions relating to its own, it asserts that reality is alive and negentropic. When it is no longer successful, it is the upward look that shows reality as a process, non-living, entropic.

If we realize that our two looks are fixed on the same thing, the border disappears.

Life and death

Blurring the line between living and non-living does not prevent giving consistency to the separation between life and death. Because even if this transition is less brutal than we generally imagine, it has a capital significance. Strong identity representation for the downward look. The Spirit pole only exists in life. Is it possible to find an echo of this meaning in the upward look?

Depending on the free energy flow passing through them, there are two categories of elements, corresponding to two equilibrium people: low energy (EL) and energy consuming (EC). An EL element is a system closed enough that very little free energy escapes. Therefore it is not dependent on an influx of free energy. It is autonomous, particularly stable. An EC element is a stable equilibrium within a range of variation of the free energy flow passing through it. It corresponds to that 'equilibrium on the edge of chaos' seen in the previous chapter.

Example of an EL element: a pendulum oscillating until it stops at the lowest point of its travel. This low-conflict system is seen by the downward look as 'non-living'.

Example of an EC element: the cell, which consumes energy. Its balance requires that it find some in the environment. “Let it find” is a formulation of a downward, intentional look. For the upward, it is a system crossed by the flow of energy and which maintains stability only if the incoming quantity is sufficient to maintain the outgoing quantity.

The cell is part of a large competitive environment. As an element, it survives if it can manage to stay within the range of energy flow corresponding to its equilibrium. It must find the resources to keep spending them. However, the opening of an element/system is never definitively fixed. More open or more closed, the repercussions of conflicts on it vary in importance. In other words an element can pass from EL to EC or vice versa.

An animal is an EC element. By dying it loses its complexity. It freezes and decomposes, reverts to the level of a collection of biomolecules. Like the pendulum, it is a system that is reaching its lowest energy. From life to ‘death’.

A seed is in the EL state, a stable collection of biomolecules. However, contact with water, change of context, switches it to the EC state. Return of an intrinsic conflict. Start of the processes allowing it to manage this conflict. From apparent death to life. Appearance of an organism… on the edge of chaos.

The peculiarity of life, no doubt, is that it never completely descends the scale of complexity, leaving this particularly stable trace that is the genetic code. A code that forces biomolecules to organize. Our animal, before dying, dispersed its genetic code. Our seed is the minimal residue of a complex plant.

Life is an oscillation in the scale of complexity. Since it easily tends to become evanescent, this avoids falling out of it.

Is the second principle universal?

Let us carefully differentiate between the universality of the second principle at one level of organization and its very different effects for the

entire complex dimension. The second thermodynamic principle is, like most principles, as much epistemic as it is ontological. It appears under the downward look with the closure of an organizational level, which it helps to form. But the real upward engine is not the second principle, it is the pulse that drives it. The second principle is structuralist, like complex attractors.

The search for the minimum level of energy is universal in the sense that it is found in each level of reality, under a specific guise. The energy of conflict diminishes with the organization of the system in a steady state or equivalent states. The balance is on the lowest energy level.

Even in human relations, the principle holds true: an individual seeks to resolve her conflicts. When she meets her needs and no longer encounters a conflictual situation (or persuades herself that they have disappeared), she confines herself to her behavioral routines. She is no longer inventing. On the other hand, if she feels that she is not yet in the place she deserves, she consumes a lot of energy, to spend in this conflict. Negentropy is very human because it is based on the psychological representation of conflict.

Let us not take the versatility of the second principle for a character of universality. This is a principle entirely based on information-communication. Thermodynamics is only one application. But information, in isolation, is just numbers. These numbers have no real meaning apart from some real thing they are addressing. It takes quality for quantity to make sense. It takes an *informessence* of the thing for the information-communication to relate to a precise quality.

The second principle says nothing about informessence. It is exclusively interested in relationships. Which makes it a major tool for understanding complexity. But not a transcendent principle.

Complexity and fractal decrease in free energy

Free energy decreases exponentially with elevation in the complex dimension, from atomic particles to neural exchanges. A corollary is that building an additional level of complexity takes less and less energy. This is true even up to the top floors of *Stratium*: mentally ordering complex

abstractions, in an effort of thought that seems to exhaust the mind, increases the brain's glucose consumption by barely 1%.

Understandably, only a small number of synaptic connections and weights change at the top of the hierarchy. A modest fraction of energy compared to the expense of the rest of the brain, which prepares the mass of information already surimposed.

If we make conflict the engine of self-organization, then it seems that as it becomes fragmented and diversified the conflict requires decreasing energy to build the additional levels of reality. Fractal evolution of the top of complexity: more finesse and diversification of the conceptual frontier, more smallness of the energy used.

It takes a sensitivity rooted in, or greater than, the level of reality in question to experience the energy consumption. This is why, perhaps, the handling of complex abstractions causes us a feeling of psychic exhaustion, while the majority of our neurons continue their interactive fireworks without giving the slightest sign of fatigue.

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Around equilibrium

Equilibrium under the downward look

At or out of equilibrium, self-organization is the exploration of different solutions to the inherent conflict of the system. A sustainable organization is an interaction that loops in on itself, an outcome bringing back to the starting conditions. Loop sometimes so swift that it is inconsistent with our observation criteria, and called ‘equilibrium’. Or it can be long, continue to explore the solutions, come back close to the first, thus designate attractors. The organization is said to be ‘out of equilibrium’, but nonetheless points to a famous attractor in the system, a way of dealing with conflict. The notion of equilibrium, under these conditions, can be redefined as the superposition of the state of the system and the attractor, a borderline case.

Under the downward look: stability

What are, for an observer, the different possible stabilities of a system in its time line? Does it have one or more stable states? How reluctantly or hastily does it join each of them?

Let's start with the most fleeting: the *unstable*. Any change in relationships destroys this kind of balance. Why associate 'balance' and 'unstable', which are contradictory? This shows the importance for a state of those around it in the causal sequence. Some states are equilibrium solutions. They vote for themselves. But an unstable equilibrium is surrounded by states that do not do the same. Its fame is very punctual. The system passing through it is likely to ignore it. It has to slow down in its neighborhood to have a chance to stop there. That is, the previous states must indirectly contribute to it, by preparing the conditions for the judgment on the unstable equilibrium. Most of the time its maintenance is only possible with a higher feedback control allowing the neighboring states to be the ones which lead back to the unstable equilibrium.

Special case: *neutral* equilibrium. It is surrounded by other unstable balances. Each state votes for itself, is therefore neutral with respect to its neighbors. It neither moves away nor brings it closer.

Finally, if a certain number of contiguous states vote for a single state, it is called 'stable equilibrium'. The number of voters and their fervor determines the extent of the zone of stability and different profiles of access to stable equilibrium. The state is *self-stable* when it spontaneously returns to the same equilibrium in the event of a disturbance. It is *superstable* when the return is faster after another disturbance.

The notion of *metastability* comes from the presence of other self-stable states in the vicinity. The equilibrium is said to be metastable when it is self-stable within certain limits but beyond that the system adopts an even more stable state (or less). This notion joins that, upward, of main and secondary attractors.

For the downward, representative look, the states of the system are individuations of all possible states. A 'balanced' state is maximum individuation. The group of states of the system is occasionally reduced to this individuation. The whole (D) becomes one (T). Stability corresponds to the influence of T on its neighboring states. None, this is an unstable equilibrium. Strong (evenly), the T creates a zone of stability around it.

Exponentially strong, the T is superstable. Finally, if the neighboring states are also in maximal individuation, each T is a neutral equilibrium.

These different zones of stability for a system are associated with the downward concept that there are different possible representations of them, of variable celebrity, aggregating a variable number of states of the system, achieving a more or less complete approximation of the temporal dimension of the system. . A representation is a famous individuation of the system. This representation erases the others in a higher interactive level, where the proper time of interactions only makes the representation exist and not the rest. The asymmetry of states in terms of stability creates a higher level of reality.

Stability is an *identity* characteristic. For the upward look, processes stop at stability. For the downward, the representation seeks to become more stable. We can say that a stable system has a lot of personality, whether it is a human psyche or something else. It becomes an important benchmark, a beacon around which the other interacting elements revolve, a pull towards the T of the T<>D conflict, which is never more than temporarily balanced.

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Open and closed interactions

How to relate the concepts attached to equilibrium with the characteristics of interactive sequences? The return to the initial state or a neighboring state defines stability. Synonyms: closed loop, circular computation, self-referential system (second order cybernetics).

It is the downward look that defines an interactive loop as closed. Under the upward, the elements only live their relationships. Nothing exists ontologically to compare them. It takes an observer. But this is not necessarily a brain equipped with its conceptual mask. The system represents itself by the simple fact of closing its interactions and retaining certain general properties that make it a higher order element in the context. This self-representation is complemented by "discovering" other elements with identical properties, which do not necessarily have the same constitution. Thus relate things that would not have interacted, or not interacted in this way, as a single set of their constitutive mechanisms. It is their individuation as an interactive loop, their relative stability, that creates

this additional relational level. Self-representation creates the level of reality, the fragment of consciousness.

The conservation of the interactive sequence defines the elementary time of the representation for the upward look. It makes the property "reoffend" at a rate that grounds the interaction of the next level. In the other direction (downward look), the existential time of an element is based on the surimposition of the elementary times of its constitution.

An interactive loop is never more than temporarily closed. It is perpetually exposed to evolution, either in the constitution of the elements that participate in it, or in the context in which the loop has formed. Evolution can keep the loop closed, just by changing the interactive path. The system is said to be in self-stabilizing equilibrium (it returns to its previous state despite the modified interactive sequence). Or the loop opens, the system does not revert to the previous state, but stays close to it. The state becomes an attractor, whose influence on the system has not entirely disappeared. Or different repetitive evolutions of the context keep the system in a series of intermediate balances. It is said to be metastable.

Any of these balances can make the system interact as element *E* of a larger whole. This new plane of interactive reality can retroactively influence the underlying context to stabilize the equilibrium of the system/element *E*. The loop becomes closed again for *E*, because its opening created an additional level of organization, not apparent in the initial interactive loop of *E*. Everything happens as if *E* were initially a closed system and that by passing through one of its equilibria it opens up to a vaster system which is surimposed on it.

It is a loop that opens in the vertical complex dimension. This observation is very important because it allows to anchor the definition of a complex entity. An entity is a stack of information whose final equilibrium has not yet been defined. This higher indefinite equilibrium is surimposed on other more defined ones, which are its constitution. At the higher level of interaction the entity experiences possible choices. An entity is not capped by an even higher organization that would rigorously impose its behavior on it, or ignore it. The entity is participating in a new organization where

their choice matters. It is the surimposition of systems whose choices have counted. The whole forms an intention of its own.

What the entity experiences is the surimpression of the balances that constitute it and allow it to exist. It is through this foundation of existence that it displays its identity and can exercise an intentional choice.

I have chosen general terms carefully so that this definition can apply to any entity in the complex dimension, whether it is a free atom or a thought.

A thought, redefined in these terms, is an intentional mental entity, built on top of the successive balances of the underlying concepts. This conceptual hierarchy has been stabilized by the successive interactions of the mind with the environment and is called the *personality*. A thought is a temporary stability of the top of the mental organization, which seeks to exercise its intention, succeeds or not. That it succeeds makes it more famous, more likely to be summoned again, because it back-stabilized the stack of balances that gave birth to it. This is how the personality slowly evolves under the pressure of thoughts trying to achieve celebrity.

Let's go back to the conditions that make an interactive loop return to its starting point or not. In reality, individuations are innumerable, poorly delimited, evolving. Real entities are isolated systems only in a particular level of information. They are entwined together on other levels. For example the universe is a single vast system of quantum excitations, where certain forces have an infinite range. A system is isolated only because its underlying organization has defined a range of stability where it can be viewed as such.

How to precisely define the isolation of a system? It is based on the spatio-temporal shift between close and distant interactions. Each force has its own time curve. When an interaction has already come full circle before another force can intervene, its detail is oblivious to it. The spatial framework intervenes jointly with the proper time of the grouping concerned, which is the surimposition of the elementary times of its constitution. This is how assembled elements self-define through their

interactions as a system, a system ‘closed’ to distant influences that have no time to intervene. The closure of the system is favored by several trends:
-The distances between intrinsic elements are short compared to outside influencers.
-The degrees of freedom of the elements are reduced. They quickly explore all of their interactive paths.
-Corollary: the interactive sequences are brief, likely to come to an end before an outside influence.
-The external context is itself insulating, not conducive to participating in intrinsic interactions, for example the solid wall of a gas chamber.

If the interactive sequence is long, or even almost infinite before hoping to complete, there are two ways for the system to appear isolated and stable from a downward perspective: either its states have similar properties (thermodynamic equilibrium), or the difference in scale temporal between system and observer transforms the almost infinity of the sequence into almost instantaneous for the observer.

What if the system does not fit into one of these categories, if its constitution changes before its interactions can complete? This system is not closed. How much leeway do we have to say it's still the same system? It depends on our interaction with it and the properties on which that interaction is based. The system self-defines its identity as an interactive element. This self-representation makes it participate or not, in the new context in which it is located, at a higher level of reality. As observers we do not interact with it directly, but are able to simulate the representation that other elements capable of doing so have. Eventually we can thus control the interaction, acting on the context.

Even open and modified by its own evolution, entangled with others, a system can still come full circle. The reason is that different sequences of information with relative independence can together create attractors. The attractor is a level of information emerging above that of sequences. Attractors can fit together, creating more complex figures. A system can be temporarily isolated and then participate in the ballet of an attractor, like a wandering planet that periodically enters a solar system.

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Strength of a paradigm, *trans-scope*

Simulation requires a deeper understanding of the essence of the thing than experimentation.

Experimentation consists of starting from initial conditions, the entirety of which cannot be known. These conditions are a level of information merging the underlying reality. They represent the essence of the thing studied. Observation makes it possible to know the fate of the thing, its reactions to the context. To correlate the changes of the context with the evolution of the thing is to construct a model of the thing. Experience creates arbitrary change. It validates the model if the evolution is that observed for the thing in the same spontaneous context. However the model is possibly wrong, because of the approximation on the initial conditions.

Simulation is more ambitious. It designs an algorithm that tries to reproduce the initial conditions. The model includes understanding these conditions. The simulation can involve a great height of complexity, if the calculations remain accessible. Starting from a particularly stable level of organization, it becomes very solid.

We have just unmasked the notion of the *strength of an organizational paradigm*. Each level of organization forms its paradigm. It influences the adjacent levels. Overlying but also underlying. What is human intention if not a highly complex paradigm that manipulates matter? The stability of a paradigm is the strength of the relationships between elements of a level. It is also the firmness of the initial conditions for the underlying organization, and the assurance of building a reliable model.

The presence of such levels of reality, the most stable, is what allows us to start simulations. Their firmness shields the variations in the informessence of the underlying levels. This is how knowledge can be built right in the middle of the complex dimension, without knowing anything of its foundations.

The *strength* of a paradigm is therefore linked to the great stability of the level whose organization it determines. Another characteristic is necessary to describe it:
Trans-scope is its vertical reach in complexity, in distance on the organizational hierarchy. It is independent of its strength. It is correlated with the fact that the paradigms of the adjacent levels are less dogmatic. They do not completely erase the consequences of a particularly powerful paradigm.

Some big trans-scope paradigms: quantum mechanics, self-replication of certain molecules, isolation from the intracellular medium by an outer membrane, information storage by DNA, the neuron's binding capacity, conscious integration, long term memory mediated by the hippocampus.

Low trans-scope is generally related to the remarkable independence of levels adjacent to that of the paradigm. This rapid collapse may raise suspicion of the presence of ignored intermediate levels. This is the case with the brain-to-mind transition. Their very different paradigms encourage dualism. In reality, a large number of organizational plans, constructed by neural groups, are hidden between the two.

In the emerging vocabulary, the grouping of closely related levels in terms of organization is called ‘integration grade’ or ‘field of reality’. It is also Heisenberg's ‘nomological region’ (nomos = law in Greek). Different systems are sensitive to the same laws, while these become inoperative at a distance (in terms of the hierarchy of systems). This is the same phenomenon that I describe by the force of a paradigm, and the neologism ‘trans-scope’ is useful to describe its loss of strength at a distance from the level it symbolizes.

How does the erasure of this power work? It comes from the simplifications exerted by the addition of an organization level. That the representation greatly simplifies the underlying level means that it obliterates a large part of its transformations. The previous paradigm is explicitly weakened.

The idea that a force can have infinite reach is part of the horizontal vision. In vertical complex vision, no force has this power. On the contrary, an imperative force in physical interactions can lose all influence to the next level. The rules have changed in quality. The multiplication of levels represent so many different qualities that form a barrier to the reach of a paradigm.

Trans-scope is not a fixed characteristic for a paradigm. It changes according to the evolutions of the level and its entanglement with the others. Take the example of phenomena occurring near a critical point in a phase transition. The modeling of the different stages does not respond to the same paradigms. Beginning and end are described by quantum field theory (QFT), while the transition itself is only analyzed by classical mechanics. In other words, the QFT reflects the organization of macroscopic states at equilibrium well, but does not reflect the change of state. The critical point corresponds to the opening of the level to the overlying. Macroscopic paradigms are breaking in and replacing QFT. We could say that the trans-scope of the QFT has turned negative.

A paradigm is an approximation

A paradigm is a construction of the mind, a mirror of the representation of reality by itself. This representation is an independent level of information constructed by reality. Approximation of the underlying complexity, but an approximation *inscribed* in reality. This is how dualism dissolves completely: on the one hand a paradigm is a codification of neural networks, but on the other hand this codification only reproduces the very nature of reality: the approximate synthesis of a level d information by another. Under these conditions, can a paradigm itself be anything other than an approximation?

It is by being an approximation that a paradigm gains the status of *intention*. It tries to maintain itself even when reality wants to escape it, threatens to dissolve it. It is then a matter of forcing reality to maintain this image of itself. Acquisition of an identity. Desire for eternity.

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Comperaction

Two complex entities can interact at different levels of their organization. To describe the end result with the term 'interaction' is not satisfactory. 'Interaction' refers to two elements of a set whose properties are well defined. It is possible to create an interactive model on these isolated principles, starting from initial conditions which are realistic approximations. The approximation is no longer realistic as soon as the entities become more complex. The 'initial conditions' hide deeper and unrecognized interactions. The model becomes coarse.

The neologism 'comperaction' addresses the relationships between complex entities. It asks interesting questions: How to coordinate in a *comperactive model* the interactions of the different organized stages of entities?

Human relations are the prime example. They include pheromonal and gestural exchanges, active appearances, memories, contextual predictions. Flattening all these levels into a horizontal model leads straight to failure. But the vertical model is difficult to establish. The importance of each criterion, in the horizontal model, becomes their trans-scope, in the vertical. Pheromones and appearance powerfully transport the young, still instinctive brain. They lose their importance in the aged brain wrapped in wisdom.

The comperactive model is thus a model of the interaction between representative stages and not the simple set of their independent models. It is a model of the relativity of their independence. Model of *interdependence*.

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Representation and constitution

I have to insist on how the double look fits into reality, how it transforms it from a purely reductionist approach. The double look applies to mathematical computations. This "frame" of reality takes on a very different meaning, starting from both the initial data and the result.

« Since the output is implied upon input, the computation never generates any new information », say Charles Bennett and Rolf Landauer. This is typically a statement of the upward look, of the constitutive process. The

vision of the downward look is very different. The output of the computation (the *result*) is independent information that hides the input. Indeed different input situations can lead to the same result. Impossible, from the output, to tell the implied input. Taken in isolation, the output / representation is information that destroys that of the input for the downward look. It is perfectly possible to manipulate it regardless of the entrance. This is the *property* of the output, similar to what recognizes this property, regardless of the input / constitution of the element.

Tracing the causal chain to identify all the possible inputs is only achievable by limiting the downward look. Imagine for example the set of computations leading to the number 2, which you would have to look for if you did not know anything about the initial entries… A Mathematical Archangel assists you, capable of all the calculations. How to choose, among the infinite number of entries that She will have found, the one that served as the basis for the computation? Computation is *logically irreversible*. This irreversibility is the basis of the independence of the output information, which proves Bennett and Landauer wrong: *the computation does generate new information*, hidden in the sign '='. Equality conceals a fundamental inequality: there can be a multitude of items on one side for only one on the other.

The only reversible computations are those which use a simple function of symmetry: A becomes non-A (in the binary sense where non-A is the exact inverse of A), then confronted with non-A it is easy to pose the reverse operation, which necessarily leads to A. The computation is reversible. The information is retained. There are none created either.

In complex reality, the vast majority of computations are irreversible. The output has relative independence with respect to its possible inputs. It does not destroy information (it does not exist without its inputs), on the contrary adds one: the fusion of all possible inputs. An approximation that merges different potential constitutions.

This representation, the result, has a truly separate existence. *Mathematically different* existence from the constitution in that, on either side of the sign '=' do not line up the same number of items, and that this position is not

reversible. For the downward look there is always *only one* result in front of many constitutions. For the upward look there are always *many* constitutions before a single result.

'Reversible' and 'irreversible' are terms tied to the arrow of time. We will deal with time in the next chapter, as well as a more complete definition of the observer, which conditions that of representation.

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Transcendental principle? T<>D hypothesis

What can be the engine of the complex dimension?
Make reality a universe-block without engine is to refuse the question. It does not answer our first experience.
The simplicity of this engine is concealous *under* the maths and other most basic concepts we have.
The common point is that all have their antithesis. They only define themselves with their antithesis, in the whole formed with it. Conflict without the possibility of radical separation.
Opposition, in every thing, between an individual and a whole, symbolized by the acronym T<>D (soliTary <> soliDary).
'Conflict' is the term of the downward look. 'T<>D' is its equivalent for the upward look.

Example of a conflict system where items can not remain in a state. But their oscillation loops to form a higher balance of the states. Extra reality level.
The conflict explores possible solutions, stops on stable or repetitive. It is the engine that organizes.
As an additional level of reality, the organization always contains the conflict. It represents without making it disappear.
The conflict physically corresponds to free energy, whose form is specific to each level.
The complexity gradually reduces raw free energy while fragmenting it further. Fractal evolution.

T<>D is a minimalist principle. "I am" and "I belong". Our fundamental concepts are an emergence of it.

The human mind is a luster lit by this principle, suspended in the middle of a reality that he can only enlighten part.
At the beginning of the conceptual field: the number. The number is the relationship between the individual and the collective.
T<>D is not the conflict *between* elements of a system, but the tension between each element and the whole formed of it and others.

What's call 'substance' is the symmetrical appearance of the successive states of one thing.
In physics T<>D is quantified by the number of permitted symmetries. Its engine is called 'symmetry break'.
Downward / extrinsic break: the environment of the element forces it to make a choice.
Upward / intrinsic break: the constitution of the element changes. *Fluctuation*.
In maths: T<>D is quantified by binarism. Its engine is hidden in the sign '='.
Systemic: the engine is the variation / stabilization couple.
Biology of evolution: mutation / selection.

How does the variation of T<>D influence those of other T? Non-instantaneous transmission called *propagation* or *transduction*.
It is a change initiated within D and not T. The constitution of T is not the origin. It creates the conditions of change.
The upward look, which should make us understand the mechanism of propagation, is actually very limited. It is an upward look of a model of underlying reality (manufactured by the downward look) and not a true ontological look.

An individuation is an attractor in the complex dimension.
The information is a step of individuation, unit of distance T<>D between the individualized thing and the whole.
In a complex entity, a reality level separates constituted individuation (substance, information) and individuation in the process (form, information-relation).
"An individuation takes form" does not indicate independence between individual and form. It's the duplication of the look. Passage of 'I am' (without form) to 'I am within' (the form appears).

Several T form a single D. D is the meeting not of 'the parts' but the 'I belong' for each T. The difference is that the 'I belong' are integrated together (which defines the independent existence of D).
The participation of each T to D differs. It is measured by the T/D value. Minimum for optional T, maximum for indispensable T to the existence of D.
Horizontal dimension of complexity: a system is defined by all its elements and their relationships.
Vertical dimension: a whole is defined by all non-zero T/D, that is to say by the interests of the elements to the existence of whole.

Semantic translation: identical T/D elements are separated but *not distinguishable*. A non-identical T/D makes them distinguishable. Their individuality does not have the same importance in the whole. *Difference* vs *distinguisability*.
Conscious attention is an excellent example of T/D evolving from one moment to another. I describe the experience of a thought/neural configuration briefly increasing its T/D into conscious integration.
Another application of T/D value: the human couple. The couple is not a relationship between 2 individuals but between 2 T having different T/D ratios with D (the couple as the integrated whole).

To understand the world one would have to start without knowledge or substances, but only like it from a principle.

Why the need for a transcendental principle?

My effort to present the complex dimension has so far consisted in segmenting it into levels corresponding to our observations, and making these discontinuities realistic. 'Origin' and 'issue' are kept. The complex dimension has a privileged, ontological interactive direction. The top only exists surimposed on the bottom. Relative independence. Each level emerges into a reality that is no longer virgin. What rules will it write down in its turn? But above all, why does self-organization continue? What is the responsible pressure?

The double look shows us the forms of complexity. We are witnessing the process. What moves it? Understanding motorization seems as difficult as it is for consciousness. Yet we have argued that it is unacceptable to

eliminate the problem of conscious experience by declaring it illusory. Likewise, how can one be satisfied with a block universe that turns its internal engine into an illusion for the spirits within? Isn't this again the expression of eliminatory materialism? The principle of this book, you will understand, is to surimpose and not to eliminate. How do we give a motor to the surimposition, which corresponds to our mental experience of such tension, just as we have sought a non-eliminatory explanation of the conscious experience?

Suppose this transcendental motor exists and elevates the complex dimension. How simple can it be, so extraordinary that it can be hidden behind all forms? You cannot be satisfied with any equation. Why this particular shape and not another? We would be forced to search, eternally, for an explanation of the explanation. The motor of the Whole cannot be a mathematical formulation; it *creates* the math. It creates any language we might think of. Thus, at best, we can access its first *conceivable* emergence. Something that is not at the sophisticated abstract top of our minds but at the very root of how it works, at the entrance to this conceptual edifice.

This thing is immediately surrounded by the least decomposable concepts available to us: individuation, regularity, information, asymmetry, change. Each has its anti-thesis: everything, chaos, absence, symmetry, uniformity. All these couples have one thing in common: the conflict, the opposition between an individuation and a whole. An opposition that makes no sense without the presence of all parties. Indissoluble conflict. Opposition without the possibility of radical separation. There is no individual without everything and no everything without individuals. I symbolized this conflict in the acronym T<>D (soliTary <> soliDary).

Conflict and T<>D denote the same thing. 'Conflict' is the term for the downward look; 'T<>D' is its equivalent for the upward look. We will deal with them successively.

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The conflict

Conflict is omnipresent.
A general theory of reality is nothing more than a modeling of conflict.

The conflict under the upward look: a driving force

How can conflict be a driving force for organization? Let us take our simple model: 3 elements A B and C can take the value 0 or 1. They form a triangle, each in relation to the 2 others. The properties of the system are that an element cannot have the same value as the one to its left. If A is 0, C is necessarily 1, B is necessarily 0; but then A is forced to switch to 1, C becomes 0, etc… Permanent and insoluble conflict between values, which switch as quickly as possible between 0 and 1. No equilibrium possible? However, there is one: the flashing of each element has a stable periodicity. The system formed by A B and C connects the states 0-1-0 and 1-0-1 (or the associations 0-1 and 1-0 start a frantic rotation around the triangle). The state of the system loops back on itself. If this looping occurs within an insignificant timeframe from the point of view of the interactions of a larger system, the triangle appears as a fixed element. It forms the stable constitution of the higher system. The loop is the representation of the 3 conflicting elements. Organized and outdated conflict in information surimposed by the stable properties of the loop.

The conflict does not go away. It is only limited. The conflict created information without adding energy, simply by exploring the possibilities and "stopping" on a tightly organized solution. This information is individuation in a larger system formed by individuals of the same type, likely to enter into a relationship. An additional level of reality has formed.

Conflict is at the heart of any organization. The conflict is in itself a contradiction: it opposes and unites. Opposition is not possible without the framework of the meeting. From the conflict results an exploration of possible solutions, which drags or stops in areas of equilibrium. Process called *organization*. Conflict is the organizing force.

When an additional level of reality is created, the organization always contains conflict. The opposing elements are in no way assimilated to each other, other than by the superior system which they together form. To persist, for a system, means to respect the criteria of equilibrium of its internal opposition. It can break down when the interactions it experiences as an element threaten that balance.

Let's summarize the embryology of reality through conflict:
The universe was born out of a (really great) conflict. There are no words to explain it yet (the conflict will produce them). Conflict is individuation, a (really great) release of energy. Which implies that before this energy exists, but linked.

The conflict tends to diminish. The reason is simple: the sequence of interactions stretches over the most alike, in terms of something that represents it. For this thing the sequence is made up of 'stable' and 'unstable' parts. The sequence also includes areas of individuation. When the context allows it, the sequence loops on a stable part. For the thing that represents it takes the name of *element*.

The conflict is reduced. Synonyms: free energy decreases; entropy increases. But the individuation of the elements creates the conditions for a new conflict. They are not in the same *location*. The before-universe has not regained its symmetry. The universe is still bustling with free energy, in a modified form.

The interactive sequence of the elements is surimposed on that which constituted them. It is also moving towards conflict reduction. The free energy of the universe is a little more minimized. A level of complexity has been added.

The evolution is indeed towards an increase in the general entropy at the base of the complex dimension, and simultaneously towards an elevation of this dimension. Seen as surimpositions, complex entities are more diverse.

Diversification increases the complexity of the conflict between different aspects of reality. The conflict is less and less energetic. Its diversity fragments its energy, but individuation encourages it to fragment itself further. Here we find the notion of fractal evolution.

However, in the complex dimension, one level of organization does not follow the previous one, it is *surimposed* on it. This is a two-way relationship and not a classic causation. The higher level retrocontrols the

previous one. A turn of the tiniest fractal level (the most complex in the overlay) can change the fate of the more powerful level. A tiny fragment of free energy can be the source of an immense amount of additional released.

The conflict under the downward look: competing representations

Conflict, depending on the level of reality at which it is observed, receives particular names. Asymmetry, disorder, free energy. A name that has earned its fame in one discipline tends to colonize others. Thus the success of free energy in thermodynamics has made the concept reused in biology and neuroscience.

This concept developed by Karl Friston is as follows: biological systems are self-limiting to a small number of states. They thus minimize a free energy function of their internal states, implying predictions on the hidden states of their environment. Here we find the principle of approximation of reality developed in the previous chapter.

The concept of *free energy minimization* has been extended to neuroscience where it is called *active inference*. Neural networks try to minimize the difference between their model of the world and the information provided by sensory sensors. *Action* is this attempt to reduce the gap between subjective model and objective perception.

Friston's theory is interesting but fits in with purely horizontal thinking. The minimization of free energy accounts for the process of an isolated reality level, but not for its construction or its sequencing in the complex dimension. As it is, the principle would standardize the biological and mental fate of living beings in the same context, as they diversify. Feedback from higher models to lower in complexity is not taken into account. We must add the complex *verticality*.

The most interesting point that Friston's work suggests is of another order. By transposing the principle of free energy minimization from thermodynamics to biology and neuroscience, he metamorphoses a *statistically* phenomenon into *driven* principle. An intention appeared in passing. By what miracle?

The only possible answer is that intention is already germinating in thermodynamics. The only exploration of the possible by the system, and its stop on states minimizing free energy, is the identity intention of the system. This intention then aggregates a multitude of additional criteria as it climbs the complexity ladder. However, it can only be understood as a representation of a set of states minimizing free energy and not a single state. This is where the representation is an approximation and constitutes a different level of information. The representation appears only for the downward look, remains invisible to the upward.

As neural states are perpetually evolving under the influence of sensory stimuli, several representations compete, corresponding to different sets of underlying states depending on the context. The higher representations switch, each minimizing the free energy of the lower state sets at best. This is how thought dances without losing its coherence.

How does it achieve the best possible consistency? This is where *mimicry* comes in. An intention is transmitted directly to the conceptual level where it is understood. It is no longer the spontaneous organization of environmental stimuli.

Take the example of Karl Popper, author of *The Logic of Scientific Discovery*. He explains that a mental organization is created by the conflict between the different regularities of the environment. In doing so, he analyzes the mental process and simultaneously transmits its representation. The reader does not carry out the analysis herself with her own conceptual edifice. She swallows up the representation.

With Popper, the reader learns *refutability*, an intentional tool that examines their own mental process. She learns to better organize her conflicts. Refutability, it is important to make it clear, did not arise out of its own mental ontology. It is an independent representation that has arisen in the interactive environment of her consciousness. It will alter the underlying mental states and the free energy of their conflict. Demonstration that the principle of free energy minimization is valid only in the system self-defined by these mental states.

Product of conflict, refutability is its guardian angel. A correct theory is synonymous with an efficient conceptual organization. It is defined in relation to the errors that surround it. Hence the need to be refutable. No refutability, no errors allowing to mark out the preferential organization. All that remains is a belief suspended in its lonely, unique and blazing paradise, dazzling its worshipers, holding spirits close to it like moths near a lantern.

To refute is to launch missiles against correct theory. If they are indeed mistakes, they will fall apart on contact without doing it any harm. But if one of them comes from a more effective truth… Explosion!

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The fundamental of T<>D

T<>D is the backbone of *Surimposium*, a general self-organizing theory of reality. How are we going to justify this importance? Let us detail: this principle is, in one thing, the conflict between one's individualistic and one's collectivist parts. 'Individualist' is not used in a restrictive sense. It is enough that the thing has relations, in some way being able to express: « I am not *everything* ». From this principle derive in a direct line the following fundamentals: discontinuity, asymmetry, interaction. Others are already more distant in the hierarchy of essentials: causality, time, locality. They are similar to the properties, that is to say the effects of the organization driven by the T<>D engine.

Conflict between individualist part and collectivist part. The minimalism of the principle is imperative. We seek to free it from language. By remaining minimalist, we can ship it outside our conceptual field, get rid of it and make it a true transcendent principle, be content with its emergence. By reducing our conceptual pyramid to a portion of self-organized reality, it is the continuity of its structure that allows projections on the rest. Our mind is like a chandelier hanging in the middle. Precarious situation ? It provides a broader horizon than if the mind thinks it is resting somewhere, on a hypothetical foundation. By sending the T<>D out of the conceptual field, we are not making it an 'origin' but a link between all the differences, observable or hidden.

We will see that the T<>D can be described by any form of language, that it is even their soul. This is how it frees itself from language. It is transferred without difficulty from mental representations to the mathematical language of reality. By having sent the T<>D out of the conceptual field, it comes back to us in the form of an authentically *essential* principle.

Where to start in our conceptual field? Let us start from the concept of number. Two major definitions clash. The first, attributed to Thales, is static: it is a *collection of units*. The second, attributed to the Pythagoreans, is dynamic: it is the *measure of progression*. But this is a circular definition: the number is already present in "measure". The two definitions are actually similar: *number is the relationship between the individual and the collective*. It's communication. It can be based on a variety of things, including the numbers themselves. What all of these things have in common is that they relate to both the individual and the collective.

The common point is the T<>D principle. It is, for everything, the conflicting relation between the individualizing and the collectivizing tendency of the thing. « I am » and « I belong to ». Conflict is the fundamental impulse that drives everything to organize itself, to overcome this contradiction: I cannot be whole and part at the same time. I must become something else over this contradiction.

The T<>D principle is at the very heart of mathematics. It founds the number. Number is one of those organizations that cover up the contradiction. It resolves conflicts while creating others that are less severe. The complexity of mathematics breaks the conflict into smaller and smaller, better organized fragments, like a fractal process.

Why does the number itself become a source of conflict? It is individuation in a mathematical universe, the T of T<>D. A mathematical universe is a *topos*, a particular place where we give ourselves objects and relational rules between them. The topos is not only the meeting of objects and axioms. It is not reduced to inter-individual relationships. Behind each of these occurrences looms the *whole*. How is it thus in ambush? No inter-individual relationship would take place without belonging to the topos. It is the fact that objects share the same category of universe that makes

interaction possible. A topos is the D of T<>D. Objects exchange within an omnipresent collective.

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Symmetry and asymmetry

Why are additional levels of organization created? Reality explores the continuum of possibilities and creates spaces of symmetry that are interactive loops. Such a process produces an ascending order. It creates the *substance* of reality, since what we call this is the most stable appearance of interactive sequences. *Substance is based on persistence*, on the apparent symmetry of successive states. But this should lead to an increasingly frozen universe. Now we see that order, far from being a constantly thickening glue, is expanding and interwoven in surimposed levels, taking on an increasing multitude of forms. Under what impulse?

T<>D in physics

If the T<>D conflict is this impulse and it is declared a transcendental principle, it must be found in every discipline of knowledge. Very long exploration. Let's start by identifying it near the origin. In physics it is about asymmetry. Each displacement of the conflict T<>D is a rupture of symmetry. In a homogeneous level of organization (fields, atoms, molecules) a break occurs. Local individuation. It acts on the other components of its close environment. Everyone takes a different attitude depending on previous relationships and their position in relation to the excited one. Each component of the collective is thus pushed towards individuation. A break in symmetry transforms a stable collective into an assembly of individuals seeking a new balance.

What causes this break in symmetry? Two influences correspond to the two views:
1) Downward influence: The system is homogeneous but its environment forces it to make a choice. The whole superior to the system looks at one of its parts. The intrinsic organization of the system does not allow it to respond to this extrinsic constraint. A break appears.

2) Upward influence: The break in symmetry comes from the intrinsic organization of the system, the homogeneity of which is not maintained. This is the only possible mechanism when system and environment are in

equilibrium. Or when there is no environment yet, the system is *everything*, or it no longer has any relation to what produced it. The Big Bang thus makes the origin of the universe a break in intrinsic symmetry.

The break in intrinsic symmetry is called *fluctuation*. The asymmetry of the fluctuation breaks the equilibrium of the system. To return to symmetry, the elements must reorganize. They are a society whose rules are transformed by exploring a different context. However, this exploration is not instantaneous. The delay creates a temporal identity to the system. This identity makes it an individuation of a new order. New order, new everything. Asymmetry, followed by the attempt to return to symmetry, piles up the levels of organization, complicates reality.

T<>D in mathematics and elsewhere

Individuation is easy to identify in mathematics. Binarism 1/0. The conflict appears more clearly in Boolean logic: 1=true 0=false. Binarism is already a representative language. It presupposes separation, quantification. Any representation belongs to 1 or 0, to true or to false. Often it seems to be floating between the two. Isn't this an indication that it is *surimposed*, perched on a less clear-cut composition between the opponents? Encouragement to break it down into its constituent levels, to apply finer quantifications to it, not to forget that we are manipulating an inaccessible substance with symbols.

Identifying the T<>D principle in each discipline is not enough. We must also give a name to the engine, even if we will see in a few moments how to unify principle and engine. The engine is an alternator between individuation and collectivization. In physics: fluctuation / reorganization (of another order). In math: both sides of the sign '=', emergence in itself. Systemically: variation / stabilization. In evolutionary biology: mutation / selection. Etc.

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Propagation / transduction

The T<>D is attached to an element T while involving the other elements forming the D. How does the variation of a T<>D influence those of the other T? How does a transformation spread?

The relationship between individuation and the whole is often a dynamic. Stability is just a special case. The influence can grow in either direction, from the element to the whole or vice versa. This is a different development than that inherent in the element. It is extrinsic and triggers a transformation of the element that is not initiated in its constitution. The change is transmitted to its neighbors within the D and not within the T.

Transmission is not instantaneous. It *spreads*. Simondon calls this phenomenon *transduction*. Transduction arises in a local singularity. One of the T's somewhere in the D changes its metastable balance. The change is transmitted to other T's, which are also metastable. The initiation of their transformation is indeed initiated by the neighborhood with the modified T and not by their own constitution. Transduction is a mechanism belonging to the level of reality of the elements and not to the underlying levels. These only create the conditions for the possibility of the mechanism.

The micromechanisms create the conditions for the appearance of D, a set of T's endowed with similar properties and capable of propagating any modification of their individual T<>D ratio. The relationship exists both ways. The propagation of the transformation of a T must also be seen as the other T's undergoing the influence of a new D symbolized by the transformed T.

Transduction is easy to represent in models, under the downward look. It is much more mysterious for the upward look. How is the propagation of an *organization* possible? This ties in with the ontological question of communication, which is just as difficult. What allows communicating parties to know which intrinsic organizations they are dealing with when they exchange a bit of information? How do they identify the *quality* of this information? What exactly does a boson, a communicating particle contain? We don't know what to do with it except to let our downward look include it in a pattern.

This is the occasion to say that the upward look is in fact very limited. What we know about ontology comes from models that look at the organizations they create. Atoms come together into molecules and we declare this to be the upward look. But it is always of a model, that is, of a construction of the

downward look, that it starts. The upward look is *the mask* of the true ontological look, which is inaccessible to us. It is not possible to know the discourse of the real per se. We can only hear it, that is to say already interpret what it communicates.

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Individuation and form

Let's come back to what an individuation is, in the light of the complexity. It is in fact an *attractor of the complex dimension*. Attractor both in the level of reality in which it appears (its system) and in the complex dimension. It also attracts the adjacent reality planes. The underlying planes are influenced by this individuation. The overlying planes respect its existence to continue to exist themselves.

Information is a step of individuation. Unit of the T<>D distance which characterizes an element in its relation to the whole. The more the information adds its steps, the more the distance between the element and the whole increases. The closer the information gets to unity, the closer the element is to the whole.

The concepts of information and individuation are therefore closely intertwined. Each based on the other, the definition of couple seems circular. But there are two aspects to information: constitutive and relational. The second participates in the relationship, not the first. Information does not come out of thin air. It arises from a founding base. Both aspects respond to *constituted individuation* and to *individuation under construction*. This is why I insist on the separation of the two aspects of information, constitutive informessence and representative or relational information.

The two aspects exist just as authentically as the realistic double look, the look of individuals (of the already constituted whole(s) interacting), and the look of the additional whole born of the interactions in progress.

Is there a birth to all of this?

In investigating reality, the mind converges in multiple ways to its origin. The cosmologist focuses on the Big Bang, the physicist on the quantum

vacuum, the mathematician on sets and logic, the philosopher on time and causality. All of them arrive, at the bottom of this funnel, at a common observation: there is originally an individuation of something within something else. This individuation takes shape.

What does "an individuation take shape" mean exactly? Isn't the form already contained in the very principle of individuation? Or is form an independent principle that comes to apply to an essence that does not have it? In other words: can information and substance be separated?

It is very difficult to answer this question. But we deeply feel that there are two ways of responding: by *reasoning* and by *experiencing* the question. Two independent ways and yet it is impossible to find a clear line of demarcation, other than by the elements of language. What reasons is also what experiences. Here it is not a question of the separation between the Spirit and Real poles, but of the fact that the mental process does not experience itself as a numerical sequence, or any other succession of forms. The mind arises from a soil which is perhaps a *stack* of forms, but which is experienced as substance.

The double look, once again, provides a solution to this dilemma. What constitutes individuation does not see its form. This aspect of individuation is experienced as separation with no other reference than itself. It is as representation within the rest that it becomes form. This other aspect of individuation only exists by reference to the rest. The transition from one aspect to the other is 'I am' (formless) to 'I am within' (form appears).

It is thus possible to see the form start in the principle of individuation itself, and not make it an independent principle. It is our apparatus to represent, the mind, which extracts form and substance from reality at an early stage, in order to detach itself from it. But the ontology is unique. The fundamental principles themselves converge in the monism of conflict, of something that contains its own opposition, inseparably.

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T/D value

The T<>D is the tension between 'I am' and 'I am part of'. There is more than one T for a single D. Each T participates in a specific way to the

common D. The D is the fusion not of 'parts' but of 'I am part of' for each T. The nuance is important. It makes the difference between a collection of elements without any representative and one integrated into a whole (a real D).

Here arises the notion of cohesion between the elements of a whole, with respect to their integration. Each of the elements shows a more or less strong cohesion with the others in its participation in the whole. The whole is not considered here as just the set of elements but their fusion. Whole *surimposed* on the elements. Certain elements are essential to the constitution of this all-fusion, endowed with particular properties. Others are incidental, and some can be removed without changing the properties of the whole. That is, elements are in the set but not in the whole-fusion.

The T/D value measures the participation rate of an element T in the integration of D. The optional elements have a minimum T/D value, the essentials maximum. This setting is a characteristic of the relationship between the element and the whole considered. A complex element shows several values depending on the whole(s) in which it participates. A whole is self-defined by the set of T/D values of its elements. The difference with the definition of a classical system is that the set of relations *between* elements is replaced by the set of relations *of each element with the whole* that they constitute. Relations in the vertical complex dimension and not in the spatial framework.

We have indeed defined two dimensions of complexity. In horizontal dimension, a system is defined by all of its elements and their relationships. In the vertical dimension, a whole-fusion is defined by the set of non-zero T/D related to it, that is, by its elements and the strength of their participation in the cohesion of the whole.

Let's illustrate the value of this measure. For each element of a system, the T/D value is used at any time to define its state in the T<>D conflict. This value is the confluence between the imposition of its T identity on the collective, and its abandonment in favor of being part of the collective. It is not a binary value but a setting in a unit and time scale owned by the collective. A T/D of 1 indicates that the individuality of the element is

imposed on the system (for example the presence of a molecule in a certain spatial conformation causes identical transformation of surrounding molecules of the same composition). A T/D of 0 indicates that the individuality of the element has no impact on the collective (case of molecules transformed in the previous example).

In a gas located in a closed chamber, all the molecules have a T/D of 0. None has a more marked individual action than another within the system. Heating a wall of the chamber does not change anything. Molecules in contact with the wall acquire greater agitation, but their rapid diffusion causes them to be replaced by others. The temperature of the gas increases homogeneously. In an oil things are different. If you heat the bottom of a pan, the locally stirred molecules take an upward then downward trajectory, causing regular shapes called Benard cells. These molecules bring regularity to the system. Their T/D increases compared to others.

The T/D value is the 'part <> fusion' setting. It can also be called a *monadic value*, between maximum and minimum integration. It relates to the notion of information in the following way: Information is the difference between 2 entropies: $\boldsymbol{I} = S - S'$. The maximum information of a thermodynamic system is the difference between its maximum entropy and the current one: $\boldsymbol{I} = S_0 - S$. S_0 is the equilibrium entropy or that which makes the system indistinguishable from its environment (for example a melted iceberg in the ocean). It measures the loss of information constituted by the inability to make this distinction. The T/D of the iceberg is T when it is solid, D when molten. Information is also the signal-to-noise ratio of the system in the middle of its environment.

Distinguishability

The T/D value has a semantic translation. An identical T/D for two elements leaves them separated but not *distinguishable*. While a non-identical T/D makes them distinguishable. Their individuality does not have the same importance within at all. It is the opposition between *difference* and *distinguishability*.

Let's illustrate this with a set of 3 coins, placed side by side on a table, that a juggler will move quickly under your gaze. One of the coins is marked on

its invisible side with a line of black felt-tip pen. It is *different*. The juggler shows it to you at the start. It is *distinguishable*. Then she begins to spin the coins around each other, slowly at first. You easily follow the marked coin with your gaze. When the game stops, you point to it. It's the right one ! But the game becomes more complicated as the juggler accelerates her movements. Eventually, you lose the marked coin with your gaze. At the next stop sign you no longer know how to designate it. It is always *different* from the others, but no more *distinguishable*.

In the previous gas example, the molecules are different in their location but not distinguishable. By posing the axiom that a whole is defined by the value 1 of the sum of the T/D of all its constituents, the molecules of the gas have a T/D barely greater than 0 (1 divided by 10^{23} pour $1cm^3$ of gas).

Attention as an experience of T/D value

The interest of T/D is also manifested in the way we are able to feel it. An approach without mathematics, which even succeeds in breaking free from the mode of thinking. It is about what everyone *experiences* as consciousness: from the state of fusion to that of parts, as if a cursor were moved on a slider called 'attention'.

Attention is such a natural and spontaneous phenomenon that we must take the time to analyze it. It is a phenomenon that is erased behind its *contents*. Or we learn to be wary of our attention. Because we pay as much attention to the wrong ideas as to the right ones. It is a danger to trust it too much, warns our education. But what we are talking about here is not the content but the phenomenon itself.

When the cursor indicates D on the slider, the attention is fused. It explains the mystical, holistic impressions, the 'surf' experienced during well-honed physical activities. At the other end of the ruler, with the cursor on T, attention becomes pointillist sensations such as a prick on the skin, an obsession, a pressing instinct, a logical flow, etc.

In the T position, a mental task acquires special fame in conscious space. This celebrity is due to the sustained activity of the neurons that symbolize it. Consciousness experiences itself as part of the neural collective. In the D

position (relaxed attention, all mental patterns have instant celebrities of the same order) consciousness experiences a fusion that goes beyond the realm of the self. It aggregates abstractions, empathic representations that promote the feeling of belonging to a whole. Higher virtual powers are easily inserted into personal reality. Most importantly, in this context, there is no longer any control higher than consciousness to allow it to observe its own experience. Personal consciousness *is* the collective.

T/D under the double look

The T/D being a measure in complex verticality, it has two faces under the double look. It is maximum for an element as its representation (for the downward look). It is fragmented between its constituents for the upward look. Applications are immediate, for example to human society.

The individual importance is at 1 from the point of view of the individual concerned (as her representation). But if we speak of individual importance in society, the vast assembly of individuals emerges. This importance instantly becomes 1 divided by 7 billion, for the most simplistic calculation, based on the equality of individuals.

A more elaborate calculation can be based on *memes* shared, unequally, by individuals. Memes are conceptual elements related to a topic. Individuals accumulating these memes show better competence in the subject. Their importance exceeds 1 divided by 7 billion in the whole that represents the social consciousness on the subject. If it is necessary to integrate this consciousness, that is to say to put in relation all the individuals to make a true collective emergence of it, it is necessary to attribute 7 billion different values, between 0 and 1, to the individual importance, for a total of 1. No value is fixed.

Most complex relationships remain incomprehensible because the vertical dimension is not taken into account. Take the human couple. It is a relationship between two individuals that becomes easily unpredictable and unexpected because it is seen as reduced to two elements, while there is a third player, which surimposes itself on the other two: *the couple*. The D of the T<>D is neglected. It's a mistake. It is almost always best represented in one of the two individuals. One feels more part of the couple and the

other more individual. Their T/D values differ. But this observation is obscured in the speech, or translated too vaguely as « I love you » to which the other cannot respond with the same force. Everyone feels themselves variably to be part of a whole that is never mentioned.

Another example: a crowd of individuals behaves unexpectedly because one of them has a predominant role over the others. Here it is the T of the T<>D that is neglected. Individuals are erroneously made egalitarian in forecasting, when they each have a different T/D value for the subject assembling them.

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What are the great classic concepts become?

Determinism can only survive in horizontal thinking, not vertical.
With the complex dimension it becomes a way of knowledge among others, adapted to the stable levels of the complexity, competitor of statistics and computation.

Anthropocentrism (everything leads to Homo) is the pendant of eliminativism (everything leads to micromechanisms). Precious tools but sterile philosophies.

The substance disappeared under the effect of horizontal thinking, which replaced it by micromechanisms. Auto-justifying models. Elimination of troublesome, substance and spirit that conceptualizes.
The substance reappears with vertical thinking, visible to *what represents*.
Hylemorphism fails to solve the relation between *hyle* (substance) and *morphos* (form) keeping irreconcilable the causalities of one over the other.
This is the *concreteness of the double look* that makes these two aspects a unique reality.
The substance becomes *informessence*, surimposing constituent information under the downward look.
The form becomes the information-relation, ensemble of the interactions of the substance, under the upward look.
Everything is information, in two aspects *realized* by the double look.
Surimposium is thus a structuralist theory maintaining the notion of substance.

Decide on the existence of a ultimately fundamental substance is no longer necessary. The substance self-defines, with a real existence.

The thing per se is its complex dimension. Quantitative but also qualitative information.
The thing per se can only self-experience, as a surimposition of qualities. A quantitative representation of one of its qualities is not the thing per se.
Consciousness can only self-experience as a thing per se. It represents the rest.

How does an intention manage to change reality? The model remains in the approximation area established by the real on its own subject.
The difference between a molecule and a consciousness, as interest bearers, is not fundamental. Molecule and mental are representations. The difference is between their spans, deeply uneven due to the stages of additional integrated information in the mind.
A weak emergence corresponds to a level of direct representation, well identified.
A strong emergence is surimposition of weak emergence, some invisible.
These two types founded the classic separation of self-organized phenomena in structural (weak emergence) and intentional (strong emergences).
The separation fades inside *Surimposium*. The reality becomes monist again.
The power of intention becomes a concept parallel to the strength of emergence.

The intention is fundamentally to exist. Assert its right to existence is already to be in relation. A new whole includes this relationship. Additional level of information. Independent of the details of the relationship. Approximation.
Mathematical transposition: a single result approximate different initial data.
A result that approximate expects to remain result. The element is confirmed temporally. New intention to be.

Classic upward causality is prolonged in the complex verticality only if it stops on stable results.
Without this complex verticality and the appearance of the downward look, causality would only be interactive sequence without direction.

The downward causality materializes in the result that approximate different initial data and reconfirms loop. The result is a downward causality as a unified look of variations in its own constitution.

Determinism

A major consequence of this chapter is that it becomes impossible to speak of fully known initial conditions. At the heart of discussions about determinism is the question of the origin of the universe. Can we know about it specific initial conditions and thus unwind its history? To keep the question valid, it must be taken out of any spatio-temporal context. The point is neither a place nor a moment, only an origin (something that everything relates to). The hypothesis of known initial conditions then remains relevant, *within the framework of horizontal thinking*, the only one which reduces the universe to its micromechanisms. In this framework in isolation, determinism could claim the ultimate accuracy, as a mode of knowledge. The block universe could be unrolled.

But the mere existence of the complex dimension annihilates this claim. Complexity asserts that all initial conditions are potentially the organization of other conditions. No certainty of reaching a supposed foundation of reality since we cannot surround it with the instruments of knowledge. If it's a foundation, you can't go beyond it. Cannot verify that there is nothing else. You would have to be outside of reality for that. But everything that makes us up, including our thoughts, is part of it. Our virtual is included, materialized in no other way than neural excitations, information like them. To define a foundation for reality would mean having a virtuality or reality foreign to our own, and nevertheless in relation to it. How would this effort put an end to our questioning of the world? Coming out of one Russian doll to find yourself nested in another?

The initial conditions are always approximate, one must conclude. The apprehensible reality can only be based on approximations. *Only the idea of correctness is correct*. Determinism is a philosophy that is not denigrable, but not practicable either, outside certain very stable levels of the complex dimension. The universal mode of knowledge is the one that manages these approximations as best as possible.

That does not make statistics the queen of science. In some contexts determinism is more efficient, in others it is computation. The universal mode is to recognize the crossings of the complex dimension and to choose the approach most suited to the rules of the level. It is not so much the precision of the initial conditions that decides, as the degrees of freedom available to the elements of the level, and their number.

This is what science does, by pragmatically compartmentalizing the disciplines. Each is inspired by the models of the neighbor, without the change always being beneficial. None of the three approaches, deterministic, statistical and computational, has succeeded in eliminating the others in all areas. This observation alone shows the poorly recognized presence of the complex dimension and the perfectly real separations that it inscribes in the essence of what surrounds us.

It is impossible to do without approximations, because the universe itself *realizes* them.

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Anthropocentrism

Let's keep reductionism as a major tool of the downward look, while in the form of eliminativism it is totalitarian and sterile. It erases the complex dimension rather than iterates through it. Its counterpart exists for the upward look. Holism is reductive when it considers the whole as an ultimate finality. *Anthropocentrism*, as well as theologies professing gods with human faces, are the sterile varieties of holism. *Desires* that disguise reality, instead of being neutral inquiries into the complexion of things. 'Neutral' here does not claim any other meaning than 'suspicious of one's desires'.

Complexion is a major tool in our investigation, but *complexionism* can also become misleading if the tool becomes an end in itself. Reality is very much a complexity, but there is no look outside it to contemplate it as an entirely unified entity. We have to admit that any look is positioned on a floor of this complexity, sees things in its own way. It is only by multiplying the looks that reality acquires its substance. The more the look is located at one end of the complex dimension, the more its extent increases. Having read

this book you have raised the top of your mind significantly and the underlying complexity is now apparent to you.

Another presupposition of complexionism that we must be wary of: thinking that complexity always goes from the simple to the complicated. It's wrong. The branches of complexity are independent. One can lie down as its neighbor falls and restarts at a less complex level. Different degrees of complexity can thus be mixed together without there being any filiation between them, at least not without going back to a much deeper common root.

The complexity value scale is perhaps an illusion, linked to our anthropocentrism precisely. We see the scale of complexity as the production of increasing diversity. The base intuitively contains less than the top. Strong influence of symmetry and fundamental forces on the base, which makes particles of the same category strictly similar. While asymmetry and diversity frolic freely at the top. Vision belonging to this summit? We should ask photons if they see themselves as less diverse than we do. Perhaps they are self-experiencing more finely than by a simple level of energy?

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Substance

How did substance disappear?

We have to go back to an ambiguity in the structuralist view of information. Classically, information has been applied to the properties of things defined as substantial matters. The substance belongs to the thing. This is its very essence, which exists apart from any solicitation about it. A forest *is*, without having to walk inside to make it exist. Now in structural physics, information refers to the knowledge we can have of a system. Information is just communication. The substance is gone. Only its relationships persist.

This is a radical transformation of the definition of information. It was facilitated by the collapse of strict determinism. Previously things seemed solid, substantial, predictable. Matterquake in the 20th century! They become chaotic, incomplete, statistical. The scientific position approaches the philosophical one: it is not possible to know the essence of things, only what they tell us.

Structuralism works so well that it is no longer necessary to know if there is an essence/substance to things. Reality is fully understood by its relationships. At least it *explores* itself that way. Because science remains pragmatic. It does not claim to explain the *existence* of reality. Important questions in science are not existential; they concern the facts in relation, that is to say the determination of a *structure*.

Horizontal structuralist thought is that of systems, pure sets of relationships. In this view, it is the functional interdependence of state quantities attributed to tiny spatial regions that supersedes the concept of substance. It is a foundation laid, and immediately forgotten as particularism within the other conditions. Information like any other? Could we have chosen other initial conditions? No. The model is based on them.

The model, by reducing information to communication, eliminates communicators. The exchange of information is seen as the only reality, coupled with a mathematical language whose author is transparent. What communicates and what receives are obscured in the equation. This great informative abrogation is, however, only a representation of the mind, whose mimicry in scientific brains is not enough to make a reality per se.

Horizontal thinking has removed the ambiguities by removing the hindrances: the substance of things and the mind that conceptualizes. It thus expelled… vertical thinking, the only one that had previously recognized the existence of these essential elements. Can the mind progress by cutting off part of its own process? Exclusive horizontal thinking is a true scientific solipsism. It continues today in the monodisciplinary use of science.

Redefining the substance

Faced with an individuation, before an individual *being*, the upward look refuses to see in it any substance, but only a group of interactions. Being can only be defined by its relationships. It is the look used in isolation by ontology to denigrate any substance to the individual. The flaw in this reduction is major: it simply loses the definition of the individual. It

appears in the self but disappears from the non-self. It gets lost in an endless maze of relationships, towards micromechanisms and the unknown. From the point of view of a possible original principle that would have initiated all of this, there is no individual, only the unfolding of itself as a whole.

Under the downward look, on the contrary, the individual exists by itself and not by his constitution. It is representation, relative independence. It is not reducible to its relationships, it is something more. This something surimposed on everything that has been added previously is what thickens its substance.

The substance is not quantifiable since it surimposes representations of qualities foreign to each other. It is itself a new, different quality, and not related to the previous ones by quantities. The surimposition is concealed in a sign '=' which is not an identity but a correlation, as in the Boltzmann equation S = k logW.

This is how the substance has a thickness which escapes the purely ascending structuralist look. This thickness and its qualitative properties are visible only to what represents, whether it is the human mind or any other process using representation.

Hylomorphism

Does this redefinition of the substance by *Surimposium* settle the debate on hylomorphism? Hylomorphism: from *hylè* (matter) and *morphè* (form); the form applies to a fundamental matter. The need for this fundamental material is controversial. Can we do without it to keep only a reality made up of pure information?

Simondon sees in hylomorphism the failure to solve the problem of individuation. Individuation is thought of as a pre-existing form shaping passive matter. If the scheme is reversed to think of matter as the causal agent of form, we have two irreconcilable approaches. None of them explains how the form - matter relationship operates concretely to achieve individuation. This radical opposition has produced, for example, the split between psychologism and sociologism. Psychologism considers the

individual as an active element, which founds and shapes the group. While sociologism considers the group as giving shape to individuals. Each approach reduces the other.

Simondon opposes to hylomorphism the 'regimes of individuation' by which individuals are constituted while being crossed by collective dimensions. He is thus very close to *Surimposium*, but without better explaining the concrete form - material relationship. He lacks the vertical dimension of complexity, the concretization of the double look of representation and constitution as a real process.

Substance and information

To be or not to be. In the contemporary structuralist view, substance is replaced by organization. Paradigm shift. This does not necessarily imply that matter is pure information. *What we can know about it* is information, and this restriction makes us incompetent to judge the existence of a substance. We can only experience the essence of reality at the levels where our own mind is anchored. Very personal knowledge of phenomenological space. The only truly certain.

With structuralism, reality is described entirely by its interactions. No need for substance. No proof that it exists. With *Surimposium*, I define the essence of matter as a surimposition of levels of information. By reversing this assumption ad infinitum, we end up with a universe of pure information. But does this coherence of structuralism make it possible to eliminate the notion of substance? A little story can make us doubt:

John is a market gardener. He grows tomatoes. They have a certain value, appreciated by the peddler. This one buys from Jean all his harvest. She transports it to the wholesaler's warehouses. The resale price includes a satisfactory margin. The value of the tomatoes goes up another notch at the wholesaler, whose trucks transport the crates to the hypermarket. The retail price to the consumer is still going up. Tomatoes are broken down in her stomach, not their value. These tomatoes, through their change of owners, have created a wealth that persists. This monetary value is converted. The peddler changes vehicle. The wholesaler pays for her laborers. The hypermarket is placing more orders and is embellished. Shareholders

receive dividends. When tomatoes have returned to the state of biomolecules, the wealth created by them continues to transform, disperse, re-aggregate in other forms.

Think of the information in matter as the market value created by tomatoes. Information takes on multiple aspects in matter, as the value of tomatoes becomes wealth independent of the succulent vegetable. But the value is well born in the tomatoes. Likewise, *information can have its origin in a substance*. It has become invisible under interactions, but information wouldn't exist without it.

Interesting remark in our analogy: for a time, the value remains attached to its material support/the tomato, while evolving according to independent/commercial criteria. Then it is perpetuated by other physical media (currency), then no material medium (telematic transactions). The evolution of information/value is decorrelated from matter.

Objection: the tomato is already information, in biological form, before becoming dematerialized wealth. But can we go back to an all-informative universe with such an objection? A distinction should be made between emerging property information (created by exchanges on the tomato) from substance information (that of the tomato itself). Return to a communication/informessence dualism which is that of *Surimposium*. At a minimum, two basic categories of information must be separated. Can we do this without leaving an all-informative universe?

The provisional conclusion is that it is impossible to formally exclude the existence of a substance from the real, even being able to fully describe its transformations through information. The investigation must be continued.

The weakness of the structuralist, all-informative vision is that *it no longer has a frame*. Indeed all frameworks are built by information. What then is the structural framework of information itself? There must be one, for such and such information to be linked to such other, or surimposed on such other in the same thing. How do they produce a common result? Neither addition nor any known operation since the information is of a different nature.

The common result has a proven existence. In particular, this is our experience called consciousness, the merged result of a really large amount of underlying information. The need for a meta-structure to this information arises.

Is it necessary to decide on the existence of a fundamental substance?

To assimilate information and substance is to leap into the unknown. The first is to confuse the description and the subject. Description is a language owned by the observer; the subject is inaccessible to the observer other than through representation. Confusing the two is self-blind to what the mind cannot know. The observer leaves, leaving only her observation.

The second leap into the unknown is to confuse *explicandum* (a phenomenon requiring an explanation) and *explicans* (explanation of the phenomenon). If the explanations are unique, it is circular reasoning. It is not scientific as it must be tested by an independent method (Popper).

Both philosophical and scientific criticism is therefore not in favor of this assimilation of information with substance. What can save it?

The main argument is that information is not just a description but a self-defining structure, that is, it asserts its existence independent of the subject. Better: the subject must disappear behind it. If the substance behaves strictly like information, without any glitches, assimilation becomes a solid hypothesis. Especially when the information can extend beyond what the substance has provided so far. *Predictions*. A theory that predicts never-before-seen aspects of matter replaces substance with information. By expanding the information network, we discover more than by searching for new substances. Physics shows the example: loops and strings are mathematical theories not based on any experimental fact. 'Dark matter' is less an unknown matter and more an equation problem posed by astrophysical measurements.

Research has become scientific because it has succeeded in stretching the boundaries set by the circular reasoning it uses. The coherence of the different parts of a theory justifies them mutually, to the point of making a

solid whole, for example the Standard Model, which almost completely does not care about not explaining gravity, so wonderful *expliquans* is it for a large number of experiences.

It is the same approach that allows this *Surimposium* to be in no way threatened by the impossibility of deciding on the substance. It creates its own substance, identified as the surimposition of information levels. In this sense it complements science.

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The thing per se

What is the thing per se, the essence of that thing, in the end? This is its *complex dimension*. To define it correctly, it is necessary to specify what looks or what experiences. Information that is recognized in a level of information of the thing, or that is experienced as the thing because it is made up of the same levels.

The essence is not only information, but the qualitative way in which it is related. It is not only an organized appearance, but the surimposition of the underlying organization, invisible and necessarily present, up to this appearance.

To understand ideally what an essence is is to experience it. Not to manipulate it with conceptual pliers. Be in it. Be its fusion. The ideal is a concept for others and a reality only for the ideal itself. Now there is only one thing that our consciousness can ideally experience: itself. All the phenomena that it thinks it experiences in place of what is foreign to it are mimicry. Most of our consciousness is a collection of mimicry. But the collection itself is authentic. The particular confluence of our conceptual society is the only thing we experience without the need for conceptualization. Phenomenal consciousness is unique and ever-changing. It is the 'I' of 'I love'. While a self-representation, the 'I' of 'I am', is already a static benchmark.

The election of phenomenal consciousness as the only authentic experience guides our understanding of the thing per se. The essence of the 'I'-phenomenon is conscious fusion. Fusion cannot exist without its underlying structure, but this structure is only *recognized* as conceptualized.

The essence is indeed the process which dissolves it without making it disappear. An analogy is the arrangement of chemicals in a fruit that gives it its taste. Taste is an essence indefinable by its chemical components and entirely based on them. We can experience this taste as a part of us, but not experience ourselves as the fruit having this taste.

Here is what surrounds the essence. Let's transpose it to any organized entity and we will have the definition of its particular essence. It is all that participates in its organization, fused into the constitutive level of the essence that we seek to define. This entity may itself be part of a larger organization. It is not, however, a 'fragment of a larger essence' (according to the horizontal vision) but a constituent element of an essence greater than the entity (vertical vision). The essence is not fragmentable, *it fuses a fragmentation*.

Since human beings are part of a society, does it have an essence?
No, because society does not exist as a physical organization. It is a collection of representations hosted by humans, but nothing merges it. Nothing experiences it as a whole because this whole is not in physical continuity with its structure. Each of us designs our own layered representations of society. Like the others, they are constitutive, active. What we experience is the fusion of all of these higher representations and other information such as personal sensations.

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Intention and reality

How does an intention manage to modify reality? The question is not so absurd. Isn't the mind after all a representative process? If it is entirely the product of its micromechanisms, where does the shift come from in its wanting to change what it represents? Why isn't it a zombie?

This shift comes from a conflict between representations, impossible to reconcile because they are in competition over the same thing. Realistic/objective versus intentional/subjective representation. The objective belongs to the Real pole, is proposed by perception. While the subjective belongs to the Spirit pole, is the thing as the spirit wishes it.

We saw in *Stratium* that there is no sharp transition between objective perception and subjective representation. The border moves according to the personality, from its success in making desires come true. In the event of repetitive or unbearable failure, subjective representations suppress objective reality. Mythomania. The Spirit pole goes so far as to truncate the elementary information of its visual field.

But what interests us in this chapter is how the mind manages to make its subjective representations objective. How does it make the real obey, since it represents falsely, or approximately?

This is only possible because the real is also based on approximations. The distorted model of the mind is close enough for the real to behave as expected, or roughly. The interactions are operational. *The model is in the approximation zone established by the real about itself.*

As we move up the complexity ladder, the mismatch between representation and constitution becomes more apparent to us, because it approaches the one we experience. It is thus possible to see a hierarchy in the terms which designate the fact of representing: result > representation > cognition > intention > will. The individuation of the representation is sharper. Polarization of the T <> D conflict.

In the previous chapter, we studied complex verticality with the upward, ontological look. Complex entities appear as the inevitable result of their constitutive interactions, settling on stable outcomes. How do they present themselves for the downward look, for representations that study the underlying representations?

Complex entities appear as *players*. They try their behavior in a great collective game at the level that brings them together. The most famous is spreading its solution. The most famous, the luckiest, or the most constrained? A molecule taking one spatial form rather than another does not seem to have 'decided' it. The downward look also has its reducing sides. Morgue of a sophisticated consciousness. It refuses to grant a personal intention to lower complex entities, preferring to see them subject

to *laws*, which are foreign to them. It dispossesses them of their behavior. The lower entity is only the plaything of its environment.

No. A complex entity is related to its environment. It owns its constitution, its informessence. It is in this property that its elementary intention resides. Property which persists in a certain range of ontological changes, and therefore which cannot be reduced to ontology, at least not to the ontology which is accessible to us, that which comes from underlying models and which is not the reality per se.

The difference between intention of molecule and consciousness seems abysmal, justifying the arrogance of consciousness. The molecule has no 'concept' of manipulating its own atoms to conform them differently. A consciousness, on the other hand, sees itself in control of free will. It manipulates its behavior by analyzing independent criteria, comparing them, experimenting, in short through an extremely complex mental process.

But isn't the difference just this height of complexity? A large number of levels of information help to develop conscious intention. Does this take away the intentional nature of the 'molecule' entity? And in this case where to look for the birth of conscious intention? Should we continue to flee into dualism?

The molecule is indeed the design of its own atoms, as its persistence, linked to the set of relations of atoms and of the context. It is a unique 'idea of solution', because as a concept of organization the molecule is too close to its atomic ontology to detach itself from it and produce choices. Direct emergence. In the human brain, on the other hand, the number of conceptual layers separating the idea from what it represents is considerably higher. A multitude of parameters are integrated. A great diversity of choices appears. We even need safeguards to avoid chaotic thinking: social mimicry, memory, habits, fear of the unknown. So we manage to keep our minds in a small pool of stability, in the middle of an unpredictable environmental ocean, populated by complex entities.

As you climb the ladder of complexity, self-organization passes through so many microsystems and planes that they become invisible. A reliable witness to the presence of a bearing is the drift of the mathematical algorithm which, until then, seemed to correctly describe the evolution of the system. Its "simplicity" anchored in the previous plan is discredited by the emergence of a higher order. The invisible levels created the notion of strong emergence, the literal meaning of which is a mixture of 'unexpected' and 'incomprehensible'. The more the observer misses a large number of these levels, the more she gets the impression of a strong emergence. Origin of matter/consciousness dualism, but also of the classification of self-organization phenomena into structural, functional, and intentional.

If the appearance of an intention in an artificial intelligence network is considered a strong emergence, it is because it processes the data through several successive levels of representation. While the solidification of water into ice is considered weak emergence, structural, because it is a single level.

With *Surimposium* these differences are blurred. Strong emergencies are surimpositions of the weak. The organization becomes apparent 'intention' to our mind as it approaches the level of complexity of those within us. The control exerted by the spatial form of a molecule over its own atoms appears too weak for our free will to be recognized as intentional. Yet it is indeed a phenomenon of the same order: a representation has appeared and exerts an influence in return on its constituents.

The force of intention

Intention is connoted as force. Can we give a physical definition of this power? Intention seems all the stronger when it is focused on a goal. No alternative. Power would then be the restriction of the solutions selected from among the possible set. It rises in proportion to two factors: large number of possibilities, small number of solutions.

Is it surprising, then, that we do not attribute any intention to the molecule in our previous example? Considered as the direct emergence of atomic interactions, the number of solutions retained is 1 among 1 possible. One minus one equals zero power of intention. The direct relationship of the

entity ‘molecule’ with its atomic constitution correlates with a major restriction of its choices. Its intention has minimal power with respect to its atoms.

But the conclusion is not the absence of intention in the molecule, nor in matter in general. *This intention exists in principle*, with insignificant power compared to that which neural networks can achieve by staging information. We find in this power of intention the parallel notion of force of emergence.

The intention develops as it acts. We told in *Stratium* the famous story of Mirabeau in 1789, who improvises his speech and apparently extracts his coherent revolutionary intention from nothing. But the examples are endless. Existing psychological anchors used by salespeople to tamper with the intentions of their potential customers. Creative process where the artist discovers her work as she performs it and it seems to impose itself on her. Words tossed in the air and the intention condenses around them. Chances of meetings and readings that radically change the destiny of people. Free will seems to disappear in this universe of micro-motivations and hazards of which it is only a transparent varnish. Consciousness itself, the last refuge for a strong emergence, the last bastion of independence for intention, would be no more causal than another appearance of reality. Would the efforts of cognitive psychology only complete behaviorist beliefs? By gradually refining the micro-mechanisms of intention, consciousness becomes an empty shell, a practical term to sum up “I want to…”.

The intention of the mind in relation to its neurons becomes of the same order as the intention of a rock in relation to its atoms, from a protein to its amino acids, from a cell to its organelles. But precisely ! As you can see from *Surimposium*, intention does not go away. It is simply brought back to its intentional micromechanism itself. It expands deeply in complexity from a very real intention in matter. By changing the direction of the look, we regain its full thickness in consciousness.

The intention is basically to exist, to assert one's right to exist, no matter what the affirmation is made of. This existential individuation is confronted

with others when their properties make them enter into a relationship. The T<>D conflict is at the root of the intention: « I am an independence within the whole ». Immediately after comes: « What is the *rest* made of (= whole without me)? What is it like me inside the rest? ». The D of T<>D becomes more precise and fragmented. There are other individuations within the whole, significant in relation to what forms my own essence. What information are we going to exchange? How will this information change others, and change me? Two directions. Not symmetrical. My intention may be stronger than theirs and I will transfer it. Or less strong and I'll be like them. Or they balance out and we don't change… except we form an association together. Something more has been created. In any case, a relationship transforms us. An additional level of information has arisen, the existence of which is very real and consists of the occurrence of the interaction.

This additional level is very important. It makes this intention appear surimposed on the simple relation. For groups of related neurons we speak of 'decision'. The decision is the representation chosen by the jointly organized elements. It forms a particular individuality, which in turn is elementary. It can evolve. Unstable, it is not given the title of element but of chaos. It all depends, however, on how this organization is viewed. What time scale? How quickly to go through all the solutions, its 'possible states'? If the organization is maintained in the observer's own time (alive or not), it is said to be 'stable' and designated as 'individuation', then 'element of a system' by being associated with its relationships. The decision participates in forming a new one, in a higher level of consciousness.

Decision making can be fast or slow, from an observer's perspective. Rather than a monolithic benchmark, it is crossing a border. The organization/system reaches a zone of stability, defined by its maintenance during variations in the context. If this zone did not exist, the tiniest variation would immediately displace the appearance of the system. As long as even a small variation does not change this appearance, it is possible to define this appearance as endowed with (relatively) independent existence. Representation based on an *approximation* of interacting elements. To be additional of reality.

Let's abandon abstraction for a very human example of decision formation and evolution: A person in their sixties has a bad knee. Her pain, intermittent at first, worsens and becomes continuous. What characterizes the precise moment when she makes the decision to have the surgery? For what this moment and not another? However, this is a major moment, as the person switches from adaptive behavior to their pain to postoperative predictive behavior, free of disability. While the risks surrounding the transaction held back her decision, those risks have not changed. Everything happens as if the pain agitated the daily life of the person, moderately at the beginning, without modifying behavioral habits. Then a threshold is crossed. A decision upsets this mental balance. Another is found. The image of the self supporting the pain, reinforced by the fear of the surgery, gives way to the image of the operated and relieved self, whatever the risks. Round trips are possible. The decision is sometimes half-hearted. But there is a clear line between the state of operation and not. The decision is a crossing and not a gradual passage from one state to another.

We have seen that 'will' is the term that replaces 'intention' in climbing the scale of complexity of mental representations. These are divided into descriptions, which try to remain faithful to the external reality (the Real pole) including in its becoming, and into desires, which try to realize the identity drives (the Spirit pole). The conflict between these representations creates new ones. Synthesis often difficult but blurring the underlying opposition. 'Will' thus designates those conscious intentions which often appear arbitrary because its alternatives are lying in wait, barely subconscious, easy to bring out.

A will is a representation seeking to collect others. It is not absolutely firm, more attractive. Many events can orbit it without modifying it. Then one of them makes it untenable, and the behavior refocuses on another attractor.

How to formalize this opposition between mental representations A and B? Interaction, in an integrated level of information, is not a balanced exchange. There is an intention from A to B and from B to A. They are asymmetrical. The will is based on this asymmetry. A with B wants C but B

with A wants D. If D occurs, B has the stronger will. Will is the celebrity of intention in the context in which it evolves. An attractor is a spike in fame and willpower. Free will would need to be renamed because it is neither free nor will; it scores goals. No freedom in being stretched towards a goal. Freedom is reborn when the will ebbs back. The diversity of intentions reappears. Free is indecision, the equivalence of intentions. No soul to officiate. An intention stronger than the others is committed alone on the top step of the podium. All we can hope for is for the others to join in cheering it on.

What mathematical transcription?

Can we transcribe this poetry of the spirit in mathematics? The real is an immeasurable number of interactions. What to discourage the reductionist claim. How to organize this infinity of micro-mechanisms to explain the multiple appearances of reality? Science is pragmatic. It is a multi-layered map, with each specialized layer extending its organization plan. Precious tiling of knowledge. Uneven ground. Some tiles are taller than others. Variable complexity. Using the vertical view of *Surimposium*, complex entities appear in their entire elevation. Tall stacks of organization separate the smaller ones.

Models have no other claim than their descriptive and predictive value. Unlike their authors, they cautiously refrain from saying what reality itself is, its origin and its final outcome. *Surimposium*, as a model, does the same, while seeking a transcendent principle to unite them. The management of reality is no longer an infinity of elementary micro-equations to coordinate (reductionism) but algorithms anchored in successive organizational plans, famous within each of them, and which must be combined.

Can we only match them empirically, or is it possible to truly marry them by an invariant principle of the scale of the organization considered? How can this invariance produce such a diversity of models?

A model is basically symbolized by an algorithm. The question, put differently, becomes: can an algorithm "go outside" its organizational field to create a new one?

A priori we could get a positive response from cellular automata. The Game of Life algorithm (Conway, Wolfram) creates stable organized shapes by continuing its calculations indefinitely. But that doesn't really meet our need. These regularities are apparent to our observation but have no specific causal effect on the further calculations of the algorithm. We can attribute to them an external causality (for example to attract our attention precisely), unfortunately this does not advance us in any way on the mathematical relationship between the algorithm and the external causality.

The algorithm can be based on linear or nonlinear equations. In a nonlinear equation, the result is reinserted as a variable under the initial conditions. We are getting closer to our need, an equation changing itself. An even greater flexibility of the model would be that the result modifies not only the initial variables, but also the form of the equation itself. Metamathematics connecting the equations between them by the transcendental principle that we are looking for. However, one constraint must not be overlooked: the form of the equation must not be transformed to the point of no longer corresponding to the organization to which it was addressed. Chaos assured. A new organization can only be established on top of the previous one. The model must outlive the one it gives birth to. One equation does not chase another, it integrates it as one of its variables.

But then we see the reappearance of an exponential complexity identical to reductionism: an algorithm is simple only in the place where it was born, and becomes incalculable as soon as a few levels of organization are added to it.

The only way out is to approximate the equations. It does not matter what range the variables go through, as long as the result is stable. Ouch! By dint of talking about results, we have just made it a new constraint. What does it correspond to in reality? Where does it stop at the result, to reintegrate it into its process? We have just made reality show itself to be discontinuous. Do we have its agreement?

The solution probably lies in the very concept of stability. Something is stable only with respect to something else. We can of course observe an

interactive loop which seems unalterably stable. But precisely this stability only makes sense on the temporal scale of observation. A proton is stable for a scale of 10^{20} years, probably not for 10^{40}. How important is it for us, human organisms, whose life is 10^{2} years? None. Our biological organization approximates the eternal duration of the proton, without any impact given the shift in time scales.

The stabilities are defined on such shifts. The nonlinear, chaotic equation approximates to a linear, computable equation. The result is added to others to form a new fragment of stability. Reality is built by approximations. It is the bridge between its dynamics and its balances.

I defined the intention in the *representation*, in the fact of surimposing a synthetic information on another constitutive one, the two intimately linked but having two different realities. It is such a shift that truly forms the birth of intention. *Wanting to be something without ever being able to be it independently*. How can this philosophical statement be translated into the information universe? How do you get it to say it in your favorite language, numbers? Or do we need to look at other ways of codifying information, such as Spencer-Brown form language?

Let's start with the numbers. How to define them as intention rather than simple description? It is easy to get them to *encode* an intention. This is the job of our daily digital assistants. But the encoded intention is external, already existing. It was not born in the numbers themselves. All the patterns that we see in them reflect *our* concepts, *our* intentions, not theirs. It is the intentions of our mind that are reflected in the numbers. In particular it attributes quality to their results.

Nonetheless, numbers have their society, governed by fearless rules. They interact. An interaction is a relationship that begins without containing its future. Calculation starts, the result has not yet occurred. Description of the initial conditions. In reality, this phase has no clear end. The initial conditions are not really set in stone until the result occurs. The constitutions of the elements change, only their properties are considered stable. The interaction between two stable elements is idealized by the mathematical equation. This is an *approximation* of reality per se. The initial

conditions change insidiously during the calculation and shift it, break its linearity. Numbers applied to reality are bits of information that don't know where they're going. Their wandering is a description of a context, and the description is their wandering.

The result that interests us, in terms of self-organization, is the one that loops in on itself. This result is repeated over and over again. It contains its becoming. Result that *expects* to be a result again. It is in this sense that information can be intention by itself, and no longer just description. In fact, the information contained in the initial conditions are also intentions. Intentions of *existence*. They expect to *be*. But not to *become*, apart from this being. Becoming is formed from the reunion of beings. If it is stable, if it waits for itself, it in turn becomes intention, a new being.

When I asked my partner how she imagines that an intention can come out of numbers, she answered spontaneously: « In any case, one cannot be without intention to be ». A universal principle ?…

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Ascending and descending causation

Is emergence a break in causality? We did not fully answer this question. Remaining monistic implies giving up a causality emerging from nothingness. Does this imply giving up any notion of top-down causality, adding to classical ontological causality?

An interaction is said to be elementary when we can no longer describe any intermediate mechanism between the starting situation and the result. Problem: No interacting element has ever been shown to be ultimately indissoluble, devoid of intrinsic complexity. An interaction only deserves the label 'elementary' within the paradigm of the system to which it belongs. The same restriction applies to the 'cause'. Cause is sort of a summary of everything that can make up the interaction, a black box until you identify an inherent complexity in the interacting element. The principle of causality is not universal, on the contrary it is contextual. This does not imply that it is false, on the contrary: it seems a relevant summary, since its codification accurately reflects the evolution of the system. Precision as one is tempted to call it perfect, that is, to confuse the essence of interaction with code.

Causality also becomes, from this angle, a self-organized edifice. It is not the engine of the organization of reality but its effect. Causality is built, from floor to floor, easily identifiable by the regularities it triggers. Easily modelable. But we are modeling the appearance of an unfolding, perhaps a impetus, and not the essence of things.

To speak of result rather than state, in reality, indicates a stable discontinuity. Whatever micro-mechanisms inside the black box are in a loop. They rewrite the same result over and over again. The loop has its own 'elemental time'. Which also defines it as an 'element' for a higher interactive level. It becomes causal in this new plane of existence. Causality is naturally discontinuous.

This ascending causation is no longer the fearless, continuous process it classically appears to be. *It only extends into the complex dimension if it finds its result*. Only the looping of the result on the constitution of an element allows it to continue. Otherwise it is just a sequence without a goal, for no reason for the slightest downward look to appear, which is the materialization of that goal. The notion of causality would not be different from a succession of points joined on a straight line. The states *would exist*, simply, without the meaning of causality appearing to anything on this line.

Classical ascending causation therefore needs descending causality to appear. The two looks do not exist without each other. But how do you make this top-down causality appear in realistic terms? How to materialize the emergence? We have said that its causality is hidden in the micromechanisms, in the approximations of the initial conditions. But this is still only an ascending causal mechanism. How does our look make it appear?

The answer lies in the phenomenon of representation itself. Physically, the representation is a looping result. Several different interactive sequences can arrive at the same stable result, at the same 'element'. Result that brings the calculation process back to its starting point. This is where it is a descending causation. *It confirms the element*. The ascending causality forms

the constituents of the calculation until the result. Descending causality makes the result the initial conditions for the formation of the calculus.

This dichotomy does not seem to mean much if the result is simply deductible from the initial conditions. Case of a linear equation, where the starting elements already contain the result. Is this real additional information? We could argue that yes, it is independent, when this result R can come from the initial conditions C1, but also from other conditions C2, C3…, while R loops systematically towards C1. The relationship is not symmetrical. R is irreversible information as a dead end for C2, C3… It *represents* C1, C2, C3… in a unique, fusional way, which is to bring back to C1. The C1-R relationship is a loop and, at the same time, is imbued with irreversibility. C1 is a *choice* for R, not an inevitability already contained in C1. It is in this sense that we can introduce a descending causality from R to C1.

We have just justified the dichotomy for the most difficult case, which is in fact the most exceptional, even purely theoretical. Many models use a linear equation but postulate that the 'black box' separating C1 from R is an imperturbable interface for the interaction. We know that in reality it is not. An interaction between excitations of quantum fields can be disturbed by a fluctuation. All realistic equations are nonlinear, possibly simplified to linear when the fluctuations are insignificant. It is easier to justify the dichotomy for a nonlinear equation. Most often, the dynamics of this lead it far from the initial conditions C1. Only the ascending causality is exercised. However, criteria can bring the elements back to conditions C1. This may be their confinement (system at equilibrium) or a continuous supply of energy (system out of equilibrium). The descending causality leading back to C1 is not contained in C1. Various fluctuations during the process, linked to elements foreign to C1, in reality creating the conditions C2, C3…, making the equation nonlinear, nevertheless lead to C1. There is no longer necessarily a single intermediate step, which we have called the result. There are a large number of them, R1, R2, R3…, all united in the fact of bringing back to C1. We can merge them into a symbolic result R, which is to lead to C1 from C2, C3… R is not C1 because of these intermediate steps. R represents the fate of C1 in different possible extensions of itself, which are C2, C3… It is a condensation of the possible. It has its own information

value. It causes C1 but is not caused only by C1. This is where descending causation makes sense again.

R, as a representation of the looping system, acquires its own temporal identity. It becomes an element in turn, with its duration and specific properties. R is a descending causality as a unified look at the variations of its own constitution.

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Synthesis

Reality is one and we are part of it. It is our representations that divide it. But precisely, that our representations are discontinuous and concrete indicates that reality fundamentally presents such discontinuities. Reality is self-representing and we are the most sophisticated aspect, to our knowledge, of this process.

In ascendancy, the diversification of reality is that of the phases of its material. The set of phases is the set of lost symmetries, equivalent to order gains. The elements of a reality level see their T<>D setting change incrementally, between the T indicating all the allowed symmetries, and the D indicating their complete prohibition. Ideal freedom or integration.

A reality level *self-defines* its symmetries by the interactive properties of its elements in a context. At the lowest known levels the actors are pure mathematical descriptions. At the levels of visible matter, the interactions are spatio-temporal and electromagnetic. The strength of the bonds decides the number of possible symmetries. An atom in a gas is close to T (ideal freedom), in a crystal it is close to D (ideal integration).

The gas thus appears as complete disorder, and the crystal as perfect order. Entropy is the principle designating this 'gain of freedom' of atoms in a gas. If they occupied a particular configuration at the start (a specific order among the innumerable possibilities), they will never return to it. They will remain in the global configurations which, by resembling each other, maximize their individual T. If the identity of the system is defined as its own T<>D setting, it is positioned in atoms and not in gas. As the system

has no collective identity, it disappears as soon as it is no longer confined. A gas is not an *entity*. It is not an organized element, like crystal is. It is part of the general collective context. It becomes a system-element only when it is isolated, and then a pseudo-identity appears which is maximum disorder, respectful of the freedom of its elements.

A collective takes on the element title when the system's T<>D setting approaches D. Achieving D is the definition of ideal stability for the element. This permanence allows it to participate in a multitude of interactions with elements of the same type and to explore possible solutions. The lost symmetries decide the T<>D setting specific to this new system. Will it in turn become stable, if the D dominates? Each level of organization thus surimposes its essence on the preceding ones, without obscuring them, thickening the *substance* of the higher entity.

Inscription of the double look in reality

The most important operation in this book is to consider the double look not just as conceptual but as *director*.

Indeed so far I have taken into account a persistent dualism in your mind, dear reader: that between virtual concepts and the real essence of things. I have justified the *conceptual* interest of the double look by showing the universality of its applications. But any concept can be replaced by another. Many have no counterpart in physical reality. I ask you now to consider the double look as *perfectly inscribed in reality*, as a principle transcending it.

Letting go of the last dualism that occupies our minds is both simple and difficult. Simple: it is only a question of sweeping away the residue of the anthropocentric morgue that has embarrassed our knowledge since its inception. Homo sapiens is no longer the center of the universe, is no longer the only one to think, to have a language, representations of the world. They are successful animals. The animals themselves are successful cell colonies. Cells are primitive bacteria and successful viruses. Viruses are successful genetic material. Genes are successful macromolecules.

At each of these stages there is something inversely to represent this success. The gene represents the success of the macromolecules assembled

within it. There is individuation emerging above them. The representations scale towards the apex of complexity, up to Homo sapiens individualizing themselves as a superior species above animal life.

But the presence of Homo sapiens is not necessary for a representation to exist. A molecule represents its atoms. The molecule does not need to have a brain for this representation to be real. A brain is used to mimic this representation, to translate it into the language of a neural code, to associate it with others, and to recreate a virtual structure similar to that of reality. If the brain does it so well, it is because it did not extract the process from nothing; it relies on the very process of reality, which is to self-represent.

Pushing the reasoning to its limit, let's go so far as to say that the self-representation of reality can be false, that it will remain virtual, that it will not be realized, in the same way that an idea can be false, not correspond to any real thing.

The false self-representations of reality on itself correspond to the multitude of states of a system that are too unstable to allow its individuation. Indeed a realistic representation does not appear only because the system finds a balance. This would be a causality that arose out of nothingness that again exposes us to criticism of historical emergentism. In fact, any state of the system gives rise to a representation, since this is defined as the set of elements and their relationships. To say false self-representation, for a state, is to say that it does not add any additional reality. A representation becomes realistic when it brings such a supplement, that it is individuation allowing the construction of a new organization.

The connection is made with our ideas. When our mental representations are wrong they do not add to our image of reality. They won't influence it. While a realistic representation allows to build additional organizations, new tools, new ways of acting on a reality that becomes obedient. Representation is indeed a transcendental principle and not an exclusive function of the brain.

Let us end with a new definition of consciousness, applicable to matter: *Consciousness is a fused representation which expresses its identity in a relative independence of what constitutes it*.

This definition covers all the usual formulations of consciousness, foreign to each other or even contradictory: consciousness as a phenomenon, social, self-observation, consciousness of something, awake, alternative, dream, bodily, animal, plant, microbial , etc. This definition anchors the genesis of consciousness in the inanimate. It overlaps with the notion of emergence, of a whole formed by the relations of the parts and gaining an existence detached from them (relatively), since modifications in the parts do not change the emerging thing.

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7
Second Empire
In search of metalanguage

With the previous chapter, *Surimposium* is in place. The verticality of the complex dimension gives a new skeleton to reality. Big job of organizing from our downward look. This epistemic view understands itself better. Thanks to a few ontological explanations, it now knows why it spontaneously sees very different levels of reality (and consciousness), from matter to sophisticated demonstrations of life in humans. These levels are very real although they do not appear to the upward look.

What our double look does not yet provide clearly is the meta-principle creating this sequencing. We have seen in the chapter 'Emergence Ontology' a number of mechanisms explaining emerging levels. But precisely: there are too many. None seem to explain everything on their own. I proposed the T<>D conflict as a meta-principle. Seductive hypothesis, but can we derive from it a metalanguage of reality, which allows it to speak from one end to the other of its complexity?

Let us take a closer look at the language, or rather the set of languages, which has the best claims for this title: mathematics. Then a second major question: What is it that animates this language? What sets it in motion? A suitor presents itself: *time*. Is it just an extra dimension, or is it hiding special talents?

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Mathematics

Mathematorium is the self-organized building of mathematics. Strata: boolean logic, sets, geometry, arithmetic, etc.
Stratification that changes the scope of Gödel's theorem. A theory can not self-justify in a level of *Mathematorium*. But the theorem does not prohibit a metamathematic connecting the levels.

Enter maths by the double look clamp. Downward branch: "How do maths operate as a way of knowledge?" Upward branch: "What is the nature of the logical entities proposed by the real?".
Virtual concepts exist in the real of neural configurations. Levels of information anchored in physical reality, that it is not necessary to eject in an idealistic universe.
If the ideals existed elsewhere, where the non-ideals would reside and how would they differentiate? What need to write a second structure parallel to that of reality?

How have math appeared? By a gradual increase in the complexity of cognitive processes. And by sorting virtual concepts close to natural selection: abstractions adapted to the real survive and generate others.
A mathematical object is *discovered* in exploring a known level of maths, *invented* in the construction of an additional level.

Affirming that maths are a language is not reducing by considering that the chatter is the real in person.
As a language the classic grammar of maths has been enriched with details, word-compounds, neologisms, shortcuts. Examples given in the text.
Language = vector of mimicry. 'Modify', for the receiver, implies that it is heterogeneous. The stratification of its essence in terms of information allows it to change without losing its global identity.
Maths are intrinsically based on such levels. Inside a level the operations are linked by deduction. Transitions between levels involve infinite or endless calculations. '=' conceals a fundamental approximation: an incalculable becomes manipulable object.
'Point' and 'instant' define space and time and simultaneously do not constitute any part. Discontinuity blends in an infinite resolution with continuity.
A measurement is strict because based on the fixity of the essence of the object under the downward look. It is approximate in relation to the range of alternatives that can be experiencing by the object, related to its complexity.
A diversity / dynamic is *proven*, a fixity / state is *represented*.

Measuring units are identical only by convention. Postulate that interactions are similar. Because we do not have the means to check the opposite. New approximation.

Example of time: each interaction is attached to its equivalent of organized real... which has its own time. Time and measurement are attached to an organization level.

A model is based on initial conditions approximating the system.
Energy reports make some insignificant forces. What does 'not significant' mean for the real?
The real makes approximations, but the model makes it more. Offset with reality.
If the model modifies the validity of the initial conditions in a range comparable to the real, it is rightful.
Its falsity comes from imperfect simulations in its own complex structure, theoretical or in that of the instruments it uses. Hidden levels weaken its determinism.

The formal logic, registered in a level of reality, is very different from the informal logic, more faithful to the complex reality. The second brings us closer to the way the real experiences itself.

The simple and the complicated are not related to the complexity (mathematics or other) but on the proximity of the levels of organization involved in the representation. There are no "simple" operations other than those innate to us.

Nested continuums: the real (*Diversium*) containing the mind (*Stratium*) containing *the possible*.
The possible is not the largest set (containing the real) but *the smallest,* part of the mind devoted to the alternative representations of the real.
The possible is strongly contingent by species consciousness, and more particularly cultural.
The mathematics is also a self-organized pyramid, founding real objects (which approach the platonic ideal) to their representation in the mind through society (family, school, profession, learned societies, culture).

Why do not we think in mathematics? This language is not adapted to the blurring of reality, a mechanism essential to share one's with that of others.
The ambiguity of the oral language diversifies the most effective representations for the group.

Mathematics does not bring any substance to reality, unlike the spoken language whose only logic is the empirical representation, substantially proven, of things.

The absence of metamathematic prevents from understanding why the objects of the maths are connected in this way.
But vertical thinking may be concealed in equations. A change of look reveals a qualitative leap in a '=' sign.
In 'Laws of Form', Spencer-Brown tries to bring up a mathematical foundation in pure geometry, without using numbers.
Its fundamental character is undoubtedly to search rather in the basic operations done invisiblely by our visual centers.
The most primitive level of math is binarism accompanied by its Boolean elementary operations. Then sit the numbers. While the geometric calculation of Spencer-Brown is a direct application of binarism to the case of two associated spatial dimensions.

The acronym « ≈+ » symbolizes the surimposition (the crossing of a level of reality). The whole adds to its parts, represents an approximation.

Mathematorium

The unification of mathematics was initiated by Whitehead and Russell in 1910. The majority of modern mathematics can be traced from the axioms of set theory. Since then, it has become possible to speak of *the* mathematic instead of its plural.

Note that in this approach there is a stratification rather than a tree structure of mathematical disciplines. Some branches are re-amalgamating to produce a new discipline. Starting from the sets, Whitehead and Russel need 362 pages and a complicated alignment of information to show that… 1 + 1 = 2.

What have we just crossed? A level of *Mathematorium*, the self-organized building of mathematics. 1 + 1 = 2 is the representation of the complicated sequence of preceding information. Change of discipline. Surimposition of a new mathematical language, based on the previous one but establishing

its own rules. The new theorems are not predictable from the previous level. Arithmetic has relative independence from sets.

In view of the number of axioms imposed on the set theory, it is unlikely to be *the* foundation. Other attempts exist. The true origin-principle must be recognized without hesitation since all mathematics, and undoubtedly reality itself, derives from it. But is it accessible to our understanding, if this is already a derivation of it? Best clue: that it should not be explainable, but only understandable. First emergence beyond which we cannot go back. Unsurpassable axiom.

Gödel's theorem

Presenting mathematics in this way limits the scope of Gödel's incompleteness theorem. This theorem does not apply *inside* a mathematical system, but looks at it from outside. To create this exterior it uses the division of levels. It shows that a mathematical theory cannot be self-justifying since its power does not exert beyond the level at which it is defined. Gödel's theorem is an elementary theorem of *Surimposium*. It does not preclude the existence of a metamathematics connecting the levels. Such a transcendental principle would impose itself on it. It is no longer possible for the theorem to project itself into an exterior since the meta-principle applies to the entirety of reality.

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Mathematical idealism or realism? Preliminaries

Knowing whether mathematics *is* reality or only a language to describe it is of paramount importance for progress. A largely undervalued importance. Because if the reality is mathematical, we can effectively project the models beyond the frontier where they are experimentable, and think that they remain valid, since they are always the *essence* of what is on the other side. On the contrary, if mathematics is a language, we have no certainty about the extent of its relevance. This last option is more likely for two preliminary reasons:

1) Much of the possible mathematics does not describe the real. As in any language, there are only virtual words, waiting to designate a reality. Getting around this problem again requires inventing a multiverse where

all conceivable mathematics actually exists. Addition that goes badly under Occam's razor.

2) Mathematical systems only apply to a portion of the real and cannot be connected in a coherent way to explain the whole observable. Mathematics is a tool at the service of the theory of everything. It is not theory on its own.

The mental universe being an assembly of representations, mathematical objects are *constitutive* of this universe. Any famous representation models the others around them. Numbers patiently sculpt the mind of the mathematician. Impossible to ask representations to go back. The circularity of mathematical reasoning *is mental even before it is logical*. That is to say that even finding a flaw in the logic of this circularity, it would still remain mental. This is how one can conceive of a universe made purely of information, devoid of any *experience* of that information. To break mental circularity is to bring to life alternative representations, to imagine, to philosophize, and even to *believe*.

Here, right in the middle of the airstrip of reductionism, we are still treading on emergencies. Emergence in mathematics is the difference between *data* and *equations*. Data is the ontology of the world. The real is offered through them. Equations are their epistemological form. The mind digests data through equations.

But aren't the equations already in the data? Is it necessary to separate them? Isn't it a simple matter of approach, through the Spirit or the Real Pole?

No, the equations are not the data; they are the *organization*. This is where the emergence is. Equations describe the whole formed by the data and their relationships, not just the assembly.

The *deduction* is artificial, does not create information, only exists in a secure space. Creative mathematics are constantly self-changing equations. They are hierarchical quanta of computation and entangled in degrees. This is where the emergence appears, within mathematics itself.

The difficulties that we have discussed in the 'Information' subchapter are found in the way in which mathematics defines their relationship to reality: are they constitutive or descriptive of reality?

Structuralism maintains that mathematics describes architecture. The place of a mathematical object in this architecture defines it exhaustively. It has no intrinsic essence. It is an element of language, existing through its external relations in a system of equations. For example, structuralism maintains that the number 1 is defined as the successor of 0 in the sequence of integers. Its position between 0 and 2 is sufficient to determine its existence within the theory of natural numbers.

Calculationism identifies nature with calculation. In this vision, a falling apple is an instantiation of the calculation of the mechanics of bodies.

Unsurprisingly, calculationists include the majority of mathematicians. While structuralists recruit from philosophers. When mathematics is part of your thinking, you are more likely to make it the essence of reality. While watching them work you think of them more as a tool, a language. The problem is faded by realizing the relative independence between what we have called informessence and interaction. Redefining substance as information is no longer such a major upheaval. This does not change the perception of the concrete, or even its nature, since we still do not know, in fine, how to identify it. To say that substance is information is simply to rename it. This leads us to create new categories of information, information-substance (*informessence*), information-relation (interaction or *calculessence*), information-realized, information-proposed.

Maintain that it is impossible to say with certainty that the mental structure called 'representation' is of the same nature as the real process. This applies to every step of the real process: substance - interaction - result. A specific representation is surimposed on each step: information - calculation - possible and realized sets. If we call "computation" the process of interaction between information, there is a difference between the *language formalism* describing this process, which we call "mathematical equations", and the *essence* of the process, the interaction itself, which self-experiences

without being able to translate, and which we could also call the 'calculessence'. Indeed, no level of organization can represent itself. *Another* is doing it. It is necessary to be out of step with the unfolding of the process to observe it. When two atoms interact, the representation 'two atoms' cannot belong to them. It's 'me' and 'the other'. For the molecule they form, on the other hand, the 'two atoms' representation is indeed an intrinsic property. It is part of the essence of the level of molecular organization. The molecular 'I' is the fusion of two atoms, which constitutes a representation of it.

Structuralism and calculationism are far too Manichean views of mathematics, and these escape easily. But that will be the subject of our conclusion. Let's take the time to understand a little better what this mathematics is.

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Enter math

Let us grasp mathematics by the clamps of our double look. The epistemic branch of the clamp is the question: « How does math work as a mode of knowledge? ». How do mathematical concepts come to agree with reason? The ontological branch of the clamp is the question: « If mathematical propositions are true, is it because there are logical entities independent of the proposition, and what is their nature? »

Am I making a mistake in speaking of "ontological clamp"? Isn't the ontological thing the property of the object to be analyzed? It just *introduces* itself. It is not graspable but observable. But precisely, if it is not graspable, we can only *talk* about it. When we practice ontology, we use the relay of a conceptual language as in epistemology. The only difference is that we reserve the property of the epistemological language, and that we give that of the ontological language to the object. We try to experience it as it is experienced. Impossible. We are not native to its essence. Native only of that of our consciousness. Of which we share certain logical elements with our congeners. Language is a consensus built on common parts. So we always have clamps in our mind when it comes to representing others. The only representations which escape this condition are the *constitutive* ones, acting in our mind. The body is being *experienced*. The emotion too. Reason

why the sensations cannot be mathematized. The only phenomenon that is not a language.

Epistemological and ontological clamps derive from a conceptual pyramid, *the mind*, which strives to grasp another virtual pyramid, such as mathematics, or a so-called 'real' pyramid, such as matter. How does the mind get there? By mimicry, during learning. Mathematical language is not given to it. It contains its internal regularities, which the mind must copy. Does this mean that this logical structure is inherent in language and not in the mind that mimics it? Let's not conclude too quickly. This structure was gradually invented by other minds as they came into contact with the world. It all started with mimicry. This attests that this structure exists in reality, not necessarily in a virtual universe as assumed by Plato.

At the start of learning, the mind cannot yet experience the proposed mathematical object. It encircles it between the two branches of the clamps, the ontological (or real which proposes itself) and the epistemic (or spirit which disposes of it). The academic difficulty is aggravated when only the epistemic branch is given to the student. She is forced to learn abstractions without the practical ontology of reality. The sets are as absent as their elements. Lack of coins, apples, squares, wheels, to reveal the anvil of reality.

When the clamp is complete, the mind places the mathematical object between two mirrors, the ontological image and the epistemological image, described by the appropriate diagrams. The math object is now isolated. Its regular use integrates it with other schemes. Mirrors are welded to what they reflect. The mathematician ends up experiencing her language, just like a spoken language. She weaves the contents of her consciousness. It is not the essence of thought but *a plan in the construction of this essence*, in the same way that the essence of a living organism does not exist without that of its system of distribution, independently of the organs which constitute it.

Provided with these benchmarks, let's review whether it is necessary for mathematical objects to have an existence of their own. The question, in fact, has lost all interest. We agree that these objects do not have a real

existence, but a virtual one. Virtual ? The existence of the virtual is very real in the configuration of neural networks. The essence of the virtual is to host all the possibilities… that these networks are capable of creating. Ideal objects exist *materially* in these networks, are reproduced from mind to mind as a symbolic configuration. There is no need to invent an existence for them elsewhere. Especially since it is impossible to understand their existence in this inaccessible elsewhere. While in neural networks it is possible to group together ideals by their intrinsic coherence, which comes from their parts, from their genitor axioms. There are ideal "families", common threads between them. The parties create links. Axioms are compound and can be reconstructed. A whole zoology of mathematical objects appears, an evolution and a natural selection. Mathematics forms a family tree. As a result, depending on *what mind* the genealogy is drawn up, the final appearance of the tree will be very different. The virtuality of mathematics is a forest without knowable limits. Our personal ideal is the tree we use today. Researchers started a consensus on this subject a long time ago. Their descendants continue to explore its ramifications. When they jump onto a new branch, they may feel like they have passed over to another tree. But we would have to go down all the branches to be sure.

Far from being a rigid and imperturbable construction, mathematics is a dynamic and shifting language. Axioms can be substituted and give birth to new mathematics. These axioms are organizational solutions on which new logical entities are built. Language is thus self-organized in the image of reality: a specific paradigm develops a level of language, and achieves an intrinsic coherence which is particularly impressive in the case of mathematics. However, this paradigm can only be organized with others in a higher and intricate way of thinking, a supra-mathematics, the form of which is not predictable from the parents.

Language and reality are organized in the same way, *but cannot be confused*. Language evolves freely in its virtual universe. It offers representations for all possible solutions. Reality is a condensation of it in the virtual, surrounded by the cloud of language. Mathematical deductions trace precise convolutions in this cloud. Everything does not seem possible in the mathematical virtual, if everything must respect a logical thread. The plots are so well defined that mathematical objects, even virtual ones, appear to

us as ideal entities populating this continuum. Logical ideals repelling chaos.

But it's wrong. We have seen how to bring together the virtual and the real, yet even with a traditional view of the virtual, the ideals are not exclusive. Non-ideals are just as present. By definition in the virtual everything is possible. Our brains invent very personal logics, smoky for trained mathematicians. Mathematical objects themselves are particular, layered logical ecosystems; inserting new postulates completely upsets them. The layout of their logic in the virtual cloud becomes completely different from the previous one. If we consider a portion of this course, it can belong to a multitude of supra-mathematical objects. Perhaps it is impossible to see a complete route. All that deduction shows is a level of these objects, caught between two axioms. The mathematical virtual continuum is then populated fantastically. Ideals become objects among others. They come together as a family attached to the particular functioning of the human brain. A subgroup.

To perceive how mathematics is a changing dynamic, almost *a meteorology of logic*, let's do a thought experiment. You know that the constants of the universe deserve this name only because its interactive laws are postulated the same everywhere. Several snags taint this consistency: the Big Bang, the origin of these laws not understood; black holes, obscure enough to generate suspicion about their content; the minute duration of human observation to appreciate a constancy over eons. Now imagine that reality is based on more fanciful laws (do not look for any new coherent physics in what follows). The universal constants change noticeably over the years. Pairs of virtual particles emerging from a vacuum are no longer so evanescent. They disturb atoms enough to cause new real particles to appear, occasionally changing the type of atom to another. The structure of materials is influenced by it, as well as all biochemistry and therefore living things. Self-organization has nevertheless succeeded in making thinking beings who resemble us. However, they use completely different mathematics. No “law” allows definitive equations. All mathematical objects are *provisionally* adapted to reality. These beings especially developed the theory of chaos and structured the different mathematical corpus among themselves to make them more flexible and adaptable to

rapid changes in natural conditions. For these beings, mathematics is as evolving and changing a language as the spoken language is to us under the influence of cultural changes.

What makes these beings different from us? Only a relation between the speeds of organization of the universe and of thought. With these beings they are close, with us they are separated by an abyssal ladder. But wait ! In speaking of the speed of organization of our universe, we have contented ourselves with reducing it to that of its physical micromechanisms. We have not included that of its complex vertices. About the heights we hope to be, the "laws" are no longer stable. The socio-cultural environment evolves in a perceptible way over the time of human existence. Context and laws change quickly. Our social "mathematics" are evolving. New equations replace the previous ones at each age of life.

These thinking beings inhabiting a chaotic universe, finally, *they are us*, in contemporary society. Perspective case. Mathematics is a fixed language only in the reduction operated by a postulate, like any language. Together, they are a gigantic theater, harboring figures to the art of staging them.

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How did mathematics come about?

Mathematical symbols carved into 30,000-year-old Paleolithic bones

The *Stratium* concept simplifies the answer. The stratification of the neurological system has an evolutionary history. Cognitive processes gradually stacked on top of each other as they connected with their like-minded neighbors. Organizations validated? Those that enabled our ancestors to master the environment and survive. Better motor coordination, speed of reaction to certain stimuli, performance of slower thinking under other circumstances. Emotions to improve the discrimination of stimuli. Mathematics originated in addition, subtraction, Boolean logic, and Bayesian predictions, which enabled early cognitive processes to sort out the best behavioral solutions.

Over these first intuitions, these "archaic truths", appeared more complex representations, groups, classifications, axioms, built on basic objects, deriving their specific theorems. Different relationships of axioms in turn

create an additional level of integration. The self-organization of mathematical language grows under the pressure of the environment, thanks to the abstractions preserved and transmitted by culture. The mind responds to pressures with empiricism. It tests the solutions learned, whether or not it is satisfied with them, looks for alternatives, makes mistakes, and thus identifies a better potential solution. In this research it uses an already proven arrangement of mathematical tools; it continues the deductions. If this fails, it creates its own palette using a new axiom or a novel arrangement of known axioms. Are these innovative objects going to prove useful? Can they surimpose themselves on the existing organization? The new theory is just begging to be tested.

Issue for the endless question: « Is a mathematical object invented or discovered? ». Did it pre-exist the thought of its discoverer or not? Let us answer that it is discovered when it arises from the exploration of a known level of mathematics, and that it is invented when it arises from the construction of an additional level, which is not a simple reorganization of a known level. For example the *concept of prime number* is an invention, the *theorems about prime numbers* are discoveries. The invented mathematical object has a virtual presence at the beginning. That it turns out to correspond to reality, after experimentation, implies that reality invented it before its discoverer. But we are proud enough to come second in this way. In our eyes and those of our fellows, reality seems to bend to our mind. Those whose creations do not escape the virtual sometimes gain a pretty celebrity of artist, but not of scientist.

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Mathematics as a language

Let us return to the hushed controversy over whether mathematics is the very structure of reality or a language describing it. To assert that it is a language is not reductive considering that *the discourer is the real in person*. It is mimed by the human mind which makes it its Real pole. No gap between 'virtual' and 'real' mathematics. The mind's projections of non-existent mathematics could become projections of reality in person.

What is the difference between reality and its language? What is science if not a group of languages organizing the different domains of knowledge, *in accordance* with reality? These languages, like what they describe, are

layered. Assemblies of elementary codes into more elaborate concepts. From bottom to top: fundamental principles (discontinuity, causality, order), logic, sets, math, concepts specific to each discipline. Each floor is built on the basis of the previous one. The physical sciences are built on their specific mathematics.

When it seems possible to do science without going through mathematics, it is because the level of the language used has deviated greatly from it, hierarchically. An intermediate conceptual stack hides the level of encryption. Science, in these conditions, is based on the intrinsic logic of its disciplinary language, resulting from its empirical discoveries. It always seeks to consolidate its discourse by recreating it from mathematics. Errors or details may appear. To renounce this process of filiation is to fall into *belief*, a mode of thought suspended in the conceptual pile and finding its justification in its only internal coherence, independently of all the preceding levels.

Belief, which does not require a connection between knowledge, is a representative mode that is particularly easy to appropriate. Religions are the most popular example. Note, however, that some reductive practices of science come close. They claim to be "anchored in a fundamental level of reality" and ignore all the underlying organization, including the believer's own mind, a simple mirror of the fundamental.

From a global and historical perspective, mathematics is comparable to other languages. Vocabulary, principles, classifications, all these criteria are constantly evolving. Mathematics is a moving galaxy, not a frozen ideal structure that would be laid bare by a patient stripping. Some mathematical objects are more fundamental than others, but these are *progenitors* more than *universals*.

Like a language, the classical grammar of mathematics has been enriched with precisions, compound words and neologisms. The limits of the complex hierarchy of Galois and Riemann have been pushed back by schematization. The structural unit characteristic of classical mathematics has seen its poles ejected by the study of fluxions and deformations of mathematical quasi-objects. The semantic explosion of classical models was

followed by a reflective process. Or, to put it more simply, the map of *Mathematorium*, initially made up of boulevards, one-way streets and closed streets, was enriched with shortcuts, bridges and pedestrian crossings. The journeys are made easier.

Mathematics is a language, and what is a language if not a vector of mimicry? It is the means of transmission from one informessence to another. How could a mimicry be transmitted if there was not in the receiver something capable of changing as a consequence, of supporting the resemblance? "Modifying oneself" implies heterogeneity in the receptor. Arrangement capable of being reconfigured without the receiver losing its own characteristics, if only its spatial location. Change without losing your identity. Several levels of information are needed. Different arrangements can support a similar level of fusion. An obvious approximation at one level becomes invisible at another.

Mathematics is inherently based on such levels and kinds of approximations. They indeed have purely analytical and deductive plans, where the operations are linked seamlessly and in a manner that is perfectly consistent with the postulates used. They also have an essential transitive level: the infinites. An infinite number or an infinite series of calculations to arrive at a finite symbol is the proper way of mathematics to cross a level of information. A mathematical object which cannot be decomposed into its parts in a finite way becomes definable by an approximation towards infinity. An example is a Taylor series: $e^x = 1 + x + (1/1*2)x^2 + (1/1*2*3)x^3$… the coefficients of x are a series of real numbers; if they are not increasing too quickly and $x < 1$, the powers of x are getting smaller and smaller. As the number of terms tends to infinity, the right-hand side of the equality becomes more and more precise without ever touching the real e^x. e^x is both incalculable and infinitely closely defined. The sign '=' has imperceptibly changed its role. The operation is no longer deductive but approximate. To the right of the sign: an incalculable; on the left: a new mathematical object. '=' Indicates a change of level: an incalculable becomes a manipulable object.

These new objects are all the more graspable as there are acronyms to fix them. Infinite numbers are defined with absolute precision by geometry.

'Pi' is the ratio of a circle to its diameter. 'Root of 2' is the ratio of the diagonal to the sides of a square. Geometry makes the approximation of the numbers that underlie it invisible. Examples abound; Taylor series are also found in quantum field theory, and their terms line up in graphs called *Feynman diagrams*, forming perfectly defined patterns. Countless numbers are organized into fused objects such as 'Pi' or a geometric figure. This is an example of the emergence of one organization over another within the very languages that describe reality.

Another level of organization is the attribution of a truth value to first level mathematical operations. The Boolean calculus manipulates these values (1=true, 0=false) using higher level operations, conjunction disjunction implication (AND, OR, IF/THEN), equivalents of addition subtraction and multiplication of the level 'numbers'. First example of the possibility of treating mathematics as a language by itself, therefore of stratifying this language. Another remarkable example is the Bayesian calculus, which puts the control of probabilities by other probabilities. Bayes' theorem is typically a bidirectional organization where one uncertain value is associated with other uncertain parameters, and these parameters in turn refine the uncertain value. Bayes's formula adds, above a probability, a level of *expectation*[33].

The stratification of the formulas reveals *metamathematic objects*. For example the *point*, and the *instant*. Considering them in a single level makes them logically inconceivable: is not the 'point' simultaneously presence and absence of space, since it defines it and at the same time does not constitute any part of it? Likewise, the 'instant' is the basis of time but does not represent the least measurable part of it. Contradictions at the very basis of the language of logic? This concern, that bristled Berkeley a lot in *The Analyst*, disappears if we return to the 'point' and the 'instant' their metamathematic quality: they represent the smallest definable quantity within each considered system, which absolves them of being quantifiable in themselves. The postulate of infinitely divisible length and time works

[33] Is it a coincidence that the mathematical stratification corresponds to qualitative strata in language? It is here that we can guess a Bayesian functioning within the intimacy of mental processes.

magically: discontinuity merges into infinite resolution with continuity. Magic such that one wonders if it does not touch the very essence of reality.

Thus 'point' and 'instant' exist materially only in one level of observation, for example in this conversation between two passers-by:
— Sir, can you tell me at what 'point' of the map we are?
— One 'moment', please, the other said, leaning over the map.
While any attempt at ultimate quantification is meaningless. Berkeley's alternative equations, born from his refusal of infinities, are wrong and have failed to found better formulas. Quantization does not apply to a transcendental object.

Bentham's notions of *meaning* and *import* come under the same logic of stratification. They separate the immediate significance of mathematical discourse from its genesis. The genesis can include non-mathematical elements, which allows this seemingly rigid language a great practical flexibility in reality. It is always possible to assemble new mathematics. They are only deduced from each other within a level, an artificial isolate of reality.

Ability to analyze mathematics with others, limitations of early levels such as Boolean calculus, all of this encouraged further staging through the creation of formalized logical systems. Theory of proof, sets, models, computability, types… The aim of this book is not to detail them. Observe that within the mathematical corpus they are paradigms retro-controlling a previous operational level, like the organization of reality itself. What interests us here is to determine the principles common to the staged structuring of mathematical language.

Let us start from numbers, mathematical objects of lower level in this structure. The choice of operations decides their organization. If the rules are consistent with each other, the whole must be. Arithmetic, for example, is a homogeneous system, apparently leaving no number behind. Although… by dividing 1 by 3 (two integers) we have a number, 0.333… which not only is not an integer but cannot be represented by a finite series of integers. Does this number exist or not? Let's not try to get into the nominalist/idealist quarrel. The real/virtual continuity inherent in

Diversium dissolved it. Symbolic language is part of reality just like being, from which it is inseparable. The number 0.333… does exist, at a level higher than the integers it organizes with the 'division' operation. It is symbolized by '1/3'.

Mathematical objects can be linked by different rule systems. Let's say 'organizational solutions'. What is behind them and why do some work better than others? Why were the Berkeley equations wrong when their logic was perfect? What founds them is one or more postulates. Mathematicians say 'axioms', the difference being that an axiom is an unprovable claim, while a postulate can be demonstrated later. Imperceptible difference in our system of thought because an axiom can also be if not demonstrated, at least reinforced by its effectiveness to organize the mathematical objects. Axioms as much as postulates have a coherence which depends on their environment, rigorous in some associations, fragile in others. The success comes from their rigor in their own mathematical level, intimately linked in general to the respect of the underlying levels.

It is through this stratification that we can conceive of mathematics as a language that is both rigorous and approximate. Rigor in the level at which their postulates operate, approximation of the underlying levels. A way of reconciling two apparently irreconcilable points of view: the dogmatism of laws, fixed and universal norms such as Condorcet wanted, and the relativism of Bachelard, affirming that a scientist « describes her method of measurement rather than the measured object ». In *Surimposium* way of thinking, 'essence' or 'substance' is for the object the fusion of its underlying levels of organization. 'Representation' or 'measure' is the appearance of the object as seen by the overlying levels. The measure is strict because it reflects the fixity of the object's essence under the downward look. But it is approximate in relation to the range of alternatives that the upward look lends to the object, linked to its complexity, *experienced* only at its level.

We experience diversity, we represent fixity.

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Correlate mathematics with reality

An algorithm takes bits of reality to weave another.

The measure

Ontological clamp: We grasp what the real presents through *measurement*. How precise is this gesture? To specify is to divide the quantity to be measured into smaller and smaller units. By reducing them thus to infinitesimal values, we lose sight of the fact that the units are identical only by convention. When a unit of length, for example, is so tiny that you have to line up powers of ten to see it, that it is not exactly the same as its neighbor, it doesn't matter much. Let these units therefore manage among themselves to obtain a suitable average! No impact on equations based on the behavior of giant cohorts of these units and not one in particular.

The example of time is even more eloquent. If we break it down into small enough fractions, it becomes the same for all objects measuring it… as long as they move at the same speed. It is then easy to forget that each unit of time is attached to its equivalent of organized matter, that is to say an assembly of elements evolving at the same speed. The time of an electron orbiting at a speed close to light is not the same as that of particles in the atomic nucleus. On the other hand, the time of two atoms within the same molecule is counted identically. The measure is tied to a specific level of organization. Improving the accuracy of a measurement is *measuring something else*.

The model

Epistemological clamp now: how do we choose the equations that are supposed to be in line with reality? Reproducing the evolution of the complex is done with very dynamic languages such as differential equations. The intrinsic variables change over the course of the calculation. Only the unfolding of this allows the result to be achieved. No shortcuts to making a prediction. But the model remains deterministic. Restarting the calculation with the same initial conditions leads to the same result. Unfortunately, reality refuses to match such a simple model. New interactions potentially occur at any time. Additional variables appear. 'Initial' conditions reset at any time. Chaos not reduced to that of elements brought together in an arbitrary 'beginning'.

In reality the beginning is never fully known. It approximates the constitution initiating the destiny of the system. Reality is a maelstrom of new interactions happening all the time. What structures this chaos is the separation of the real into levels of organization. Among the immeasurable number of interactions concerning each element of reality (gravitation and electromagnetism have an infinite range), almost all have a tiny energy compared to the small number of the most powerful. This allows a reduction to those when designing a *representation*. So representative language, our models, are always approximations. Language cannot claim to merge with the *calculessence*, which is represented.

Dimensions are cardinal in delimiting a system and its level of organization. The distance between elements strengthens or weakens interactions. The duration of this proximity allows changes. Distance and duration give energy to the interaction. Great energy provided by proximity, low for distance. All interactions take place. But their energetic relation makes some not significant. What does 'non-significant' mean for the real? Does reality make an ontological approximation when a new level of organization is formed? Does it keep track of all of the underlying interactions, or just the most important, in this new level? We replied that the approximation is ontological, which may continue to be debated.

But consider for the rest of our discussion that descriptive language does not keep any trace of negligible interactions. The model forgets them. An algorithm correctly adapted to a system is built on initial conditions infinitely reduced compared to their totality. Our description of reality is an increasing approximation as its complexity increases. The gap with the informessence of the real is only increasing. So much so that trying to experience in one's own consciousness what a fellow human being experiences is a pitiful simulation. Our mental structures are, however, very close and united in the common denomination of being 'human'.

So it seems that even if the real makes approximations, ours are much more approximate, hence this growing gap. Why this discrepancy? Two hypotheses are not mutually exclusive:

1) Our model approximates the initial conditions too much. The real takes into account hidden variables. This evident in the humanities, at high levels of complexity, must be kept in mind for the physical sciences, where models can fall just for the wrong reasons.

2) The model exerts a retrograde causality on the system, modifying the validity of the initial conditions. The model is itself an organized edifice, if only by the measuring instruments on which it rests. It is difficult to account for the small backward causalities linked to imperfect simulations of reality in these artificially constructed levels. The independence between model and system is no longer relative but strong. The two are no longer correlated.

Emergentism is an effective way of thinking when it focuses on crossing a level. It is the stacking of hidden levels that weakens its determinism and causes it to lose its explanatory power.

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What is a mathematical proof?

Simple calculation? Modeling of a process? Organization of information according to criteria defined initially? A demonstration is a fragment of representation of reality limited by these conditions. Coming, like any representation, from the virtual, from the continuum of possibilities. Do they all exist there? Are all representations possible? Obviously, no, since a demonstration usually leads to a single result, eliminating all alternatives. However, it is only a fragment, coexisting in virtuality with others born from different initial conditions. Virtuality is a network of paths, all endowed with potential existence, but which can only be taken by a specific entry.

When we watch the logician give herself up to a demonstration, we can assume two things: 1) She models, by her representation, an essence of reality fixed by laws. Photograph of the real immobilized within the virtual. 2) She tries to reproduce, by juxtaposing fragments of representation, the same dynamic process that reality uses to construct itself. It is calculated 'in real time'. The calculation reveals additional order levels, or removes them. When there is not already a solution to complete the calculation, the calculation continues, exploring other sequences. New parameters arise,

constantly enriching and disturbing the differential equations. When a proof is successful, it is because the logician is concentrating on a section of the calculation that it is planned, in the sense of "flat at the organization level". Well defined system.

We thus differentiate the so-called formal logic, applicable to a classical demonstration, from the informal logic, which concerns more complex organizations. In the first case, the calculation is successful. The demonstration is closed. In the second case, the calculation continues. Its 'result', the organization it determines, is only provisional. Formal logic is a tool accessible to our mind. While the informal is closer to the essence of reality, does it constitute?

Formal logic makes it possible to 'understand' the described processes, to take control of them through a fused representation. Concept acting. 'To understand', 'to act' is to build additional intentions into the process so that it becomes subservient. It works at this level of organization, but the integration is forced, it does not come from the structure of the process. Understanding and process will diverge if the organization of it continues.

Informal logic allows us (almost) to *experience* the process, to transpose its essence into our conceptual edifice. 'To experience' is to keep the intention of the process itself pure. Less immediate profit for our human wishes. But the projections for the future evolution of the process are better. We can start predicting beyond the short segment analyzed by formal logic.

So we have to get out of the summary but still popular shortcut 'demonstration = deduction', where no new information would appear. The final information would already be fully contained in the premises. This is only true with an eye that is itself reductive, focused on the brief sequence of the demonstration, impervious to the ontology of the concepts involved, and the temporal dimension of their association. No results are instantaneous. Immediacy does not exist. Either *time is* and is not compressible to nothing, or *time is not* and immediacy becomes meaningless. In a demonstration we choose to involve the concepts in a certain order, at a precise moment. The construction is logical because its architecture brings this logic. It is in this architecture that an entire

ontological pyramid is hidden, which could take different paths. The 'deduction' is the property of a mind made in this image. Our concept stack is a reality engraving stamp. Reality is offered more or less freely for engraving. It is in the way we judge its response that our proprietary concepts are practiced.

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Mathematical complexity and reality

Additivity and subtractivity are readily considered the most elementary (and hence the most fundamental) operations in mathematics. It is hardly possible to imagine an interaction without adding or subtracting something, so these operations are almost intrinsic to the notion of interaction. How are they specifically different from other mathematical operations? Is it the fact that our mind manipulates them spontaneously, before having studied them? While other equations take a long learning to become familiar?

It would be a very anthropic definition of the fundamental in mathematics. Definition arbitrarily normalizing, because the speeds at which our minds appropriate the equations are very different. The definition of what is 'elementary' is not based a priori on the 'natural' of reality, but on an eminently political attitude: analytical skills are prioritized according to their ease of learning in humans.

The mind is a conceptual stack, the structure and efficiency of which are derived from the environment. From the history of this environment through genetic coding. And of the daily context for the form of each particular mind. The postulate defining 'elementary' operations fishes them in an environment containing an unknown quantity of alternative possibilities, a reflection of all that could be an analytical 'intelligence' resulting from the self-organization of reality. This unknown quantity is at least gigantic already by the fact that each human mind is a conceptual stack different from the others and that the 'real', the 'simple', are a convention between these minds, a sharing of power rather than a physical reality.

We have previously separated 'complex' and 'complicated'. With this grid, additivity is not simple but *easy*, easily accessible to our mind. It is not a

low complexity index. It is no more fundamental, original, than any other mathematical operation.

The simple differs from the complex for two reasons. We have seen the first one which is the path of possibilities. An interaction remains simple when it encounters few bifurcations, becomes complex as the bifurcations multiply. The second difference is that some operations complete, others do not. The addition of the masses of two molecules is quickly carried out; its result does not change. The location of a molecule in a gas can be theoretically calculated, but operations never reach a final result, due to thermal agitation. Gas is complex chaos.

Real operations never complete. They only find a final result in the sequencing established by our mind. We close our representations. To make them usable, we need to *put an end to them*. Do you savor the double meaning of this statement? We must apply an end of work, produce a declaration of conformity, in order to integrate this representation among the others and make comparisons. And we associate this representation with an 'end', an element of the code connecting the representations. Our whole decision-making process is based on this. Our minds quantify sequences of operations that actually have no beginning or end. The universe is a perpetual dynamic. The 'results' of the interactions that constitute it have only a provisional value, fixed only within a limited time scale, and it is the relative brevity of the scale used by the human mind that makes it appear so many permanent objects, stable results, solidity of reality.

Reality does not know the simple and the complex. It aggregates units into sets, each creating its own organization, we could say its own simplicity. The multiplication of organizational levels creates *diversity*. The 'complexity' term only has meaning if we look at the level of organization produced with a paradigm which is foreign to it, with equations which are not exactly those which reflect its essence. Therefore we operate a 'simplification' by using approximate operations to describe it, which lead to a 'final' result as the real interactions continue. We're making a movie of a lifetime, with end credits. But this life started before the movie, in the

gametes and the hopes of the parents, and ends after, in molecular recycling and the memories of loved ones.

The physical 'properties' are the reflection of the operations carried out by the real. Like these operations, they are 'simple' only at the level considered. Mass is a simple property in organizational levels where it is a major paradigm. It is governed by additive operations, which seem simple to us because our conceptual apparatus is designed for it. Our representations are encrusted with the paradigm of the mass, and its favorite operation: additivity. We are innate calculators of weight, inertia, all effects related to mass, which allows us to balance our posture, to assess our power in relation to more or less massive than us, to pick a fruit , to flee from an elephant. We add and subtract intuitively at all levels of the unconscious, before any order sent to the motor neurons.

Whereas the mass becomes property without interest at other levels. It is no longer a socially appropriate representation: 'important' people are not the heaviest, but the most charming. It is 'simple' to understand, with mass effects, why a human dies when crushed by an elephant; it is more 'complex' to know why it dies of the invasion of a microbe, whose mass is tiny. The property 'mass' is not the main one in human-microbe interactions. Additivity operations are unnecessary. It was necessary to create the paradigms of the 'biology' level to understand the infection, to reduce it to the rank of 'simple', to create operations to get rid of it. From a human health perspective, biological paradigms are more 'fundamental' than quantum equations. These last reach an extraordinarily precise representativeness. They do not suppress infections. They improve the chain of our representations, extend our conceptual edifice. We apprehend a greater height of the self-organization of the real.

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Nested continuums

Here we are at the edge of our conclusion on the relationship of mathematics to reality. Is this *the* reality it describes or *our* reality?

It is useful to summon a general theory of knowledge. On this subject, Popper defines three distinct worlds: physical, mental, intelligible. They are respectively inhabited by physical states, mental states, and objective ideas.

You find them in *Surimposium* (reality per se, Spirit pole, Real pole) with an important difference: they are nested continuums and not distinct worlds. The Popperian conception is heir to the dualism which must be got rid of for a unified theory of reality. *Surimposium* presents three worlds nested like Russian dolls: the real (*Diversium*) containing the mind (*Stratium*) containing the possible(hum!).

What is the originality of this interweaving? Generally the possible is considered to be the largest set, *containing the real*. Here it is the opposite. This is the smallest world, *contained in the mind*, in the form of alternatives to representations of reality.

The idea of the possible as a reduced rather than infinite world is supported by the antiquity of our mental programming by the environment. We cannot go outside of reality to observe it. Our analytical tool, the mind, is buried there. We would have to converse with non-human, perhaps non-neural, brains to truly expand the world of the possible. Idea found at L.A. White[34] which replaces the 3rd world, the intelligible, with that of the mind of the species. White has done a lot of work on his anthropological references. This idea is also widespread among philosophers who point out the differences in conceptual mental libraries according to cultures, in particular the East-West contrasts. Humility is required when it comes to our access to the world of the possible. Let's not reduce it to idealized mathematical concepts or objects. This is all way too… human.

Regarding White's work, note that there is no birthplace to trace the genealogy of the spirit. We could place it arbitrarily at the appearance of the first brain, but it did not fall from the sky. Assemblies of neurons are not the only entities capable of representation. Plants and microorganisms do this without having any. Excellent indication of the merits of seeking the ability to represent within the organizational process.

The species consciousness proposed by White applies to mathematics. It creates an intermediate position between structuralism and calculationism:

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[34] The locus of mathematical reality: An anthropological footnote, L.A. White, 1947

say mathematics independent of the individual mind but dependent on the mind of the species. All human brains would understand mathematics because it is structured by the same languages and coordinated by cultural memes. This position, however, does not take into account the suggestions of the real per se, nor the codes used by more crude forms of consciousness, animal or vegetable.

In Surimposium, the controversy is really extinguished by changing the paradigm of observation: by descending towards the foundations of the real one discovers an essence of the mathematical objects approaching the platonic ideal (but still property of the real), while by ascending, a growing practice of individuation is discovered, proportional to the isolation of the mind that uses it. The collection of these individual mathematics is assembled and coordinated in *Societarium*. Several levels: family, school environment, professional, learned societies, research teams, general culture, religious impregnations. Different interactions for different layers of the mental pyramid, structuring a mathematical edifice specific to each brain.

By observing *Diversium*, everyone finds what they are looking for: the pure mathematical object (towards the supposed origin of reality or in the possible that one constructs about it), "home" mathematics (in the mind creative which creates them independently, with possibly iconoclastic / non-reproducible results), *socialized* mathematics (in researchers coordinating their systems of thought). These aspects come together in every individual. Pure objects exist independently of them in the real per se, but they cannot grasp them, only represent them. Their socialized knowledge of mathematics varies in extent, depending on their educational background. Finally, their imagination creates personal concepts that are sometimes wacky and sometimes brilliant according to their consistency with the rest of the mathematical structure.

The impressive efficiency of mathematics is finally explained. The mental processes that build it are formed by deciphering reality per se. The existence of pure mathematical objects comes from the ability of any language to build its own structure, regardless of the initial regularities that created it. These virtual objects are creations of the mind, nevertheless ideal

objects in the Platonic sense also exist, outside of human intelligence, since it is reality that historically proposed the first objects to the process of representation.

In the end, mathematics is neither exclusively of human essence nor of pure idealistic origin. It is a collection of self-organized concepts linking the suggestions of reality to mental structure. Like any other language. Because on this point the controversy is easy to settle: mathematics is indeed a language. If the ideal objects exist, we cannot directly manipulate them. This is only possible through their representations.

The congruence between the words of mathematics that are the equations is very beautiful. In the past we were able to dazzle ourselves with the same consistency within other languages. The poet offered it to us. Why are there only the roses left to listen to her?

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If reality is mathematical, how come we don't naturally think in this language?

The language of mathematics is unambiguous. A priori. It is in fact complex and diverse enough in its modes of proof that theorems are accepted by some mathematicians and rejected by others. However, mathematics is much more subservient to minds than other languages. What are the advantages and disadvantages of this strict formalism? Its most obvious effectiveness concerns material processes. The material, in its many aspects, rests on remarkably similar foundations, enough to respect with impressive precision the mathematical formalism applied to them. To the point of tempting some to make it the very essence of things. Formalism conquering the lower levels of *Diversium*… Is it also advantageous for the higher levels, those of human relations? Why don't we think in mathematical language? Life knows this language. It uses it at multiple levels of biology. Even the neural networks themselves, which process data in a Bayesian way. Why has mental self-organization not chosen this language to communicate between congeners? Wouldn't we have gained flawless coordination, like robots capable of instantly and faithfully understanding the analyzes of their fellow human beings, and thus forming a remarkably efficient troop?

Nature has well experimented with this solution in populations of gregarious insects. Very productive social organization. Yet surpassed by that of individuals who understand each other less faithfully: us. The reason seems to be found in the complexity of the conceptual field, resulting in a weak mental diversity in the insect, strong in humans. What is the advantage of diversification? Above all, explore the errors, to identify the most effective behavior. Insects behaving stereotypically, error eliminates them en masse and the hive disappears. The genetic peculiarities of the queen are eliminated. On the contrary, the success of the hive spreads them. Evolutionary changes quickly disperse over large insect populations but are very low in complexity. The evolutionarily modified individual is the hive and not the insect. Insects remarkably integrate their information, using visual and olfactory codes. However, this integration remains much lower than that of the neural field of a human brain. It uses a much smaller number of complexity levels. Insects cannot dissociate their actions sufficiently to reorganize them into more numerous patterns and adapted to the wide range of contexts. The strict formalism of their language, advantageous for reliable communication, becomes a handicap in creating a variety of solutions. It is less suited to the complexity of the environment than a highly hierarchical human language.

Would mathematics, in this case, also be a handicap in humans if it were our everyday language? Of course, they are not lacking in vocabulary; mathematical formalisms are numerous. Stratification exists. Theorems are able to verify others. Various postulates create disparate branches. There are even some branches that have no practical application. Virtual language awaiting its correspondence in the real world. True mathematical imagination. How can we accuse it, then, of limiting reality?

All of this is true, and yet mathematics cannot replace spoken language. Their hierarchy is not of the same order. In mathematics, one algorithm can verify another because it has logical connections with it. They share the same postulates. Same level of organization. An algorithm is able to give a ‘formal proof’. Because it is a deductive activity, based on strict rules. It is more difficult to verify a ‘rigorous argument’, less formal but frequently used by authors. But when a real emergence in mathematics occurs, that is to say a new formalism is imposed on another aspect of an always unique

reality, the demonstration is no longer suitable. How do you demonstrate something unexpected? Where is the metamathematics to explain why some theoretical branches are compatible within a single reality and others not? It would claim the title of the language of self-organization. Grail of systemicists. In its absence, mathematics does not codify emergences. They stop there. They *break down* the structure of the complex subject, but are puzzled as to how to *merge* it.

In other words, the strength of mathematics is also its weakness. It is too rigorous to leave room for vagueness. But knowledge works on a mask of the real and not the inaccessible in itself. Isn't the blur an essential tool?

Spoken language does not bother with such severe rigor. It doubts unexpected crossings as 'natural', because they are chosen by the real. Its hierarchy is empirical. It doesn't matter that the descriptive levels have no logical relationship. Their rationality is pragmatic, responding to the proposals of the real. But above all, spoken language, like consciousness, fuses its structure. One word surimposes the levels of information. It integrates the different aspects of its subject in an object accessible to the level where it is treated.

The difference is profound. It shows the specific interest of each language, codification of individual levels for mathematics, fusion for spoken language. It also explains how we perceive them. Suppose, for example, that I write the following equation for my consciousness: Consciousness at time t = Sum (from 1 to n persona) times Celebrity (from 1 to n) in Context of time t. It's a nice formula, maybe in the computable future about my neural networks. On that day, however, I will find it a poor representation of my consciousness. It does not grant it any particular *quality*. It can refer to the computation of an artificial intelligence, or the movement of a particle bath. The pronoun 'I' seems to me much more qualitative, *substantial for an ego*. Because it integrates a lot of data on my own account and which I experience without calculation.

No matter how this data is structured to form our personality, it exists and is perfectly symbolized by a simple 'I'. So simple and meaningful that we don't mind others using it for themselves as well. The 'I' container is so

large that it can include billions of different meanings. Each of these meanings integrates information that is incompatible with each other, because they are located at independent levels of reality (gene, cell, temperament, behavior, etc). Whereas a mathematical container such as [Sum] can also include billions of pieces of information, but these must be compatible.

The objectives of the two languages diverge radically. Mathematics does not seek to form an identity/cultural representation, but a rigorously coherent language. The goal is not to make mistakes, but *to eliminate them*. Spoken language is not intentionally used to make mistakes, nevertheless its formalism clearly stems from the need to *protect possible mistakes*, which are identity-related. It is *ambiguous* from person to person. The result of two contradictory pressures: to promote individualism, which allows the species to explore all the alternatives of thought, and to promote collectivism, the pooling of the most effective concepts. Spoken language *must be* ambiguous. *This ambiguity is a major stimulus in everyday conflicts*. I am citing here the conflict in its constructive role. Self-organization drives conflict. It is through it that we form more inclusive concepts, more organizing because they are more shared. Stacking of language structures. No concept is ever universal to the point where it no longer finds a contradictory one. Our collective conceptual edifice is rising.

If one day the top of this pile becomes mathematisable, doesn't that imply a society made up of beings capable of logically reaching agreement in all circumstances? Wouldn't this society then look like an anthill, also remarkably managed, which has reached the end of its evolution as an organized entity?

This day is unlikely. Classical mathematics, unsuited to the inherent blurring of human thought, cannot become its exclusive language. The richness of thought comes from its condensation around a myriad of benchmarks isolated in their specific qualities. The spoken language is a better reflection of it but remains a translation. The danger would be to simplify it mathematically when, on the contrary, it must become more complex. Those who excessively use any artificial language, in programming or in science, easily perceive the colonization of this

formalism on their other thoughts. The imagination narrows around what it allows. On the contrary, learning new languages greatly expands the diversity of thought. On this subject, we should regret the reduction in school hours spent enriching the mother tongue, as well as the omnipresence of social networks where a hundred words is enough to communicate.

Is reality mathematical? We frequently cross this hypothesis in this book. Mathematics remarkably codifies information, but we have just seen that codified information, in isolation, does not add substance to reality. The same information sometimes applies to substantially very different realities (multiple realization). Locking in a mathematical logic prevents surimposing together levels that do not fall under the same formalism. It would however be necessary to create a real *mathematical substance*. This tour de force is carried out without difficulty by spoken language, whose only logic is the empirical representation of reality. Spoken language is representative, but *representative of the substance* of reality. Mathematics represents information in its independent levels but not in its substantial integration. Thus, we cannot assimilate reality to information until the source principle of this integration is identified.

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Metamathematics

Metamathematic deficiency appears from the foundation of language. Why the addition and multiplication properties intertwine as they do remains a mystery. Example: A definition of the complexity of an integer proposed by Malher and Popken is the minimum number of 1(s) needed to write it using addition and multiplication. Difficult calculation for large integers, without an algorithm to simplify it. Another witness to this irreducible dissociation between addition and multiplication is the Goldbach conjecture (cf).

Dissociation does not mean inconsistency. On the contrary, it is possible to reconstruct almost all of mathematics from addition, including other basic operations (multiplication, subtraction, division, exponent, root), derivatives and integrals, trigonometric functions. Topology is also attached to it: derivation and integration are equivalent on the separations and mergers of topological objects. Addition is also the fundamental

operation of agent-oriented programming. However, we are going through the metamathematic structure here without understanding its principle. If we had the principle, we could explain why this branch produces such and such a result rather than another. We could extend the mathematical edifice in the same simple way that we find new solutions to a known equation.

But maybe we are actually trapped in horizontal thinking? Perhaps it is possible to make metamathematics appear simply by changing our way of seeing? Wonder if vertical thinking isn't already in the equations?

Consider a simple equation: 2 + 3 = 5. An equality. Is it completely? If so, what would be the point of setting such an equation, since the 2 sides would have exactly the same meaning? In reality there is a hidden stack in this equality. 2 and 3 together form a set called '5'. Horizontal thinking flattens the equation and prevents us from perceiving the superposition of the two meanings: 2 and 3 at the bottom, 5 at the top. However, each meaning has its own role in the sequence of the equations: the 5 is a unique element that can participate in other sets, while its structure is the set of 2 and 3, or alternatively of 1 and 4… The 5 is a 'representation' common to several sets.

In vertical thinking we should write the equation as follows:

$$\begin{array}{c} 2+3 \\ = \\ 5 \end{array}$$

At first glance, verticalizing mathematics in this way does not seem very productive. Again, it has to do with the way we look at it. Is it not a candidate for some thinkers to be the very essence of reality? It is certainly not in the form that the mind practices it. Mathematics is a descriptive language, and not the *informessence* of reality. We confuse the two because horizontal thinking perceives only the properties of the mathematical object, but not the surimposition of its layers of information. Different ontogeneses can produce a mathematical object of the same appearance. What importance for the mind of which it is only a tool? Mathematics-language can be applied to systems that are very different in their constitution. Its purpose is to model a level of reality defining the system, not to identify the essence of the complex entity of which the system is a

part. *Decryption and not encryption*. The decryption puts us in front of all the pieces of the real thing, but has dissolved its wholeness. Its *essential* information has disintegrated into the multitude of scattered fragments.

By abandoning (illusory?) considerations of the essence of things to religion, science has convinced itself that this knowledge could be replaced by the means of manipulating it. The scientist's efforts go in this direction. Mathematics is practiced as a tool. Language fills the mind. But is it sufficient to have removed the notion of substance to say that it has disappeared?

Perhaps there is at the heart of mathematics a meta-principle, a true skeleton of the essence of the world. But who among researchers conceives of mathematics as an entity endowed with qualitative organs? In this view, a different quality should be attributed to similar equations describing different systems. For example, the mathematical model of a human brain would not be of the same order as that of a silicon chip. Is it possible ? Not currently. Classically, an equation is only valid by its symbols and their relations, not what is symbolized. 2 and 3 equal 5, what could we add? Perhaps, precisely, an additional layer of substance to reality. Closer to our direct experience than a simple collection of algorithms?

It is impossible to talk about metamathematical foundations without quoting 'Laws of form', where Spencer-Brown develops a particularly original calculus, let's call it *LoF calculus*. This is not classic logic. This mathematics is purely geometric, without numerical measurement[35]. Spencer-Brown elevates it to the most primitive dimension of notation: two-dimensional space. Is this really a more basic foundation of mathematics, in the pyramidal description of this language?

Spencer-Brown's critics accused him of circular reasoning. Unfounded criticism, when its theory is precisely a reaction to the defects of this type of reasoning. The numbers define themselves. Spencer-Brown uses vertical

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[35] A controversy assimilates the work of Spencer-Brown to a simple reformulation of the Boolean calculus. Criticism based on the lack of specific applications of the LoF calculus, but which neglects the metamathematic work that presided over its design. Spencer-Brown showed the connection between binarism and geometry.

thinking to break out of the bottleneck. He gives up using numbers to directly enter shapes.

Is a single dimension enough to define the space? A single dimension can be named in all possible ways. It is simply the individuation of something from the rest, by some criterion, location or whatever. This makes it possible to locate several things in the same location. A single dimension is a simple enumeration, a series of individuations. For example a series of points on a line, a set of excitation states of a field. The operations applying to such suites are restricted because few organizational solutions are offered by the single dimension. The differences are based on this one property.

The diversity of solutions increases exponentially with the number of properties. A second spatial dimension truly creates the specific notion of space. It is the fact that *the dimensions cooperate* that 'kicks off' the space. A new descriptive universe called 'geometry' appears. The number of theorems governing this new universe is exploding. Mathematical Big Bang.

Does this birth take place before the birth of numbers? By directly manipulating shapes, Spencer-Brown manages to dispense with digital measurements. However, are not numbers always involved in the constitution of parts? 'One' is separate from 'Everything'. 'Everything' can be broken down into 'two' or 'three'. As for 'Nothing', it is still equivalent to 'zero', itself a UFO within number theory. Would geometric rules manipulate numbers without showing them?

Our problem is this: on the one hand, numbers are already present in a single dimension, this dimension being defined by individuations or discontinuities of a particular type. On the other hand, the interaction of two universally associated dimensions makes it possible to directly manipulate forms, the language specific to this interaction, without resorting to numbers.

The origin of the dilemma is clearer: the first statement postulates the discontinuity of any dimension even before it enters into relation with any

other. The second assertion postulates the continuity of two-dimensional space before it can be broken up and subjected to numbers. Two great theories loom in the shadows and they seem irreconcilable. Fundamental *continuity* versus fundamental *discontinuity*. How to decide?

The discontinuity and its offspring the quanta have upset our view of reality. However, a quanta, ultimately, harbors a continuity: its own. Quantum theory does not say that reality is infinitely divisible. It says that the divisibility is such that the sequence of discontinuities becomes indistinguishable from a continuity. It is not just a mathematical postulate but the behavior of the real. The essence of a plane of matter achieves this approximation. There is no real contradiction between continuity and discontinuity. The entangled wave and corpuscular aspects of matter bear witness to this, which we will discuss again elsewhere.

Our dilemma over spatial dimensions extends to any property. It can be reformulated as follows: should we consider the element endowed with its properties (including its spatio-temporal coordinates) as indivisible before applying any manipulation by numbers to it? Or are the properties already a description, a language with its numerical equivalent, constituting the element? The hypothesis that the association of spatial dimensions takes place in the tiny space of continuity that a quanta represents, even before the quanta add up, corroborates the first possibility. The elementary individual would already be endowed with its dimensional properties before any interaction with another. The reality would be a granular background.

On the contrary, the hypothesis that a quanta is pure information, creating spatial dimensions through its association with other quanta, makes numbers the basis of reality and spatial geometry is their production. Unfortunately the concept of 'pure information' remains very mysterious. How does one piece of information separate from another with nothing outside of it in which to separate? 'Elements' and 'backgrounds' tell a chicken and egg story, the impossible outcome of which we will examine later.

Whatever the nature of the quanta, it is difficult to stack all the properties of the constituents of reality in this elemental grain. The properties are emerging. They build each other. Is there one claiming to give birth to all the others? No. Not even the spatial dimension. A quanton is a superposition of states in the same location. So the original characteristic of individuation is not a known property. It can only be theorized, reduced to its simplest formulation: 'I am' (the individuation), 'I am not' (the nothing / the whole).

Two labels resist dismemberment: 1 and 0. 'I am a part' and 'I am not a part'. Three is only 1 + 1 + 1, more of 'I am a part' decreasing the strength of 'I am not a part'. Here we find the T<>D setting in numbers: multiplying by zero sets all other numbers to zero (they become the same), multiplying by one leaves them unchanged, multiplying by more changes them in an individual way. Adjustment between perfect collectivization and perfect individuation.

All numbers can be written with binary language and Boolean calculus. Root of how a computer works. The mathematical organization pyramid becomes more precise, by placing 0/1 binarism at the root, the Boolean identity operations, then their application to various properties, including the spatial dimensions defining the geometry. The LoF calculus is applied early to this characterization, without the numbers being necessary. However, the logic of real numbers applies to all individualizing properties, including spatial location. LoF calculus then appears as an alternative to numbers in terms of geometry, and not a more foundational language of mathematics. LoF calculus and numerical calculus are both derived from binarism.

Understanding why one or the other is in our favor requires looking into our thought processes. Let's not forget the ubiquitous bidirectionality between *Stratium* and *Matterium*. It is impossible to model reality without observing the mind in the process of modeling. Mathematics is a language, translation of the essence of the phenomenon through our conceptual pyramid. They do not experience the phenomenon. They are the mold, endowed with an experience of their own in our mind. Why does the mold

appear sometimes simple, basic, original, beautiful, sometimes complicated, devious, counter-intuitive, repulsive?

That the mold has a complex appearance arises from the distance between the essence of the thing and the concept which considers and evaluates it in our consciousness. The essence of it is simple by definition. *What is experienced* is the ideal of the simple. It doesn't need to be represented. My conscious impressions don't need to be represented to myself. I represent them *to compare them and share them with others*. On the other hand, I need to represent the conscious impressions of others. I mimic them from mine. This is how they seem easy to digest. 'Sharing what the other person is feeling' seems 'simple' to me. But when the structure of a thing makes its essence very strange, the representation I can construct about it seems complex, difficult to grasp. The thing does not communicate evaluation of my work nor correct it like my peers do. The thing is content to remain silent if my representation is wrong.

Why would geometric language seem simple and accessible to me if it is not fundamental? It happens to be at the root of the analytical work of visual neurons. The proximity of this task, in terms of staging to consciousness, makes it particularly identity, 'natural', property of conscious fusion. While the mathematical essence of a quanton is far removed from the paradigms of my consciousness. Its modeling seems difficult to me, requiring complicated equations (which are 'natural' to the quanton).

In the end, the versatility of the logic of numbers, its innumerable variations across the chosen postulates, its ubiquitous applications, seem to declare it as the level immediately above 0/1 binarism accompanied by its elementary Boolean operations. The introduction of a second dimension makes LoF calculus a direct application of binarism to the case of two associated spatial dimensions. LoF calculus is a simple alternative because both it embraces the essence of this two-dimensional universe and it is a shortcut to conscious conceptualization, especially for people who already have an excellent celebrity of geometric language, derived from our visual centers. The others use the logic of numbers, which is more universal, but

also more complicated because of the longer paradigmatic path to appropriate.

It remains to connect, at the bottom of this pyramid, the 0/1 binarism and its elementary operations with our principle T<>D. I have indicated that it is not wise to want to reduce this principle to a language, no matter what level it occupies in our minds. However it is easy to see a relation between binarism and T<>D. Zero is not the opposite of '1'. The '1' is an individuation within zero, that is readily confused with Nothing (which is not a non-existent). The '1' is only a difference from the Whole / Nothing / no differentiation. From then on, a relation is established, which I have called a conflict, because the '1' breaks the uniformity of the Whole/ Nothing. Symmetry broken by the « Ah! ». Ah!symmetry…

The seriousness of mathematics deserves to develop this embryonic metamathematics in a future book. I hope to convince that it cannot be done independently of the epistemic approach of the double look. A simple mathematical reality attractor is the root of an intention. Its existence is enough to create an asymmetry. *Intention thus exists within mathematics itself*, through the presence of attractors that the mind places there, through the very existence of the complex process of representation.

It is possible to summarize the principle of Surimposium by a mathematical acronym. Every element is made up of two parts of intricate information, all of its constituent information and, in addition, the whole formed by their relationships. The overlay brings together and adds the result without replacing the terms of the addition. The mathematical acronym for the overlay could be "=+". It replaces the single "=" in Boltzmann's formula, which relates the entropy of a gas to the number of possible states of its molecules. Entropy is more information. Compression of underlying information that does not replace it. Compression is a valid approximation, on its own, in most calculations. The changes in constitution do not significantly change the whole.

The approximation is also temporal. The approximations are very solid when the elementary time differences are high between the whole and its constituents. They are fragile when times are close, or even similar

(hierarchical neural networks). There is a formal delay between the constituents and the symbol, which characterizes the codification of the symbol[36]. This delay determines the possible scope of the approximation.

The approximation can be introduced in our acronym with "≈+", which is its final version at this point.

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Time

Time can only be founded on relationships.
To say that the organization of relations extends does not imply any movement, no time, only causality.

Classic models of the universe: The Block Universe (all events exist, *eternalism*) of physicists opposes *presentism* (only the present exists) of philosophers, with an intermediate candidate: Growing Block Universe (*non-futurism*)
Presentism is refuted by physicists because of its incompatibility with Einsteinian space-time. But it's a reductionist frame.
The Block Universe has its own faults. Far removed from our conscious experience. It is deterministic, incompatible with quantum mechanics. The causal direction does not have an explanation. Nothing either on the origin and end of the sequence. Hypothetical.

History of the space-time frame: start to 2 dimensions (displacement on surfaces only), formalization of the vertical movement by Galileo then Newton.
The temporal movement is still universal. It ceases to be when the spatio-temporal framework must integrate Maxwell's electromagnetism. The frame becomes Einsteinian, isotropic for the 4 dimensions (all are equivalent for displacements).

[36] Consequence: The biological and digital neural codes are natively incomprehensible to each other, due to different delays. However, the code of a biological matrix can be reinterpreted by a digital, or that of the digital can be slowed down for a biological.

"All the inertial frames are equivalent for the realization of any physical experiment". Einstein introduced a radical paradigm change. Time has become personal, that of my inertial framework.
It is to share the same planetary surface that brings together humans in a community of the present.

The Minskowskian space-time (4Dm) is used in special relativity, the Einsteinian (4De) in general relativity. The 4De integrates gravitation. It is no longer necessary to consider it as a force. It is already included in the frame.
Strength but also weakness of the model. Arise the question: how does the container (dimensions) differ from content (forces)? The frame appears epistemic rather than ontologic.

Give up in the 'lived time'? Suicide of the Spirit Pole and its experience before the Real Pole. Unacceptable. The outcome must remain a dialogue.
In fact the Block Universe is perhaps the ultimate survival of the desire of the Spirit Pole to install a proprietary framework to reality. It is not really ontological.

Synthesis with the complex dimension: Base the time on interactions takes it out of the frame-time to make it a *weft-time*.
The instant is defined in a level of complexity as the temporal unit separating two representations of one thing, 'even' because for the thing this unit is insecable.
The frame-time changes with the evolution of science. The weft-time is immutable since the property of interactions. It's the true ontological time.

The temporal identity of one thing is a merger of events. It includes past stability of its constitutive interactions and the prediction it continues.
Surimposium is individualized from the Growing Block-Universe theory by adding the complex dimension. Present as a border of a universe (4+1)-varieties? No, the complex dimension is apart. Only to be ontological, it bases all the others, which appear to us in the form of frames.

The presentism regains its rights, as a *complex present*.
The present appears as a superposition of levels / frames to the downward look. It is proven ontologically as fusion of the causal sequences of these levels. The merger is the time unit of the upper level.

The concept ‘Growing Block-Universe’ survives, as a layer cake of these reality levels with their causal sequences.

The causal direction is born from asymmetry, in this relational and identity present, between the reality of extended interactions towards the past but not towards the future. Explain causality involves renouncing the Block Universe, at least in complexity levels where this direction appears.
Each level of reality is its own Block Universe. Some curl. *Endless day*. This repetition forms the present moment of the level that represents it. Extent of temporal sequence that becomes the present from a higher level of complexity.

Mental relations create a very manifest time arrow because their levels of information are strongly integrated, unlike the lower micromechanisms of complexity.
The existence 'in the present' is an integrated information along the causal sequence.
It settles on the past of its existential elements and the future that integration predicts them.
The passage of the proven time comes from asymmetry, in the experience of the present, between this past realized and the future predicts.
The passage rate varies according to the degree of integration of neural levels of complexity. It decreases when networks deal with known data (the constitution uniformizes, the conscious present extends, the time slows down). It increases when the environment is restless (chaotic constitution, present narrowed, time is accelerating).

Redefinition of the individual: The isolation of a system, individual foundation, is a spatial and temporal gathering.
By temporal gathering it is necessary to hear the telescoping of the interactions in a quantum of unfolding that belongs only to the individual.

Course of time = sequence of events. Is there an *arrow of time*?
The mind must say "*I am* the arrow of time". It has become thus by the only elevation of its complexity. Increased number of criteria integrated into its merged experience of present.
The arrow of the proven time, as well as the extent of the present, thus increases from childhood to adulthood with the learning and elevation of the depth of information where the consciousness is perk.

Time exists, necessarily to build the real. An interaction, in a level of reality, calls for an incompressible time, mandatory to separate states.

Is the time tensed or tenseless? Is the sequence of states fixed or unfolds?
McTaggart wanted to demonstrate the impossibility of the passage of time. His reasoning is wrong. He wants to multiply the times in an absurd demonstration, but the tension is of another order, since we wanted to separate the time of its passage.
The tension may exist but the concept is no longer necessary. We have differently defined the passage of experienced time.

Found time

Founding time implies refounding it, because we always use a priori. Impossible to do otherwise. A virgin brain cannot redo the experiences accumulated by a culture on its own. The learnings tattoo a pre-built conceptual stack. For the young mind that climbs it, it's a series of 'why'. For the mature mind that descends it, it is a continuation of 'because'. Let's try to get rid of our preconceptions as much as possible. What are we observing?

Things in relation. Don't talk about *elements*. 'Element' is already an attempt to codify the thing. It's an atom in a language. Atomism is to be avoided. We have never encountered a non-breaking atom, except because of our blindness and our lack of resources. Behind the atoms are fields, vibrations, for some of the pure mathematical entities. Language is freed from the substance of things. Without saying whether the substance exists or not, let us content ourselves with examining what is accessible to observation: the relations. Everything is made of relationships between things and things are made of intrinsic relationships.

Things are getting organized. There are repeating orders within their apparent chaos. For things it's not chaos, one must assume. It is their identity, their experienced life. Let us thus awaken our double look from the start: the order belongs to the downward look, the relationship to the upward look. In the middle is the same thing: an organization.

The organization is expanding. It is not yet necessary to speak of causality, nor of time. These principles are instantly applied to any observation by our mind, because its own processes are intimately based on them. It wants a cause for everything. It wants a timeline for everything. Hold on to its leash!

When I say the organization is expanding, don't imagine movement. The movement immediately summons time. If the organization has a beginning and an end, as a sequence they are not on the same level of reality. No past and future. What connects them is neither a time nor a movement. We will not go further than 'relationship'. If you want to see a bit of turmoil in it you can say that the relationship is fraught with *tension*. But all of this is not really helpful at this point. They are interpretations belonging to your mind, and absolutely not related things. These things have not yet built the spatiotemporal basis that serve as the foundation for your interpretations.

When I say 'not yet' I am not introducing a time dimension. I am only talking about the complex dimension, the first which appears in relations between things. These relationships indeed build a whole which is added to the existing whole. The whole 'things in relation' is no longer just the set 'things in juxtaposition'.

Among the added whole(s) appear the organizations that serve as the foundations of our mental frameworks: space and time. Above, in the complex dimension, the levels now settle in this frame. Our mental levels are intrinsically imbued with it, first because their own processes are inscribed in this framework, then because their purpose is to mimic the underlying levels.

This ability to mimicry is what saves our mind. When a level of reality refuses all mimicry, the mind is compelled to reject the frame, including, with great difficulty, the frame of its own processes. This is the necessary step to understand time. The mind must begin by recognizing the existence of the complex dimension in order to descend it and free itself from the frames that surround it.

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The classic inquiry

There are two opposing conceptions of the space-time universe:
1) All its points and events exist jointly. Block universe or *eternalism*[37].
2) Only the present exists. On both sides, the past no longer exists and the future not yet. *Presentism*.

Presentism is no longer sustainable, say physicists. Because of Einsteinian physics, one reads frequently. Convincing? Even though everything has its own time frame of reference, nothing forces presentism to be universal. There could be an infinity of them. This type of extrapolation does not bother multiverse physicists. The real difficulty with presentism is the temporal scale.

Presentism indeed seems to impose an elementary space of time applying to the entire complex scope of the present moment. This basic unit does not exist. The moment should be free of complexity. However, depending on the level of reality considered, the unit of time varies in astronomical proportions. A thought imposes a persistence of the present of a fraction of a second, during which an eternity has taken place in the quantum world. The block universe seems better suited to the complex dimension and its temporal staggering.

But was presentism more sustainable before the Einsteinian revolution? Who can be convinced without the slightest doubt to share a universal time with other consciousnesses? They do not use the same paces of language and thought. They must experience themselves according to a personal clock other than mine, without their experience of time differing. But do I grant these consciousnesses complete independence? Not really. The universality of the present is based on a quick approximation: that other consciousnesses be twins of mine. It is my time that I make universal by applying it to others, and to the entire universe. If others do the same, we all agree on the existence of universal time, when it is in fact a multitude of personal times, very similar it is true, grouped behind this name.

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[37] The *block universe* of physicists corresponds to the *eternalism* of philosophers. *Presentism* only exists for philosophers (it is refuted by physicists). Finally the intermediate position, a *universe-block in evolution* (or in expansion or in growth) corresponds to the *non-futurism* of the philosophers (the past exists, not the future).

It is easy to ridicule the flaws of classical presentism. But let's not shy away from those in the block universe. They are numerous. It is a radically deterministic concept, whereas physics distances itself from this philosophy. Another critical question for the block universe is its origin. Without time, no progress, no training. The 'universe' sequence loses its birth. It emerges from nothingness in its entirety.

Causality also changes meaning. It becomes an arbitrary direction invented by our mind. A paradigm shift that researchers of theory of everything have not yet integrated. An original equation would lose all importance. Why would one part of the bloc have primacy over the others?

Is it possible to break away from the opposition between eternalism and presentism? Note that intuition suggests neither to us. What we experience has been formulated in a thousand ways in human libraries: the past is frozen, the present dances, and the future is not yet written.

Clearly this impression is related to the nature of our mental process. Our memories persist, the present requires constant alignment with our existing patterns, and our predictions are never certainties.

However, it is by extracting ourselves from the Spirit pole that we have scientifically clarified the current knowledge of the Real pole. They go in the same direction. They are even more categorical: the past is definitively frozen, even if our memories about it are unreliable. The present is the solving of probabilistic equations. The future being posterior to this resolution, remains a universe of possibilities.

This painting denounces that of an integral block universe. The block, if it exists, is confined to the past. At its limit, the *local present*, a process continues to build it. Relativistic frames of reference are not incompatible with this assumption. Some executives are in the future of others, but no communication is possible with one's own future. Unbeatable speed of light. Being in fact unable to access our future, we are denied the ability to confirm the universe-bloc hypothesis. It becomes suspicious. This is not a

consequence of our mental process but of the physical law that this hypothesis itself instituted.

The rival hypothesis is therefore that of a building block. Need a new name? No. For several books I have called it *Diversium*, the self-organizing universe… always in the process of self-organization. And its model is this *Surimposium*. In the scientific literature, Georges Ellis is similarly disappointed with the block universe and proposed the term *Evolving Block Universe* EBU for a model saying the same thing. He has substantiated it mathematically and responds brilliantly to criticism. It probably deserves the status of official interpretation more than the block universe. I would prefer the neighboring term '*Block Universe in Expansion*', because 'evolving' already contains the notion of time that we are trying to explain.

Surimposium differs from EBU, however, for profound reasons. It is essential that the hypothesis can integrate the complex dimension. What the block universe does not allow. Worse, it is the Einsteinian space-time itself which does not allow this integration. How can it accommodate multiple levels of information in the same spatiotemporal location?

How to explain that a quanton, that is to say a quantum field excitation, does not have a rigorously defined location at an instant t in a 4D framework that claims to encompass everything? A quanton has no universe line. How can we explain that it is also an element of an atom, a molecule, a material, an organism, a conscious and intentional entity? How is all of this information stored in one place? Is there a limit to local storage? We can see that 4D lacks one dimension, or more, to claim to be a universal framework.

How did thought get lost in this dead end? We have to go back on its journey. Isn't the problem that it assumes an ultimate backdrop to everything it observes? The Einsteinian approach seems the last manifestation of this compulsive framing. Let's explain why.

The history of the space-time frame

By frame do not mean a composition but a weaving, a standardized void, the invisible effect of the simple presence of the dimensions in which we

live. A frame is essential to our perception. Even if we do not observe anything in particular in its field, we must be able to locate any event that occurs. Our mind is intimately configured to place each piece of information in a frame. The general background is divided into several sections: body, outside the body, outside the field of perception, outside of physical reality (abstractions). The first three sections are treated in a physical 3D framework, and until recently the time dimension was treated separately. This is still the case for most of everyday life.

A frame is a construction. Two engineers participated in an inseparable way. *Reality* is the initiator of the project. But the construction fleshed out its self-awareness and, having become very complex in the human mind, began to participate in the project. Today *the mind* has taken over, often to the point of considering itself independent of reality. Double steering committee that we have formalized with the Spirit and Real poles. The real initiated the mind project, built its support, then the additional layers of information brought about the emergence of a consciousness emancipated from the real. Relative independence which split it into Spirit and Real poles. The two look at each other and converse.

The beginning of the dialogue was confused. Emancipation was still in its infancy. The nascent mind retraces this initiatory journey. An infant struggles to differentiate the outer universe from the Self. She is helped by her programmed instincts. Then it is the learning, knowledge accumulated by the human collective, which truly emancipates it. No progress in dialogue without progress in language.

The journey of emancipation is therefore above all the journey of knowledge. Evolution makes us retrace this history at birth, with a major consequence: the mind remains in connection with the instincts, with the past experiences that have shaped it. Identity consistency of the species. The mind can integrate notions foreign to instincts. Be careful that they are not too contradictory. At the risk of a real split between the Spirit and Real poles. It is a neurosis which lies in wait for the scientist: the mind reasons by disregarding its own presence. It thinks it's confused with the immutability of the frame. Exclusive and solitary Real Pole. The Spirit Pole is no longer just a ghost floating above reality.

When the dialogue continues among others between the two poles, the Real seems too tinged with the desires of the Spirit. The result is a compromise far removed from authentic reality for the scientist. It is the Real pole this time that looks like a ghost. Its weakness gives free rein to an exuberant identity that sometimes flirts with madness. We thus have the two extremes of the mind too polarized on the self or the non-self.

The Real pole therefore has a course, a history. It is a social consciousness continually torn by reality. The most torn are those who come closest to the true nature of reality and are called scientific geniuses. Their memes diffuse among others, changing the composition of the Real pole there, as long as this does not upset the identity balance too much.

Without going too far back in the course of the spatio-temporal framework, note that it started in two dimensions. Our ancestors moved over a surface, a universe they thought was entirely flat. Going up and down didn't mean moving vertically, but moving on the surface of a bumpy plane of hills and mountains. The sky and the depths of the ground were independent, metaphysical universes. Aristotle still thought that way. He only considered physical displacement in its two most common dimensions. For a falling weight or rising smoke, it is a body that "tends to rejoin its natural environment", the air or the earth.

It sounds preposterous to our minds today, but for the time it was perfectly rational. Aristotle is an expert in logic. Obviously the movements in two horizontal dimensions are easy and controlled, while in the vertical direction they are either impossible (upward without something to pull you) or dangerous (falling downward). It is a radically different axis of the movement.

Galileo then Newton formalized gravity to make it a permanent force but possible to thwart. The movement is seen to be extended naturally in the 3 dimensions of space. Time is set aside: impossible to oppose. Its nature is different in Newtonian mechanics. It says *isotropic* those dimensions whose directions are equivalent and interchangeable (in 3D space you can choose any direction as ‘vertical’) and the other *anisotropic* (time).

Reality continued to rebel. The Galileo principle adopted by Newton (the laws of mechanics are invariant by change of frame of reference) is defeated by Maxwell's equations on electromagnetism. Einstein proposes to reintegrate electromagnetism into the principle of invariance of the laws of physics, but the modification of the equations has a surprising consequence: each frame of reference now has its own time. Newton's universal and anisotropic time has lived. Make way for relativistic time.

Newton's '3D space + universal time' framework is replaced by *space-time*, 4D (mathematicians say 4-manifolds), isotropic with the Minkowskian model. All its directions are equivalent, with one restriction. Its lines are divided into 3 kinds: time, space and light. It is the directions of the kind 'time' that are equivalent, in other words the speeds. This is the basis of the equivalence of speeds in special relativity.

Einsteinian space-time

« All inertial frameworks are equivalent for the performance of any physical experiment ». The paradigm shift brought about by Einstein's relativity is radical. To fully grasp it requires refounding our spontaneous impressions before our academic knowledge. We must no longer think that light is *propagating*, that it is heading towards us at high speed. If this were the case, a photon from an object heading towards us would add its speed to that of the object, as if it were a projectile fired at us by the object. But the speed of light is constant[38], whether it comes from a fixed or moving object. Light does not propagate; it is a transit of information at a level of reality underlying the space itself, from which the spatial dimensions emerge. The speed of the photon is the incompressible speed of the communication of information in this level. The spatial coordinates of two different inertial frames (two objects moving relative to each other) are related to them by

[38] constant in a homogeneous medium, eg vacuum. An experiment in 1999 slowed photons from a laser to 64km/h in a Bose-Einstein condensate. Another in 2015 slowed down a non-refractive photon at room temperature. The speed of light could be quietly decreasing, being inhomogeneous in the universe, and having been higher in its early days. Some information is transmitted faster than light: Cherenkov radiation (a kind of light boom equivalent to sonic boom photons), inflation, quantum entanglement.

equations called Lorentz transformations. These strict laws restrict all travel and have strange effects on an 'environment' that we thought was common to all its hosts. No. The movement places us in an authentic solipsism: our physical reality is strictly personal. We share it with other entities only because they move at a speed very little different from ours. Sharing the same planetary surface unites, more than any other criterion, all humans in a community of the present.

An original way of explaining the insurmountable nature of the speed of light is the Lorentz contraction: the length of an object contracts in the axis of its motion, in proportion to its speed. If it could reach the speed of light its length would become zero. It does not cease to exist. Everything happens as if the dimension of its length becomes imperceptible. It can no longer 'advance' at a higher speed, since the dimension of this advancement has disappeared. In the observable universe only a massless quanta of energy such as the photon seems capable of it. Maybe there are other things that can do it, but we just can't see them.

Relativistic physics does not 'spatialize' time. It's more of a treatment analogy. It rids time of 'now' like it rids space of 'here'. There is no longer manifest time as there is no manifest space.

Minskowskian and Einsteinian 4D

The Minskowskian space-time (4Dm) is used in special relativity and the Einsteinian (4De) in general relativity. 4De differs from 4Dm by integrating gravity. A line in the 4Dm becomes a geodesic in the 4De. In general relativity it is no longer necessary to consider gravity as a force since it is already included in the 4De framework. The inertial universe lines (without acceleration) of objects include this force. It is only necessary to add the other forces to define the trajectory of the objects.

This ability of the 4De is considered to be its great strength. Its chronogeometry includes the modeling of a universal force, gravitation. This is in fact the first model *that is not a pure frame*. It is modified by its content, the presence of the masses. From flat Earth up to 4Dm, physics has only changed the framework in which it installs reality. With the 4De, for the first time, real content becomes, in part, its own framework. A step

towards the idea that reality is entirely self-organized, *without container*, only content.

This strength of 4De is perhaps also its weakness. Integrating gravity into the frame does not make this principle of the container disappear. The other forces are kept out. A dualism persists, containing it with gravitation, and the content with the other fundamental forces. Is this the reason for the failure of the synthesis of quantum and relativistic mechanics?

Gravity differs from other forces by a chasm of energy and distance scale. It thus seems, in content, a manifestation of a level of organization different from the other forces. Potential source of the difficulty in bringing them together in a single model. The 4De is a model suitable for cosmic space and distances, perfect for the scale of gravity, not that of other forces. It simplifies the model of gravity but is also an obstacle, as a holdover from the concept of a universal framework, to integrate different levels of reality and the forces that operate in them.

Be careful, I am not saying that the idea of a frame is irrelevant. Let's not forget our two looks. *For the downward look*, frames are repositories and valuable. They create a framework for our representations, install our thought. Furthermore, *Surimposium* confirms the reality of their existence in the level they describe. An emerging level is the observation of one's own content. The whole is containing. The whole self-fabricates its own framework, which is the experience of being this whole. Our mental representations are varieties of these experiences. They create their frames. Inventing a frame makes it exist. Convincing yourself of a theory of personality makes you behave according to its rules.

It is *in the upward look* that we have to get rid of the containers. Ontologically they are invisible. Only content that interacts remains.

Abandon the lived time?

The Spirit pole is struggling to agree with the Real pole's new diktat on time. 4D and its consequences are far from coinciding with everyday life. The vast majority of humanity continues to live in a Newtonian universe. It must be said that the Spirit pole hardly has the opportunity to experience

the isotropy of the Minkowskian model. This would require reaching extraordinarily high speeds. So must the Spirit pole surrender to the arguments of the new Real pole and abandon its particular experience of time?

It's not so much the passage of time that is a problem. You don't have to give it up. 4D does not denigrate in mind the ability to experience the passage of time. It discharges itself from it.

That the course of time becomes entirely intrinsic to the mind is hardly embarrassing to us. We can think of ourselves as time travelers, installed on board our own process, sailing in the direction that this process has favored, within a spatio-temporal ocean where all directions are theoretically accessible.

The reverse temporal direction is not completely closed to us, since we can conceptualize the past, if not experience it. All of our experience is preserved.

What creates a more radical difficulty in mind is the disappearance of the present, that abrupt line that separates a frozen and knowable past from a hypothetical and guessable future. Common concerns about space-time are less about its mathematics and more about the disappearance of free will. This is carried out without trial by the block universe. The future is written for all lines of the universe. We may believe we are deciding in the present… Ouch! This one no longer exists.

The Spirit pole is entirely focused on prediction, that is, the conviction that improving its models will increase its hold on the world. To renounce this faculty goes further than a simple bow to the Real pole. It is to denigrate its own essence, the purpose of its intimate process. Is it the expulsion of their Spirit pole in limbo that keeps radical physicalists from taking offense at such an assassination?

Mine is still there and worried about it. It accepts very well to take care of its own course of time, as it has always done spontaneously, but it refuses the annihilation of the present, with a solid argument: it is a present that

created the block-universe model. Another present can erase it. My Spirit pole, and then others, will always be there to experience this passage.

What could convince my Spirit pole is to have a glimpse of its future, try to change it (demonstrate that it is not written) and verify that it is impossible. However, the Einsteinian mechanics does not allow it. The block universe is not refutable. It should not satisfy a demanding Real pole.

How to overcome the universe-block hypothesis? Another observation encourages us: Einsteinian mechanics poses problems for quantum physics. The incompatibility concerns in particular… the origin. One end of this block universe. Where time is not a milestone but a measure like any other. The block universe would have limits, and the theory which gave birth to it becomes aberrant for these limits? Here is what weakens it.

But we won't need to jostle it. You are now familiar with the complex dimension and its formalization. The only guiding principle: self-organization. Nothing escapes it, including the dimensions. Dimensional models are frameworks adapted to emergencies formed by the 'reality' process, not backdrops.

With this approach, 4D appears as the survival of the Spirit Pole's desire to set up a framework for reality. Framework accessible to mental representations rather than property of reality. The last offspring of the *aether*? Quitting is difficult. Most of humanity still lives on surfaces. We are talking about *sizes* rather than *vertical distances*. Few of us frequent 3D space on a daily basis. A tiny fraction is walking around in the 4D. How can we expect great popularity from the next step forward: definitively abandon any perceptual framework to reality?

Yet I encourage you to do so. If only to regain your free will, which the last framework is trying to rob you of. If your Spirit pole feels like mine, it will gladly take the big jump.

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‘Block universe’ vs ‘expanding block universe’

We have cited the reluctance of the Spirit pole for eternalism and its bloc universe (BU). Let's do the same for the Real pole with respect to its alternative, the expanding block universe (EBU). It has three main flaws:
1) The law of conservation of energy is unhappy with a single past existing in reality.
2) The future emerges from nothing (the rest is existing). Magic wand?
3) How is the existence of the present different from that of the past?

1) In the EBU the past persists. It is not eliminated in the transformation brought about by the present. But the future does not exist. How to apply a homogeneous law of conservation of energy to this universe?

BU seems less concerned with the problem. Past and future have the same existence value. The law of conservation is a global property of the causal sequence. The EBU is in worse posture. It is cut in two by the present. Why is the energy not conserved beyond the present?

This is a false problem for two reasons. The first is that our assumptions concern the nature of the universe and that the law of conservation of energy is a property of it. It is not with property that we can invalidate nature. The reasoning is upside down.

Second, the problem is in fact included in the other supposed flaw, which concerns precisely the nature of the studied universe: the existence of nothingness, at least on the other side of the present. Let's take a closer look.

2) Emergence from nothingness. The existence of a terminal, in this case a present that draws the border with the non-existent future, implies a *something else* in which the EBU is found. The existence of this other thing and its nature is a clearly intractable problem. The hypotheses formulated must therefore take note of this limit and take it into account. They must avoid any opinion, any justification of their own existence, based on this unknown. If one succeeds and another does not, the first should be preferred, unless the second is much better at explaining what is observable. Does the BU do better than the EBU in this subject?

An important point, which I have not seen covered in any publication, is that the disappearance of ontological time allows you to do whatever you want with this notion. Paradoxically, *it is used* by supporters of the block universe, you will understand how.

BU exists in its entirety, from the most remote past to the most distant future. You have to split the hypothesis in two: either it is bounded or it is not. In the first case, we are faced with similar questions to the EBU: emergence from nothingness, brutal for the BU, staggered for the EBU. In the second case the BU is infinite. Negative response to the presence of something else. It is not certain that this infinitude is a more digestible speculation for our minds than nothingness. But that's not what concerns us here. The important thing is that the notion of time is still used in these choices, in a carefully hidden way.

We have to look for this way in our own mind, it is so fundamental to it. We cannot get away from it as easily as we think. It is our Real pole that manufactures the BU concept, not the essence of the real. The Real pole is always a part of the mind. It emerges on invisible, unconscious mechanisms, where the notion of time is already intimately integrated.

UB is a concept of a *out of time* universe, where *time has no meaning*. These negative references… are in fact references to time. They are based on its absence. Just because a concept does not intervene does not mean that it has faded away. It has not disappeared from the chain of causation. It is hidden within the very principle of causation. It belongs to those root principles under which our thinking cannot go. There is nothing to manipulate them. There is only one way to erase such a principle: *to say that it exists and that it does not exist, and to conclude the same thing*.

This is not the case for the BU hypothesis. To say that time exists or not does not lead to the same conclusions. Saying that time does not exist means seeing the future as real as the past. To say that time exists leads to possibilities of different universes but is forbidden in the BU hypothesis. This is a hypothesis that makes good use of the notion of time.

Nor is the EBU hypothesis capable of completely freeing itself from this notion so embedded in our minds, yet this fact is not denigrated. Whether or not time exists is irrelevant to it. The universe may or may not be bounded, the future may be non-existent and bounded by the present. The real erasure of the notion of time provokes this state of mind where beginning and end are as probable as infinity. Part of reality may exist and another part not yet, without this 'not yet' having any temporal significance, any *starting point*.

What is very difficult to understand as a supporter of the BU is that *something is contemplating* the BU, in this case one's own mind, and that it is indeed a point of departure. Flaw which I challenge several times in this book: the scientist expels her mind in an elsewhere, a platonic ideal, where it would no longer have any impact on reality. The Real can be observed on its own? No, it's still a Real pole busy conceptualizing. If we had no impact on reality, even conceptualization would be impossible. Unless you fall back into the dualistic deadlock.

Let's go back for a moment to an earlier statement: time is hidden within causality. Can we indeed say that the concept of causal sequence is freed from that of time? This is the postulate adopted by physics when it speaks of *causal space*, before any introduction of unfolding and dating. The events are seen as simply juxtaposed in this space, united by their causal link. The term sequence is inappropriate. Rather, it is a blotter effect: every real event is united with a multitude of others in close proximity and up to considerable distances. Each is the summation of an overwhelming number of links. Each element of the sequence is a small universe on its own. It is impossible for us to access all of its complexity.

To reduce this to a point in a causal space seems very approximate. Here we have a powerful clue that there are arguably better ways of portraying reality. But for now let's keep the causal space, for lack of anything better. In this space we have no time to separate a beginning and an end. All states are equivalent. Does this correspond to what is observed?

No. Causality has a direction. A state A can exist without the state B it causes, but not the other way around. Each state can only justify its

existence with the help of those placed in one direction of the sequence, while the other direction has no influence on that existence. This is incompatible with an equivalent existence of all states. Causation hides a mechanism of occurrence from the existence of states, and this mechanism is of course a stripped-down version of time, something the mind is unable to shake off. What it got rid of was any formalization of the mechanism. But it's still there.

The block universe, in its apparent purity, is indeed a blindness to the fundamental processes of the mind that invented it.

I will conclude that the expanding universe-block hypothesis is the best because, contrary to appearances, it does not take a position on the existence or not of time. It is agnostic. It only defines a local present for the evolving process. No universal present. Unlike the BU, it is in accordance with the principle of causality by differentiating the two directions of existence: proven for causal events, hypothetical for events not yet causal (from the position of the so-called 'present' event) .

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Synthesis with the complex dimension

Before starting this synthesis, let us detail the weak points of the classic inquiry. Is it possible to correct them to start from a sound conceptual basis?

Framework and object

A framework is defined in relation to objects placed in it. Objects are said to have their own 'frame of reference'. But can an object be assimilated to a point in space-time? No, a point is a pure mathematical entity, impossible to convert into reality (absence of dimensions). Real entities have dimensions, and reveal themselves in aspects foreign to each other on the scale of observation. The complexity makes them multidimensional and yet integrated beings. How to reconcile this multidimensioning of scale with a single spatio-temporal point? At what level do we place the point, when they have different trajectories and universe lines depending on the level?

The 4D framework fails to integrate complexity. Reduction deconstructs objects to excitations of quantum fields, polarizations of a very energetic

vacuum. At this point the frame has become transparent, as has the substance. What's left?

Only the polarizations and their relations are apparent, symbolized by vectors and their equations. However, the causal chain is not visible. Successive organizations cannot be predicted on the basis of initial polarizations alone. They are modeled after having been observed. For the framework to explain the causal chain, it would have to symbolize the relationships of the entire chain. The Einsteinian 4D is one such attempt: it symbolizes gravity. But no framework can symbolize all of the organizational parameters in complexity. If either of them succeeded, it would be an extraordinarily complex model, so complete it would be… reality per se. Nothing inside of it can support such a model, outside of its very essence.

One hypothesis is reinforced: the only 'realistic framework' is the set of relationships between objects, one organization after another. Each organization defines its own level of reality, endowed with its own spatial and temporal metrics. The peculiarity of our observable universe is that the spatial metrics of objects seem to respond to share a common definition, while the temporal metrics remain independent. It is not certain that this is the case in the unobservable part of the organized universe.

In other words, we have just taken time out of a framework and based it entirely on the relationships between objects. *Framework-time* becomes *weaving-time*. Now it is possible to integrate it into the complex dimension.

The instant can be defined simply by a tiny time system separating two representations. These representations are said to be of the 'same' thing because there is only a moment to separate them, *only for the thing* this moment is indivisible.

The downward look is a prisoner of the frameworks

The mind is a tool to categorize, group together and predict a common destiny of things and events. It seeks a universal future. This research establishes a formalism that the mind attributes to reality but which is

indeed a representation belonging to the mind. What we have called its Real pole.

Frameworks and laws are thus the direct emanation of this formalism. The framework is a mental organization. When I say the downward look trapped by the frameworks, it is still giving it too much freedom. The downward look is the stacking of mental frames of representation, nothing more.

The mind receives information from several spatial directions through the senses. It constructs a spatial multidimensional framework. Initially only displacements in the two dimensions of a horizontal plane seem equivalent. Verticality behaves differently. It imposes a downward movement. Moving upwards is difficult or impossible. The framework imagined by the mind is thus a flat world where the vertical leads to different, less accessible worlds, the underground and the celestial. It becomes natural to place truly inaccessible worlds at the ends of the vertical, except by getting rid of one's earthly body: Hell and Paradise.

A framework encloses reality. It must wiggle terribly, produce glaring inconsistencies, for the framework to start to crack. Inevitable resistance: the framework is the very structure of human understanding. Long after the 2D frame, 3D begins to take hold. The Earth has become spherical (still with difficulty today). Space swelled too. For the mind to travel through it, the vertical becomes a dimension like the other two, interchangeable with them.

But for the time it seems impossible. Time is deeply separated from the spatial dimensions, in the initial framework. Even more than the vertical, it imposes its tyrannical direction. Impossible to escape. No turning back. Leak forward as if something is pushing us at its own speed. We experience time rather than feel that we own it. It imposes itself on everyone simultaneously. This is the most universal dimension that our mind has been able to identify. Clearly it is different from all the others.

Here again the resistance had to give way. At least for the minds concerned with the occult behaviors of reality. Our times, if measured with sufficient

precision, are all different. Even that of your neighbor at the table. You are with her on a rotating planet which itself moves in space. Each follows its own path in space-time. The time coordinates of your neighbor are not the same. They are only close enough that the slowness of your sensory information gives your mind a sense of simultaneity.

Time became the new equivalent dimension in the 4D frame as the vertical had become the new equivalent in the 3D frame.

But this evolution remains that of the framework. The time thus integrated in the 4D is a *framework-time*. It remains property of the Real pole and not of reality per se. With each step forward, the mind commits the same blunder: it thinks that by having enlarged its framework, it is finally in front of the very essence of reality. It is a mistake. It just pushed the downward look a little further down the complex dimension. But it is always the downward alone that looks like this. Descending is the succession of frameworks. Very effective as well. But there is another look.

The upward look is that of things in relation. They don't *understand* each other. They do not establish any framework. They just interact. Interactions stop on stable loops called organizations. It is possible to call these stable loops 'proper time', but that's already confusing. It has nothing to do with the framework-time we were talking about earlier. Proper time is really the property of interactions, of the causal chain, and nothing else. It does not belong to any universal framework. This time, which is not really one, is called the *weaving-time*.

Framework-time is an intrinsic property of interaction. Whereas the time frame is an extrinsic property, in fact belonging to the observer, therefore to the downward look. These two faces of time are useful and necessary, as is the double look itself, but let us be careful not to use one of them in place of the other, to make one of the two the only 'time' to be defined.

There is indeed, at the crossroads of these two views, something that we could call « the » time. But this something is the communication between weaving-time, ontological, and framework-time, epistemological. This is not a feature of reality but of the relationship between the levels of the

complex dimension. It's an *interactive* time. This is undoubtedly the reason for the multiplicity of definitions that you meet on the subject. The result depends on *who* and *what* are in relation to define it.

Because there is a framework-time for each level of representation of the mind. A scientist uses 4D. The individual uses the time for her daily experiences. An accountant uses the annuity. Likewise, there is a frame time for each level of organization of matter, quantons, atoms, molecules, neural networks. The separation is that of the look and not a separation of spirit/matter. Each level has a downward look at what constitutes it and upward at what it builds.

It is important to understand that you don't need a brain to establish a framework-time. A bacterium establishes a framework-time for its environment. As an emergence it survives because its internal organization is the knowledge of a maximum delay to find the nutrients that are essential for it. Eventually it can make metabolic changes when this time is exceeded. Its metabolism builds a weaving-time (upward look), and the bacteria, emergence merging metabolic functions, establishes a framework-time (downward look). It's the same 'time' seen from opposite directions.

Weaving-time and temporal identity

The 4D framework-time already helps us to refine the concept of identity in time. Everything has its universe line in space-time. But it is the weaving-time that allows us to firmly establish the temporal identity. Identity is an emergence over the causal sequence of the thing, from its beginning to the end. The temporal identity is no longer a particular moment of the existence of the thing, nor the set of its successive occurrences. It is the *fusion* of all these occurrences.

As weaving-time is the property of the thing, it is a definition of time *in the thing*, and no longer of the thing in time. The thing is a persistent identity, from start to finish, over its multiple successive iterations. The thing is experienced, at every moment, as the iteration of the moment within this emergence of identity that includes others. The whole is surimposed on each of its temporal parts.

Here is what allows us to establish in physical matter the concept of human identity that I told you about in *Stratium*. Identity which is not reduced to the present self but extended from the past self to the future/hoped for. I have told you about the pathological reduction of the self confined to the present, for example when pain or unmet needs invade the mind and exclude any other representation. The higher levels of self-representation collapse, and the mind again becomes a mere collection of needs. Its identity has shrunk in time, without the passage of time changing in any way. Time is in fact the property of these levels of representations, of the extent that they cover between birth and forecast.

What the consciousness experiences becomes easy to understand. It is a fusion of levels of information, the basis of which is a constant influx of sensory stimuli. Stimuli assembled in representations. The proper times differ. The representation is a unity greater than the stimuli, both spatially by the number of neurons involved, and temporally by the duration of synchronization of the excited neurons. The final level, conscious integration, is the most extensive in proper time and space. Conscious experience is the surimposition of all of these levels. We find there both traces of sensory stimuli, as well as the identity born of representations, and also the temporal extension linked to the integration of memories and predictions. Past self and future self associated with the present self. All of this is fused into an emergence which is conscious experience.

Philosophers have attempted to fix the spatiotemporal emergence in the *perduring* identity, as opposed to the *enduring*. There are indeed two ways to persist:

The enduring thing is the repetition over time of something that does not change. Identity is in this absence of change.
The perduring thing is an assembly of temporal parts whose constitution differs but which form a recognizable whole. Identity is in the change maintaining the temporal continuity of the whole, an emergence over these temporal parts.

Human identity is typically an perduring thing. Personality and behavior change dramatically from birth to death, yet both the person herself and

those around her say they are the same being. Almost every cell in the body has changed. Of course, neurons seem enduring (they are the same) but their connections have been upset, yet it is in this network that identity is inscribed.

The neuron is only enduring under the light microscope. Under the electron microscope, all of its constituents have been changed, recycled. It is itself an assembly of different temporal parts. Identity built on an absence of identities. Emergence too.

So are there really enduring things? They seem easier to find in the material. An atom, a proton, these are things that give the impression of almost eternal endurance. The identity of a proton is indeed so long that we do not yet know how to properly evaluate it. Despite this, it is only a lasting identity over quite different parts of time, a ballet of quantons in which it is impossible to predict when a particular dance step will return. It is the quantons and all their assembled steps that produce the temporal identity of the proton. Thanks to the low degrees of symmetry they allow themselves. This reduced imagination is the reason for the incredible uniformity of identity of the proton. But that doesn't make the proton, or any other particle of matter, an enduring entity.

The downward look sees only perduring things, illusorously appearing enduring thanks to the great constancy of their temporal identity. But let's not deviate from the double look. For the thing that is felt in its temporal identity, this impression is very enduring. It is the upward look, that of emergence that is constituted. Consciousness experiences itself as similar, from one moment to the next, when it is no longer perched on the same part of time. Consciousness feels enduring, unchanging. This is how it can form *enduring intentions*, which channel its destiny in a specific path. Temporal identity becomes a map and no longer a wasteland.

Limitations of classic models

BU and EBU share the fault of not taking into account the complex dimension. These are reductionist theories. The observable universe is not a system of elements, regardless of the size of the observed elements. It is the surimposition of a multitude of information grouped into relatively

independent levels. Independence which is the basis of the very notion of the element.

We are thus dealing in reality with piles of entangled systems, each establishing its own rules. There is a causal link from the bottom to the top of the complexity, but also a retrocausal link in the reverse direction, by the approximation that the system makes on its own constitution. Each floor defines its own time. There is no longer a local present but a multitude.

They are united by their unified 4De reference frame. This allows general relativity to be an effective approximation… depending on the scale on which the whole is looked at, that is, the level of the complex dimension. There is a unified present for synchronized neural interactions of the consciousness network, but it differs on the underlying stages of neural processing. This present breaks down into a really large number of fleeting moments for the particles that make up neurons. Their speeds are mind-blowing for the still frame of reference of the cell.

The EBU approaches *Surimposium* by taking on an additional dimension: complexity. Instead of being a 4-manifold boundary of the 4De space, the EBU becomes a (4+1)-variety boundary. I emphasize the separation of the complex dimension in the (4+1). It cannot a priori be integrated with others, because it generates others, and is probably the place where this causal time is born which it seems impossible to get rid of.

The taking into account of this complex dimension obliges to start again from zero all the traditional discussion. First of all, we have a problem of terminology. There is a hierarchy between the dimensions. Spatials are isotropic: from a point in space you can turn in any direction and call it ‘vertical’ or ‘horizontal’. No one can denigrate you. While the time dimension is anisotropic: direction and displacement are imposed. Universe lines belong to different types in the time dimension, not in the spatial ones. The mathematical dimensions are those of their language: they correspond or not to real dimensions. They may or may not fit into the hierarchy. The complex dimension is the most fundamental: it creates all the others. Let's free it from other dimensions by just saying ‘complexity’.

What do we know about complexity? We have *experienced* knowledge of one potential end, human consciousness. It is on the other end, the supposed foundation of reality, that the vagueness is most important. Einsteinian relativity does not see time in the same way as quantum mechanics. Is this the reason why we continue to think about human time rather than the time of its quantons, even about the block universe? Probably. In order for us to accept eliminativism, all the models would have to speak at the same time, that they flow directly from each other. But the only thing that connects them is the complex dimension. It is a transcendent theory of complexity that can explain the manifestations of time in these different settings, up to consciousness.

We can start from any framework, in this hierarchy, and seek to relate its model of time with that of its neighbors. The goal is not to expand this model. It is to keep only the transcendental aspect, which other levels can identify with. The frameworks disappear. Only the complexity remains.

Presentism regains its rights

Now let's take our candidates back and see if they can be transformed into a transcendental model. Presentism, eternalism/block universe (BU) and expanding block universe (EBU), each carries their cross. That of presentism is its incompatibility with Einsteinian relativity. The cross of eternalism is its inability to explain the experience of passing time. The EBU cross is to make only past and present exist without explaining what differentiates them.

First unforeseen event: presentism is no longer out of the game. Only the 4D framework has eliminated it. It is insufficient. The controversy lies within the eliminativist way of thinking. This is not a logical contradiction. Reductionism symbolizes reality in one of its levels of complexity, the arbitrary one of the earliest known micromechanisms. It does not know what founds it and the organization it produces. The 4De is a framework for objects. These objects are reduced to their representation. As soon as we expand the complex dimension, this accordion is no longer flattened by eliminativism, reality becomes interactive levels each creating their own time. An object cannot be a point in space-time. There is no such reality. There are only interactions that define their unitary '4D volume' (we will

say *4D-volume*). An object is made of these surimposed volumes. The object's temporal experience covers and includes the 4D-volumes of its constituent levels.

In this deployment of complexity, presentism regains its rights. It does not find them as a universal present, since it is incompatible with the physical as well as the psychological levels. Nor does it find them as an Einsteinian local present, since that would make them a purely spatial definition, attempting to escape the 4D time axis. Here, the notion of a 3D object with its universe line in 4D becomes obsolete.

Presentism regains its rights as a *complex present*. Appears the notion of the presence of levels of reality, self-defined in the sequence of their relations, sharing the 4D framework. The present is experienced within each level. When it comes to a highly complex entity, it is its upper level that experiences the surimposition of the underlying levels as the present. *Constituted-present* as seen by upward look, *experienced-present* as seen by downward.

If it is an observer looking at the complex level (downward), she assigns it a time frame. A consciousness looks at another consciousness and attributes to it a time frame close to its own. If it is a physicist looking at consciousness with her 4D model anchored in particles (upward), she assigns it the same frame of reference. In this ontological direction, she does not see the complexity. All complex entities are flattened by horizontal vision. The Einsteinian framework is unrealistic. It is an easy approximation for the physicist to handle. It allows to model the particle level of reality, down to cosmic distances. It attributes a present that we consider effective to objects less complex than ourselves. These objects are not lively enough to contradict it. *Framed-present*.

The complex present

Presentism has regained a perfectly natural anchor: *interaction*. Interaction is a transcendental notion. No need to attach a time to it since it defines it.

Time-being[39]. There is nothing more to the interaction than its present. Past and future are only its borders, the limits of the present. They have no reality within the interaction.

This is why it is difficult to convince our neurons that the past and the future exist as well as the present in the universe-block hypothesis. Neural synchronization is a concrete reality. It has no other present than that of the things involved in the interaction, no matter how far they have traveled to participate. The present is strictly local. This statement is valid regardless of the level of complexity. The present is the same for quantons and the conscious state located far above in complexity. The only thing that sets them apart is the gap between the limits of the interaction. But it is not a question of differences in duration which would correspond to a common dating. Each level defines its own time. It is only for convenience that it is counted in fractions of a second.

Before detailing the present of a highly complex entity such as a human being, let us take the simpler case of a star. Particularly impressive entity in terms of spatial extent, lifespan and power output. But in terms of complexity its rise is modest. A few interactive floors, quantum fields with heavy atoms assembled by this high pressure furnace. What can be one of these atoms' present?

The identity of the atom begins with its formation in the star. It stretches along its causal sequence over billions of years until it disintegrates. For the moment, let's not assume an *unfolding* in the verbs 'to begin' and 'to stretch'. The atom's *experienced-present* changes as it interacts with its neighbors. It is very brief in the turbulent maelstrom that is the star. Finally, the atom's *framed-present* integrates the two previous notions in our minds. It is a 4D-volume whose spatial size is tiny (even taking into account its

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[39] An elementary duration or unit of time is what André Comte-Sponville calls *time-being*: neither result of a sum (mathematical time) nor limit of a division (instant), but the undivided continuation of an existence. 'Time-being' is the term adapted from the point of view of the element experiencing this duration, which can be a consciousness. I will, however, keep 'elementary duration', more general in the sense that it clearly assigns the value of duration to the element, without specifying which it is.

displacements) and gigantic temporal size (corresponding to the duration of the identity).

The framed-present addresses the ‘atom’ level of complexity, viewed by something more complex than itself. While the atom’s experienced-present surimposes those of the underlying levels. When the atom's experienced-present begins, before it has even completed any interaction with any other atoms, the underlying experienced-present(s) has already ridden for eternity. At their levels, an endless number of interactions occurred between quantons. A long causal sequence has taken place, eventually coming to an end; however, the properties and the present of the atom were not altered.

Quantons have gone through a multitude of interactions, have been able to pick up other particles, and retransmit them; their identity has changed. A life has taken place. Past, present, future, all of these underlying moments are merged into the atom's experienced-present, which is only just beginning. The atom's experienced-present *contains the past, present and future* of its constituent levels. The downward look, by defining a *constitutive present*, is therefore valid. It represents the constitution of the experienced-present to place it in a framework. The framework exists… in relative independence. It is only valid for the observer examining the level. It does not define the experienced-present itself, which is understandable only within the level: I, quanton, interact with other quantons, becoming with them a higher level ‘I’, particle which in turn interacts with others, until I begin my experience of the I-atom, which surimposes the previous ones. I am no longer a quanton. I still am… “deep down”, but I am much more. My own time has changed. It slowed down. My substance wriggles without it changing my properties.

In dealing with emergence in the previous chapter, I have kept the postulate that emergence is an instantaneous phenomenon. Simultaneous with its micromechanisms. Imperative assumption if we want to keep it compatible with a universal 4D framework. The concept of emergence having difficulty in establishing itself, why create the additional difficulty of resorting to a framework specific to each emergence. Insult to Occam's razor! But we have just seen that the framework is epistemological and not

ontological. Under upward look, the elements create their specific environment by the way they organize themselves. If the framework seems unchanged to the downward look, it is because some of its aspects are deeply and very firmly rooted in the very structure of the elements. The levels share them.

This is the case with spatial dimensions. 3D space exists from the earliest known levels of matter. 3D space is created on a particularly fundamental and stable floor. It is binding on all overlying organizations. This does not imply that it is *foundational*. The distant entanglement of quantum objects suggests the opposite. At a lower level than known to matter, distant things in 3D space form a unique reality.

3D space is remarkably stable and imposes its universality in the complex dimension. This is not the case with time. The 4D is actually a 3+1D. A particular property of the time dimension is that it changes scale with complexity. That the 4D framework does not support. We have to replace it with a hierarchy: 3+1aD, 3+1bD… 3+1nD. If we are to get rid of universal time for good, *let's not make the mistake of replacing it with a universal dimension*.

Thanks to this hierarchy, the epistemic framework finally becomes effective, embracing the ontological organization. 3D does not change from level to level (except below quantum entanglement), keeping a unique location for the complex structure of each material object. On the other hand, each level has its own temporal dimension +1n…, which gives it a specific temporal identity. It is not independent of that of the previous levels. On the contrary, it is closely based on their relationships. Principle of relative independence, which allows us to understand how an experience can be both fused and multiple. Experience is the surimposition of a multitude of interrelated time dimensions. Any entity, whether it has organized a brain or is even a simple object, experiences this way.

It becomes possible to give a true spatio-temporal definition of things, which includes their complexity. A spatiotemporal entity is the integration of a material structure in a spatial location, within a specific time space at the organizational level where the entity is considered. This piece of time is

identity, self-generated, and not a duration in a universal temporal dimension. The identity dimension of the entity is based on the surimposition of all its underlying identity dimensions.

With such a flexible definition, it is easy to explain the present of consciousness. Each conscious experience is the synchronization of a neural network with multiple layers of information surimposed on it. It can be a 'brief' present, like the feeling of a mosquito bite, because there is a short hierarchy between skin stimulus and conscious integration. It can be a 'long' present, like a reverie, where a hierarchy of high abstraction is involved. It takes a long time for neural groups to form the new organized sequence corresponding to daydreaming. Here the terms 'short' and 'long' have value only because these present(s) are observed by other mental functions or by outsiders. The present is identical and personal to each of our sensations. It is by being *represented* that it is measured. The present is the temporal unit of the organization that creates it. Sometimes it spreads considerably, in consciousness, through the integration of our memories and predictions.

What becomes of the block universe and the expanding block universe?

Local presentism survives in complexity. Good news for common sense. How are its competitors doing?

We have just defined the present as *the representation of a causal sequence*[40]. A series of interactions in one level of reality becomes a time unit in another. This pile of ascending compositions (and descending decompositions) has a summit only the final level representing (in these lines is my consciousness), and has no certain basis. This pile floats in a whole that we try to keep monistic[41].

Without a certain basis, there is no ultimately fundamental unity of time. It may exist, but it is a dangerous assumption; it is our minds that seem

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[40] Time as a representation of a causal sequence is the *relational time* of philosophers. The differences made here are the division of this time into levels of relationship whose independence is only relative. Principle of surimposition.

[41] monist for the upward look, "multi-dualist" for the downward look.

hungry, in their desire to fully conquer reality, which is arguably an illusion, as with any party trying to figure out the whole thing.

Any temporal unit is then only a representation of something else, a sequence of which the temporal unit is the emergent property. The concept of a block universe is still valid. It becomes a mille-feuille of temporal layers, all closely adherent to each other. Their independence is only relative. The present is local, not just spatially; it is also in the sheet. The theoretical question becomes: does the mille-feuille exist entirely (block universe)? Or has it not finished unfolding (expanding block-universe)?

Let's do a thought experiment, using a general assumption about the universe: let it come full circle. Its end is its beginning. Its immeasurable causal sequence returns to its starting point. What becomes of the block universe? Is it a single object, or an endlessly repeated object?

We are not comfortable with infinities, which seem to serve as a refuge for our uncertainties. Suppose it is a single object. But then, if we take one of its layers of reality, and its interacting elements loop around on their own, is it a single object or a repeated object? If it is a repeated object, can it be repeated *without something that represents it repeated*? Can it be without having recorded something from the previous loop that lets it know it's a repetition? But then it's not the same sequence anymore. It is modified by this memory.

You probably heard about 'Groundhog Day'', that fabulous film by Harold Ramis where the main character, Phil Connors, relives the same day over and over again. For it to finally unfold according to his wishes, it is not enough for him to know every moment by heart. *He* needs to change when nothing else has changed by the restart of the day. Phil Connors' brain is the only thing that transforms. It retains the course of the previous days. The repeated day is therefore not exactly the same as its predecessors. If it was, Phil would have no memory of the other iterations and would behave exactly the same. It would be impossible for him to say that this is a duplicate day. Phil knows this because he's the only one *outside* of the Groundhog Day.

Phil Connors sends us back to the idea that there is time because there is something to represent it. This is the framed-time (for what represents). And there is a time because there is a constitution underlying the temporal unity of the thing. This is the experienced-time (by the thing). They are the same time, seen by both looks.

In this time there is also a framed-present and an experienced-present of each thing, the same present seen by both looks. This present is defined by its unity of constitution. For downward look it is an element of reality individualized by its persistence. For upward this is the interactive sequence involved in this persistence.

If the sequence loops, for the interacting elements it is a 'never ending day'. As far as this sequence is concerned, it is a perpetual 'present'.

If the sequence does not loop identically but keeps the same representation (the whole remains above slightly different parts), the 'day' unfolds differently but with similar results. Phil Connors tries out different methods of seduction, all of which result in rejection by the chosen one of his heart. The past of the day becomes entangled in its present, because it lingers in Phil's brain.

The future is also involved as Phil's brain changes its predictions, and its behavior accordingly. But these are just neural interactions that have been altered. Can we really say that the past and the future of these interactions are involved in their present?

The direction we give to causality answers yes, but for the past only. Any interaction is the consequence of those which preceded it and will in turn be the cause of futures. The reverse is not true. The interactive future does not intervene in the interactive present. When the Einsteinian 4D model suggests the possibility of an overlap between the present and the future of a thing, through the gravitational deformations of this space, it is not an *interactive* overlap. These are only events of neighboring 4D coordinates, not interacting, and probably incapable of being informed of this proximity other than by the model.

The relational present therefore has an extension towards the past but not towards the future. This asymmetry is entirely attributable to the causal direction. This asymmetry makes the future different from the past within each thing's own time. This corresponds to our conscious experience, and it is a subjective argument[42] for an expansion of the block universe rather than its fixity.

The term ‘expansion’ does not contain any temporal connotations here. It is only the reflection of the causal direction in a time defined in a purely relational way.

It is of course admissible to discuss the causal direction. If it is the shared property of our minds rather than of reality, this conception collapses. However, having involved the complex dimension prevents this discussion from stalling. It is perfectly possible to maintain the causal direction for the levels of information processed by our mind, including the neural processing process itself, while removing this direction from the microscopic levels of reality. This makes causal direction a property of information levels, not something that transcends them. Let's digest this turnaround.

Because the consequences are important. The block universe becomes the model suited to levels where causal direction does not exist, while its expanding version coincides with levels endowed with that direction. It is eliminativism that gets out of hand. If the eliminativist maintains that reality is reduced to non-causal relationships, that means her mind is pure delusion. No need to insist on this suicidal posture, which fails to explain what an illusion is.

Eliminativism out of the game, block universes find consistency. They multiply. Each level of reality constitutes its own block-universe. Some, made of looped sequences, are limited. *Single day* for interacting elements. *Repetition of identical days* for what represents them. Repetition that founds the constant present of this thing that represents.

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[42] I use ‘subjective’ in the meaning of conscious experienced objectivity which is imperative if we are to satisfy the two poles, Spirit and Real, and not just eliminativist science.

In other levels, the sequences are not looped, but what represents them keeps the same properties. Surimposed, they are an entity that changes without changing. The present of this entity does the same: it changes in its constitution without changing in the experience that is made of it. « I » am the same over subtly different processes. This is how the present experienced in consciousness stretches towards its past. It goes back not to the formation of the brain but to the much earlier beginning of the causal sequence producing the current mental state. This stretching is completed by the presence of representations of the past, the memories, which give it the appearance of great antiquity, but here it is indeed an appearance: memories are *currently* being solicited.

The stretch is also about the future, through the predictions embedded in the current mental state. Illusion of the presence of the future that we objectively experience in this way. Our mental present is indeed an expanding block, a unitary block which extends from the integration of its different components, a synchronization between these assembled information which becomes the temporal unit of thought.

It is necessary to differentiate, in the experience of the conscious present, its *contents*, which include past and future events, and its *container*, which is the synchronization of neural groups. The duration of the container goes from the beginning relationship between mental components and the end of their integration. As much as the beginning is blurry, unraveled in the mental relational past, as the result is clear, a formed integration. This is what makes the strength of the experienced present, between a past that is slowly fading away and a future that is not yet integrated. The experienced present is a *front*, a limit pushed by the causal direction.

Mental relationships create a strong arrow of time, while micromechanisms do not. At their very low level of complexity, they are still juxtapositions rather than integrations. Remember that integration is information that only makes sense in the presence of all the others. The difference between information integrated or not is the difference between a collective and a collection.

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The incomplete Whole

Under the upward look, the individualized elements do not know their destiny. They don't include the context. If there is predictability, it is intrinsic to them. Easy to see it in a human brain that models its future. Is this possible for an element of matter? An 'element' is only a reaction taking the title of 'structure' by its wrapping on itself. We could say that it predicts itself as an element by the presence of this loop. An element only remains if its intrinsic evolution comes back to the start of the loop. The intrinsic predictability of an element is limited to the fact that its properties are maintained through its very structure. It is not self-observation at this point. The element does not consider its fate. Nor does a brain need to consider itself predicting to determine its fate. These are independent levels of information. The experienced prediction is different from the observed.

The upward prediction is experienced a priori. It is probabilistic. No assurance of achievement. The future does not exist for the element.

Downward, an observer sees the result of an organization of the elements with the context. Representation. It links the initial conditions and the result by a model. The a posteriori predictability is better, thanks to the symmetry. The conservation of energy is the symmetry that postulates the constancy of physical laws over time. Identical initial conditions will lead to the same result.

A posteriori predictability remains vulnerable. Models can be found to be included in others, larger, more extended in the complex dimension. The future they determine is dependent on an approximately modeled past. It is never about « the » past, as if it were possible to access a universal version.

The last position on predictability is not a look but the Whole, the integral Reality. Containing the double look, it itself is not. The Whole is the sum of looks and experiences, unrestricted at any time or level of organization. The Whole contains complexity. This is the only posture where everything is predictable since everything *is*. Posture represented among other things by superdeterminism, which is a divine theory rather than a physical one. The Whole is not a framework. There is nothing outside of it to assess it. From within no element can conceive of more than a fraction.

Essential consequence: no model, no framework, allows to know if the Whole is complete or incomplete. For that it would take something outside of it to judge. From the inside it is impossible to differentiate whether it transforms or complements itself. No model, whether it integrates time (Minkowskian 4D) or even integrates the complex dimension (*Surimposium*), is capable of this. To make this affirmation obsolete implies to descend under the principle T<>D, the relation of individuations with the collective context. Under the present foundation of our understanding…

A complete or incomplete Whole. I knowingly used 'incomplete' and not 'evolving' to avoid any reference to time. The term 'incomplete block universe' is ultimately preferable to 'expanding block universe'. It emphasizes a neglected characteristic of its rival: the classical block universe is supposed to be *complete*, fully existing in the same way for each of its points in space-time. The corollary questions are very troublesome.

If the dimensions of the complete BU are finite, the causal chain has a beginning and/or an end. Why these ends? *In what* do the extremities deserve this name? If the dimensions are infinite, is this a new multiverse theory (all causal chains exist in an infinite time dimension)? I am suspicious of theories that suddenly lead to a frightening turgor of reality, which no solid clue can support. Monism is receding, not before religious dualism, but this time before an unbridled pluralism even more astonishing.

The incomplete BU is not free from these criticisms. It is clearly up against the problem of extremities, in particular of the shifting one of the present. But the classic discourse we used at the beginning was purely reductionist. Isolated upward look. By integrating the complex dimension, the case takes on a radically different aspect. Reality is no longer extended along a universal framework. It builds its own topology from an origin that is only assumed. A picture ? Imagine a fractal entity expanding from a center. Its number of dimensions is indeterminate. The expansion has no time frame; it is a wholeness of organization.

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The time of existence

What does it mean to exist, basically? Should we define time before existence, or the opposite? Let's take away that 'before' that reintroduces time when we don't want it yet. Let us place ourselves in the complex dimension: is time *below* existence, or *above*? Or are the two notions indissoluble, only separated by the way we look at the unique notion of *temporal existence*?

It seems difficult to separate the two concepts completely. Even by removing time from its quality of framework and reducing it to a relational definition between things, it is not possible to exclude it from the existence of things. The thing self-defines its time, its elementary duration, by its mere existence.

However, the things that we are are complex. There is no observable elementary duration that cannot be broken. The unbreakable durations, *unbreakable existences*, remain purely theoretical. An existence is, as we have just seen, part of a causal sequence between other existences, plus its representation. One existence is surimposed on other existences. It includes the before and after *for* each of them, ie the past and future *of* each. *A present existence settles on the past and the future of its existential elements*.

Another important way to define existence is to look at the continuity, or rupture, between its existential elements. It is *in a certain way of organizing their relationships* that the elements create the existence of their higher representation. Within the causal sequence, it is the integration of states with one another that forms higher existence. In terms of information, *existence is information integrated along the causal sequence*.

This is a turning point in this thinking. In *Stratium* chapter, I defined consciousness as the surimposition of multiple levels with relative independence, each based on strongly integrated information. This marked integration brings each of them into existence as a representation. Let us specify what integration means.

The question concerns the very foundation of mathematics: is the existence of a mathematical object based only on the elements participating in an

equation or on the sequence of equations founding the elements? And if this is the sequence, where do we say its beginning and end? We are faced with a common, philosophical and mathematical question: What is existence and what is its elementary time?

Saying integrated information usually assumes an elementary time for this integration. But if it is the integrated relationships that define elementary information time, it is no longer possible to use it that way. This is no longer possible, neither for the before and after in the same causal sequence (except to say arbitrarily that they are the same elementary times), nor for the causal sequences of the other levels of information (here the elementary times can be drastically different).

Defining a time of existence is not clearly reducible to the elementary time of interaction. The only satisfactory solution is to integrate the part of the causal sequence that cannot be dissociated from it. *That's the whole point of the present*. The present finds its meaning not by being assimilated to the elementary interactive time of the thing but in its extension along the causal chain. The present is a set of information integrated on a portion of the causal chain. It is a temporal definition independent of interactive time. Definition specific to the representation of this portion of the causal chain, and not to its elements. Represented time and ontological time interacting elements: we find here, for a causal sequence, the framed-time and the experienced-time. These are their versions brought down to a unique level of reality.

I have just attached the time of existence to a level of reality, seen by its representation and by its interacting elements. Now let's expand it into the complex dimension. Integrated information is an alternative presentation for phenomena that we have already encountered: interactive loop, attraction, stability. All these phenomena have one point in common: there is a symbol to describe them: element, attractor, particle. The symbol is fused information, representative of information integrated into a determined causal chain. In the complex dimension, each symbol integrates others, occupying an underlying level. Each symbol integrates past, present and future of each of its constituents (which they are to each other). Each constituent is itself the integration of a present and future past, based on

even smaller interactive times. There is no formal limit to what a symbol can integrate as surimposed times, from the past to the future of its constituents. The extent of this integration constitutes its own elementary time. This elementary time is also a present whose borders are located at another level.

Difficult to understand without an example. Take the most accessible: self-awareness. Its elementary time is variable, when I compare it to that of my environment. My time can go by quickly, or slowly, depending on the thoughts in my mind and the stimuli given to me by the environment. My present is different. It is a more stable space, which moves in the continuous flow of my elementary times. What is this expanse of my present made of? It integrates my biographical identity (my memories), my experienced identity (my current feelings), my projections on the future (the world I expect to meet).

My elementary time is the synchronization of the neural patterns supporting all of this information. It is a neural ontological time. My present is the integration of the information provided by these patterns, which concerns both the past and the future as well as my current sensations. My present is my framed-time, and my elementary time is my experienced-time.

All the known approaches of time, both experienced and formalized, easily fit into this new picture. As much philosophical as physical. Time of each consciousness, time of poets, or of myths. Time of a quantum, atomic, molecular interaction. Existential times aggregate and overlap, clearly delimited by the double look, at the interface of experienced-time and framed-time.

Redefining individuation

To define an individuation it is necessary to isolate it. The self-determination of a system (upward look) is also its isolation from the rest of the environment (downward look).

The common definition of isolation is spatial. It designates the separation of a whole, more or less radical, by its 3D limits. Isolation is also strongly a

temporal notion. Interactions take place between elements already present in the history of the isolated whole. This introduces the notion of system, which is also implicitly temporal. The system is not perceptible in a set of interactions captured in their relative simultaneity; it is revealed in their succession and their entanglement; it is not one element of calculation, nor several, but their temporal extension within the framework of an unchanged representation of the system.

Isolation is a property of the whole as much as of the elements. It is a local criterion, spatially and temporally. Each element is at each quanta of interaction, in its personal time, a synthesis of all the fields of influence of which it shares the perimeter. Integration found at each level of organization. The behavior of an elementary particle is the fusion of the three fundamental forces (gravitation is negligible) transmitted by its neighbors. The activity of a neuron is the fusion of multiple impulses transmitted at the same elementary moment by its neighbors (the elementary moment here has a metabolic value, corresponding to the rate of membrane depolarization). The relative isolation of the element, whether particle or neuron, makes it an autonomous, persistent entity. While the presence of two or more neighbors abrogates the individuality of the element and transforms it into a parallel calculator of the permanent flow of information arriving from its environment. The T<>D setting changes.

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The course of time and the arrow of time

The course of time is the sequence of states as it appears to us. The arrow of time adds the notion that this sequence can only unfold in one direction, from the past to the future.

The course of time is a neutral concept. It is a succession of states juxtaposed by a causal link. This link is authentically bidirectional: A_n causes A_{n+1} but also A_{n+1} is caused by A_n. The difference between these two relations, their respective importance, lies purely in our mind. The mind itself is a sequential process dealing with a succession of information. It is in the intimacy of its mechanism an analyst of causality. In other words: it seeks itself in the interactions that surround it. However, because it creates a *representation* of these interactions it is able to virtually change their direction. It easily imagines the sequence going upside down.

Can this inversion correspond to reality? (Can the real sequence appear in the opposite direction to that observed at the origin while maintaining the causal link?) Sometimes yes (quantum mechanics is reversible), sometimes not (statistical thermodynamics and other ontological breaks in temporal symmetry). Which appears to show the presence of an arrow of time.

I actually just stated a false problem, because the reasoning is circular. What defines direct or reverse meaning is my mind. I just let the representation of my mind replace the actual process again instead of giving it its independence. The actual sequence, in the absence of any other indication, in the absence of an observer, *is not in motion*, one way or the other.

Statistical thermodynamics does not demonstrate the existence of an arrow of time. It's a sequence like any other. *This is the model* used to manage the sequence of events which is not reversible. The model is a *realistic approximation*. It indicates that a thermodynamic system in equilibrium will take so long to revert to its initial state that it can safely be said that it is impossible. The model is a valid representation. The actual sequence conforms to this. This does not mean that it harbors the slightest arrow of time. It is our minds that harbor it.

The mind should not be thinking « Is there an arrow of time? » but « *I am* the arrow of time ». Even if it is true that we each have our time frame of reference, we should not say « I am *my* arrow of time », because there is no other for this process which constitutes it and which models all the others. 'I am my arrow' would only make sense for a material reality hearing it, if it was also a mind process and looking at our own.

As we must remain monistic, however, we must ask ourselves how this arrow of time got into our minds. We can't just evacuate it into a virtual universe, which in a monistic setting is not an explanation. The mind is formed by dealing with real processes. How did it inherit the arrow?

Let us take a step back from these opening statements. I only used the horizontal view. Yet there is not a single real process, but a multitude, surimposed rather than simultaneous. Impossible to discuss the arrow of

time without invoking the complex dimension. Penrose recognizes this implicitly by listing seven areas of knowledge affected by the answer: the second principle of thermodynamics (increasing entropy); the problem of measurement in quantum physics; violation of CP; our psychology, which distinguishes the past from the future, unlike physical time; the radiative time arrow (we eliminate the waves advanced as solutions of Maxwell's equations); the expansion of the universe; the dynamics of black holes.

From quantum mechanics to our psychology, the full height of complexity is represented. We need vertical vision! Let's apply it to the point where we stagnate in our investigation: the mind looks at the sequence of reality and sees in it an arrow that is not inherently contained in the sequence. If this is pure conceptual invention on its part, what is the point? Could the absence of an arrow be a handicap? The reason does not arise spontaneously. The other hypothesis is that the arrow is formed implicitly by the mere fact that the mental process climbs the ladder of complexity. This is the most natural and there is no shortage of arguments to flesh it out.

The arrow of time intrinsic to complexity

How is an observer born in the complex dimension? It does this from the first change of reality level. It is already born in maths, our language of the fundamental. The observer appears in the mathematical result as a statement of different possible constitutions. *The collapse of quantum entanglements is an elementary birth of an observer*. The *constitution* of the particle has not changed. For *Surimposium*, its underlying states are preserved. They are now organized. The organization *is* the observer. No need for a human eye. The mind is only that which models the birth of the observer in matter itself. It is a simulation of it. To call the mind an 'observer' is in fact to say that it is a hierarchy of observations of its own processes.

It therefore appears an observer because there is a representation that makes the two directions of an interaction asymmetric. A higher level of information, representation, was added to the set of interactions. This representation, which may correspond to several different sets, is indeed added information, the origin of which is impossible to reduce to the set

which produced it. Hence the asymmetry. The arrow of time begins in the creation of the observer and the asymmetry that underlies it.

The arrow inherently increases as one moves up the complexity scale, due to the increasing asymmetry of temporal fusion experienced by complex entities. This asymmetry is that between a past of increasing precision and a future of increasing imprecision, as an increasing number of criteria and levels of information are surimposed in the fusion experienced by the entity.

A little theoretical, isn't it? So let's take an example that each of us has experienced: the experience of the arrow of time that we have had since infancy. This arrow is very short for the child. Few memories, few predictions, especially in the long term. The youthful experience of time is a brief arrow picked up around the present. Identity fusion is temporally concentrated. Consequence: time passes very slowly. The days are endless. They are broken down into units of time corresponding to the standard of identity fusion. If the standard is small, the units multiply. A 12-hour waking day lengthens to dozens of fictitious hours experienced by the child, while in an older adult it is reduced to just a few hours.

Units of identity fusion-time? Did I really simplify things by producing this concept? Yes, if you are interested in neuroscience, because the concept corresponds to a perfectly physical phenomenon: the duration of synchronization of neural networks forming a conscious thought. The theory can be verified by measuring this duration at several ages of the brain.

By introducing the complex dimension, the controversy over the arrow of time dissolves. It does not appear to the upward look, which justifies denigrating it from a purely ontological point of view. While it is evident to the downward look, by the asymmetry it sees in its representation of things between the realized past and the uncertain future. The arrow expands as the past accumulates and the prediction improves in a level of representation.

The arrow of time is not static. It lengthens like the shadows of our mental images as the sun of our existence descends towards its twilight.

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Does time exist?

Isn't it a bit late to ask the question, after all our efforts? But the question remains. Reductionism does not make time disappear but reduces it to one parameter of the interactive sequence among others. Exit the particular quality of time. The question is thus more precisely: Does time exist in the unique way that we attribute to it?

It is the double look that can convince us to firmly answer "Yes!" by justifying it even in the deepest intimacy of the matter. But before presenting this unusual thesis, I would like to open your mind to it by pointing out the blunders of classical thought.

Manifest time does not exist in physics. Based on this observation, some physicists conclude that there is no obvious material equivalence of time. They remove subjective time from the pool of fundamental principles of reality, without asserting that it does not exist, which would expose them to the retribution of philosophers.

The approach is not so neutral. By doing so, these physicists confine the mind to its entirely personal world, populated by ideals and imaginations that allow it to construct its illusions about reality (including manifest time). The step is easy. It is of the same order as defining a clean world for mathematical ideals. These worlds added to reality, we are no longer in a dualism but in a trialism! The mind is not treated passively in this process. It is either denied or the object of a concealed postulate. In the absence of any postulate we would rather have the following discourse: The mind performs mimicry on the processes of reality, therefore the manifest time must come from a property widely held in these processes. *This discourse is monistic*.

Now let's see what the double look tells us. Let's start from a level of reality that we know well: our consciousness. The course of time clearly comes from the successive processing of events, linked by a causal link. For the

upward look, it is a train of information. To the downward look, it is an impression of time passing through this scroll.

We have said that the process is a single thing looked at from two different directions, by its constitution and by its representation. It defines its own time, viewed from two directions: that of the interactive sequence and that of experience. For the 'conscious thought' process, the two looks are the synchronization of the neurons of the conscious network and the conscious experience.

The same interpretation can be made whenever we descend from a level of reality. Let's dive right into neural physiology. The 'neuron' process is made up of its biological elements and is experienced by excitations. It has a proper time shorter than that of consciousness, is only a tiny fraction of a second. As a self-representing cellular element, it has an authentic experience of this accelerating time relative to that of consciousness.

Let us fall to the atomic nucleus. 0.3 zeptoseconds (0.3 thousandths of a trillionth of a second) is the time it takes for neutrons and protons to organize themselves to form it. Then the nucleus is stable. This does not mean that the process has stopped. Neutrons and protons continue their interaction. They renew together the fact of forming a nucleus, which define its own time. Events can interrupt the process: spontaneous emission of a particle (radioactive isotope), nucleus targeted by a physicist in his nuclear accelerator. The nucleus represents itself as a stable entity within a universe of electrons, other nuclei, and various traveling particles. It experiences its succession of intrinsic interactions as the unfolding of its own time, passing at an incredible speed compared to that of consciousness.

At no time does the downward look disappear. It is intrinsic to the complex dimension. Every organization creates it. Even the quantum vacuum, by creating stable field excitations, constructs a proper time immediately experienced as an unfolding by these excitations.

The arrow of time is not conceived only by neurons, it is a feature of all levels of reality. Property of the downward look only, while it does not

appear in the upward look. Each stage of constitution is seen as a stationary wagon in the middle of a train. It is only when representing this constitution that causality makes sense and time appears.

Time is needed to build the real

The interactions between elements of a level of reality require an incompressible delay, at least for the reality that we know. The subatomic levels are concerned. The models assume a *lifetime* for the elements involved. It must be greater than the interaction time for the system to organize itself, or even much greater when it has to explore a large number of states before finding stability. Deadline and lifespan, two temporal criteria, are inseparable in the construction of reality. Time is fundamental in the existence of the real. The "slowness" of the transmission of information, limited by the speed of light, is a strictly necessary condition. No order could appear if all trades were instantaneous.

This fundamental condition is found at each level of the organization, with specific time values. These values lengthen as one climbs the complex scale. The delays of neural exchanges form the basis of ideas and their sequence, just as the delays of exchanges between particle fields form the basis of atomic structures.

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Is time tense or tenseless?

Final controversy (high tension?) over time: is it an *image* or an *animation*? Controversy born of a muddle: our minds amalgamate in the same word two concepts foreign to each other: time and the *passage of* time. *Causal sequence and unfolding*. It's not so much the language that's at fault. Until recently it was intrinsic to the time it was passing. No one ever managed to stop it.

Then the physicists got involved. They made time a sequence of events. It is the mind, as a succession of mental events, that for them moves through the sequence of time. Paradigm reversal that corresponds to the emergence of structuralism and the upward look among physicists. This does not make the passing of time experienced by the downward look disappear… even among physicists. Could we not blame them for the lack of semantic update? If the word 'time' is now split between a sequential chain and its

animation, the vocabulary must now clearly signal it. That the popularizers do not need to brawl to take time away from its eternal passing shadow. The two remain inseparable in everyday life.

Does the wait-and-see attitude of physicists come from the fact that they are not convinced of the existence of the *passage*? The reality they are dealing with is just the sequence. Whether it passes is a question left to philosophers. Ironically, one of them, McTaggart, chose a trendy math vocabulary. He calls the sequence of events 'A series' as an animated succession, each event being its present, dividing the sequence between its past and its future. He calls 'B series' the fixed sequence, where all events have the same status. None have a 'present' value.

The sequence is a juxtaposition of events where the simple causality allows to privilege a direction. Causal arrow… which is not yet the arrow of time. Introducing a direction is not to tag one of our intentions on the nature of the sequence. It can be intrinsic. A sequence self-defines its directions and can do it differently for each.

The unfolding is something else. Something is running through the sequence. The unfolding is not the property of the sequence. There is a dynamic. But it is not a time *dimension*. It is what makes time a dimension different from others, a *tensed* dimension.

Or, a more daring hypothesis, the tension applies to all dimensions, to reality regardless of its different dimensional frames. This hypothesis is more suitable for Minkowskian space-time. Tension moves in space as well as in time. No dimension of the framework is privileged. It becomes possible to apply the same metric and the same rules to the causal sequence as for the other dimensions. The 4D Minkowskian framework holds up perfectly if all of its dimensions are tensed, or none.

McTaggart wanted to demonstrate the non-existence of the passage of time in the following way: it distinguishes for time its properties and its relations. *Properties* are the basis of the temporal A series: past, present, future. *Relations* are the basis of B series: anteriority, simultaneity, posteriority. B series is immutable. Postulating the passage of time assumes

the existence of A series, the only one to show a change. But A series is inconsistent. Any event in A series must have all 3 properties, past, present and future. Since they are incompatible, it cannot have them together. To separate them supposes the existence of a time in the second degree, and for this one a time in the third degree, etc… up to infinity. This infinity regression shows that the concept of the passage of time is wrong. For McTaggart, it doesn't exist. Although he may have experienced a long passage of time between his reflection and the publication of his article ;-)

Where is McTaggart going wrong? His argument is false because after effectively separating time and its passage, he explicitly confuses. If he calls the sequence 'time' and its unfolding 'tension', the two phenomena become of a different order. Impossible then to reintroduce a 'second degree time' in an attempt to eliminate the tension. This is no longer possible, they are independent. McTaggart is actually trying to create a new time sequence that applies to the first one and shows that to be nonsense. Indeed. But tension is not a new time sequence. It is an intrinsic property. There is nothing known "under" time, in the complex dimension, that would allow us to know where this property comes from. Under the guise of infinite regression, McTaggart's reasoning is in fact horizontal, because of this false start.

The change is in our downward look and not in the sequence seen through the upward look. Downward look effectively amalgamates time and its passage, but upward cannot start from a sufficiently fundamental representation to say that the passage does not exist.

The upward look must confront its own inconsistencies. Again, it is not the authentic ontology. The scientific Real pole starts from these representations which it says are fundamental. Including that of the block universe. But how can it visualize an eternal sequence if not from a gazebo outside it?

Here is the Real pole projected out of reality. Out of reality? Where is it ? We have abandoned the idea of a virtual universe, to remain monistic. The block universe in fact forces us to invent a dimension external to reality, a pseudo-time orthogonal to the 'Eternity' sequence, from which we could

contemplate it in all its extent. In this pseudo-time only the mind can experience the reality of the future equivalent to that of the past. All 'now' there would exist with the same reality. A time dimension of another order? We are sent back to McTaggart's reasoning by absurdity. Back to the difficulties caused by the overlapping times.

This should encourage us to define the concept of time *in* reality and not outside of it. Take time out of the framework. To re-establish it as a purely ontological phenomenon. And too bad if our downward look does not manage to split it. It's less serious than falsely splitting it up with an upward look perched on a temporary foundation.

The collapse of McTaggart's argument does not imply the existence of passing time a fortiori. This is a phenomenon that suits our experience and the real question is: Can our experience exist without an intrinsic tension in time?

You already know the answer, since we previously defined the experience of passing time as a fusion in the complex dimension. Conscious fusion involving elements of the past and the future. The constituents of this fusion are constantly changing. How can they 'change' since we don't want to use the concept of 'passage', precisely? They change in a sequence that is not on the same time scale as conscious fusion. The constitution of the phenomenon 'passing time' changes at a much higher frequency than the experience of the phenomenon. The variable 'speed' of passage is the difference in frequency between the two time steps.

Concluding on the tension of time shows that once again it is impossible to do without the double look. Upward, the Real pole looking at Spirit, time does not pass. Only one sequence is obvious. Downward, the passage of time is there, obviously just as strong, explained by the sole presence of the complex dimension. As to whether there is an ontological tension, this is an unverifiable hypothesis. We don't need it. We can make our time easier by removing it with Occam's razor. Unless, perhaps, Occam died of a hypertensive surge in the past?…

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Reconciling continuity and discontinuity

Wave-corpuscule is a fusional duality. At an indefinite level of reality, continuity and discontinuity *correspond*.

Maths are related to reality by the notion of discontinuity, sequence of the natural integers to energy quanta.

The organized real entities are divisible. If this divisibility was infinite, the infinite numbers would be realistic. While if divisibility stops at energy quanta, the infinites are monstruosities impossible to insert in the real.

Infinite divisibility is commonly used, line or wave consisting of an infinity of points.

Infinites causes only problem with horizontal thinking, not vertical. For the vertical, each level is descriptable by a sequence of natural integers. What is not it is the superior representation formed of the entire level. Infinites that appear reflect the irreducibility of the whole to the parties, and the non-transcendental nature of the representation.

Infinites return to the rank of virtual objects specific to representation and not imposed on the real.

In vertical thinking it is also possible to maintain infinite divisibility without going through an infinite number of levels. The independence of these can make obsolete at the base the model of another level.

No metamathematic research demonstrates a conceptual superiority of continuous or discontinuous. Can we reconcile rather than oppose them?

Discontinuity is only that of representation. Even a quanta is this. Give it this status frees the ontology of its pixellization.

Continuous ontology and discontinuous representation. Two indissociable aspects shown by the double look... provided to give back to the upward look its authentic ontological character.

The reductionism is the downward look clamp and not a secateur. The real is like a two-sided building, smooth on one side for the upward look, succession of balconies from the other for the downward look.

Downward look that, remember, we embedded in the real per se and not reserved for the human mind.

Surimposium replaces the neutral concept 'interaction' by 'conflict'. The advantage is to integrate the dynamics into the interaction. It is possible that the two notions are not discernible in the fundamentals of the real.

Combine continuity and discontinuity? To merge opposites, is not this to ignore logic, this attentive guardian of the cohesion of thought, to replace it

with paradox, this keeper which opens its door to all ideas? A clue allows us to think that this unnatural marriage is possible. A fusional dualism, wave and particle, is one of the most established results of physics. Behave like a point or a wave? Better: both like the two, in the same experience. How to conceptually unite the local discontinuity of the particle and the infinite continuity of the wave? Louis de Broglie mathematized it in the formula $\lambda = h/p$, which establishes the wavelength λ in proportion to the quantity p of movement of the particle (h being Planck's constant).

At a still undefined level of reality, continuity and discontinuity *correspond*.

The first relationship between mathematics and reality is *discontinuity*. Maths counts, divides. On the downward look, the discontinuous appears as a series of natural integers, one of the most fundamental objects of mathematics. On the upward look it appears as a collection of quanta of energy.

Natural numbers are divisible, however the result of dividing them is not always an integer. Is it the same for quanta of energy? Organized entities are divisible, since they are made up of smaller elements. If this divisibility were infinite, we would have in real physical entities the equivalence of endless numbers such as Pi or the root of 2. *Mathematical objects would be realistic*. On the other hand, by postulating a non-breaking quantum of energy, it is no longer possible to find a direct equivalence between endless numbers and physical reality. We do not know what they can correspond to. It becomes necessary to get rid of it in a world of Platonic ideals, whose relation to reality is not known. The hypothesis of a reality containing all the information becomes untenable. It is impossible to insert the monstrosities of infinite numbers into it.

By trying to match the natural numbers with the discontinuous view of reality, we are therefore led to an inconsistency, except by choosing the hypothesis that reality is infinitely divisible. This hypothesis is interesting. We already use it to reconcile continuity and discontinuity. The straight line is both continuous and made up of an infinite number of points. If there is an interaction focusing the coordinates, reality appears discontinuous with an interval corresponding to the scale of the interaction. Apart from that, it

is continuous, line or wave, because it is infinitely divisible, which makes the gap between its points imperceptible. It behaves like the fusion of all its points.

Nevertheless, the horizontal vision encloses us here in its flatness. Vertical vision offers an alternative, compatible with the first. If the real is a succession of organized levels, each is a set of elements that can be described by natural numbers. What cannot be described by natural numbers is the *upper representation* ultimately formed by these elements. The model that describes it easily generates infinite numbers. What do they translate? According to *Surimposium*, they simply translate the irreducibility of the whole into its parts. They reflect the presence of the T<>D conflict, this fundamental motor of reality. Break between the asymmetry of the elements and the symmetry of the whole. In the transition, the elements with their own personality become equivalent in the whole. Their contrasting influences are buried under the approximation achieved by the higher representation. Everything happens as if the real secreted a gangue of new properties around the irreducible conflict between the underlying individuations.

In this vertical view, the endlessness of a number only exists within the model used to describe a particular level. It is not transcendent. It becomes possible again to imagine an entirely structuralist reality, without involving the aberrant monsters that are the infinites. They revert to the rank of virtual objects, that is, included in *Stratium* and not imposed on the real.

Vertical vision also avoids postulating an infinite number of levels organized to explain infinite divisibility. It is possible that at some level the meaning we give to 'division' is no longer valid. The properties of reality sometimes change radically from one level to another. Let us allow the hypothesis that even the most basic notions, 'locality' 'time' 'causality' 'identity', are properties emerging from a level that does not have them. If it were possible to understand them, perhaps we would have the explanation of certain mathematical correspondences, for example why inductive reasoning and infinity regression allow the same demonstrations.

Analogue computing is theoretically as powerful as binary computing. No metamathematic research allows us to demonstrate a superiority of the discontinuous or the continuous. Keeping them irreconcilable creates a major knowledge gap. What if we tried to reconcile them?

Let's revisit the origin. *Surimposium* places conflict at the root of reality. Physics employs the more neutral concept of *interaction*. Can we confuse the two?

What does an interaction consist of, more precisely? Each of the elements involved changes from one state to another. Transformation for each of them. Rarely in a symmetrical way (even the quantum scale has exceptions). The process is formalized as follows: A becomes A', and in a space of time that is not always measurable but which it is difficult to certify as zero (simultaneity), B becomes B'. Tension between A and B, A "gives way" to A', B gives way to B'. Even if the result is related to the properties of A and B rather than to their *essence* (if we postulate a separation between the two), we can say that B' has a little of A, and A' has a little of B. You come out of an interaction as different as you come out of a conflict. Can conflict, you retort, keep its meaning between identical elements, which remain identical after interaction? The elements are never strictly similar in fact: they occupy different spatial coordinates; only their composition is similar. Location being part of *being*, this is indeed a conflict… of a different position.

There are passive interactions, you retort again (mutinous, eh?), for example a photon crosses the universe and hits a rhodopsin molecule on the retina. The photon is absorbed. The atom is "fed" rather than engaged in conflict. Yet the absorption of the photon at the level of the electronic cloud has effects that can be interpreted in terms of conflict. Energy level changes, reorganization. The wandering photon, too, was born out of an ancient conflict, perhaps the one that gave birth to light in the very first moments of the universe. Or it was reflected by a 'colored' surface, that is, sensitive to its wavelength. Again it is possible to see a conflict. The reflected photon has a speed and characteristics identical to the arriving photon… except that its direction has changed. Why wouldn't the changed motion vector

change the "identity" of the photon when it is accepted for any other change?

Interaction, as a unit of description of the real, hardly satisfies us. It does not allow us in any way to reconstitute its *dynamics*. It only symbolizes it. What exactly does it cover? What *inter*-interactions? This is the downside of quantization. When looking for smaller processes, we forget to ask ourselves what a process is. The continuity of the old setting called 'void' had at least one advantage: it was a net from which reality could not drop lower. Already that reality has terribly lost in substance, when objects appeared to us as immense expanses of vacuum separating tiny particles of matter. But if in addition the particles are no longer made of something… it is all the hereditary nobility of the material that passes under the guillotine.

'Conflict' taking the place of 'interaction' can seem like a language neighbor. However, it conceals a bit of that continuity, the absence of which makes us despair. It has a beginning and an end, a story, a *pinnacle*. Towards a conflict and beyond. Conflict is the decompensation of an interaction, its threshold, its shift. There is no need to give it a specific time, which would bring up all our problems. It is like the transition from water to ice, a blurred realm.

The discontinuity is only that of representation, foreign to the level of the conflict, even when it is extremely close to it. We have defined the organization of the higher level as a representation already independent of its constituents, without the need for human conceptualization. New special relativity, that of representation: *Surimposium* postulates that representation follows the same principles *for everything that represents*, that the balcony from which the human mind observes is not that of the favorite of the gods. The representation is a *condensate* of the underlying continuity. The perpetual transformation of information, an incompressible process, is overcome by these condensates, realistic compression. A lean algorithm represents the heavy underlying computation. How is it ? The answer is hidden in the meta-principle that self-creates reality. Didn't mathematicians get out of the game too quickly with Gödel's incompleteness theorem, poorly understood, which only contingents a level of reality and not its transcendence?

By moving the quanta to the status of representation, we free the original level of its pixelation. It acquires a continuous and virginal fusion. Of course we just changed the direction of our look. But here it's no sleight of hand. We seek to experience things within the level, to be like it, to intuition it in a philosophical sense. In this intuition, everything appears continuous. The conflicts do not follow one another; they are chained in fusion. It is in this shift in perspective that it is unexpectedly possible to reconcile the continuity and discontinuity of reality. Simply by renouncing the divine exclusivity of the double look, and giving it back to reality, we are witnessing this embrace.

Having reconciled the continuity and the discontinuity of reality has important consequences. *Diversium* is definitely engraved by these two separate and inseparable aspects. It is no longer possible to amalgamate essence and representation. If the essence of reality is information, this is not mathematics, which only forms the discontinuous aspect. When I present the layered plan of *Diversium* to you, I am not describing its essence, except for its very tiny part which is its layered representation in my personal conscious space. Your own representation of the world is another of those tiny and unique parts. The phenomenological space of philosophers is thus recognized as having its inimitable nature. Even a physically perfect clone would be different from the original. It occupies other spatial coordinates, which would lead it to different interactions.

The idea that this unique phenomenon can merge into another is diminished. This is intuition in the Bergsonian sense: experiencing another phenomenon by overlaying your own on it. This is only realistic for phenomena fully accessible to consciousness, in all their complexity. And again, the shift is enough not to be in the intuitioned phenomenon, but in its fusion with our own experience. To arrive at an exact intuition would be the ultimate perfection of the upward look, the attainment of the in-person fusion of the phenomenon under examination. Freed from all foreign and parasitic thought, consciousness would experience itself as perfectly identical to the phenomenon. But its physical nature is different, and this superposition is fleeting. It is actually an overlap between levels of

information. ‘I’ am quickly pulling away from all the other information rushing to my door.

Removing the need to choose between continuous or discontinuous real also cancels our problem of relationship between mathematical languages. How does an algorithm describing one level of organization become another, when an emergence has arisen? This is of relative importance, since the essence of the phenomenon is perfectly continuous. Our difficulties in connecting its complex levels do not prevent it from existing as continuity. The floors are one of its faces, just as a building can present you with a smooth facade on one side and a succession of balconies on the other, while remaining a single building.

Reductionism is useful to us and at the same time it cloisters us in a level of representation. It models inside a discontinuity and thus hinders us to get out of it. The discontinuity does not enclose the real. It is a pliers and not a secateurs. The pliers hooks onto the undulations of the real that we call its discontinuities. Hence the idea that mathematical languages are impossible to coordinate by a metamathematics because they describe the sequence of the vertices of these undulations of the real. Discontinuities but also incomplete continuity. Simple benchmarks, of the same nature as the mind that scrutinizes them. Benchmarks identifying themselves with others, within an essence of which they experience only a part: their own fusion.

How is *conflict* more interesting than *interaction* as an elementary process of reality? Why make this choice in *Surimposium*? ‘Conflict’ hosts ’dynamic’. It is a non-static interaction. A priori, using ‘conflict’ rejects the need to affirm or not the presence of a momentum in reality, of an *unfolding* of interactions. As a lively interaction, conflict inherently contains the idea that the two notions may not be separable.

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Synthesis

Mathematorium

The *Mathematorium* is the self-organized edifice of mathematics, a whole surimposed on its parts currently referred to as *the* mathematic. But 'the mathematic' does not express the stratification of this edifice.

The mathematic is well constituted of "mathematics". Hierarchical language. It includes elementary entities (numbers) and other complexes (equations, algorithms). The symbols hide highly complex entities. In spoken language, we easily perceive the richness underlying most words, while elementary mathematical symbols, like numbers, appear monolithic. The richness of productions that can come out of a number must make us think that they are not that much.

There is still a great deal of work to be done to understand the metamathematics of the complex dimension. However, the principle T<>D already exists in our current mathematics. It is hidden there. Indeed the sign '=' actually hides two meanings, one horizontal, the other vertical in the complex dimension.

'=' Means either 'identical to' or 'assembled in'. The first meaning, horizontal, is for example: 2+3=1+4. It is written more clearly: (2+3)=(1+4). These are two groupings of the same level, each in parentheses.

The second meaning, vertical, is 2+3=5. A grouping is transformed into a whole. If I have to write it with the same clarity as the previous equation, it gives: (2+3)=((5)). An additional container appeared around the grouping. 5 is a number, a whole and no longer just its parts. It, in turn, may participate in groupings with other *whole-numbers*.

The relation with the T<>D principle is this: the vertical meaning of the sign '=' is the passage of an element from T to D. Or again: the complex meaning of the sign '=' is the passage of a thing of its state of parts to its state of whole.

This thing stays the same. It's the location of what defines it that changes. From its parts it is a set of T. From the whole it is a fused D.

Metalanguage

Our reflections on the nature of mathematics show it as a layered edifice whose principle must be sought at the base rather than in an arbitrarily constituted equation. A symbol to be invented for "the equation of everything". Those that we know are only filiations. This is the idea in the acronym T<>D.

The T<>D is dualistic (for the downward look). The D for soliDary designates the whole, the collective, the fusion of all the elements. This first pole of the principle is absolute symmetry. If it were alone in place, reality would be an endless collection of all identical freedoms, none having a particularly marked affinity for another. Let's not talk about the elements because this already presupposes an organization and therefore the choice of *one* freedom.

The T of soliTary designates the individual, the different from the rest, the second pole identified as asymmetry. If it were alone in place, no fusion would be possible and the reality would be a collection of all dissimilar freedoms, neither having any particular affinity for another (let us note that there is at least this point in common between symmetry and asymmetry).

Derivation and integration are the operations behind which we can guess the T<>D principle. As an individuation, where do I place my border with the whole? What thickness / what blur surrounds this border? Can I reduce this vagueness by checking that it does not come from several surimposed levels of information?

"At the end" time…

…is no longer a framework, neither universal nor included in a 4D model. It is an evolutionary property of the complex dimension. This can associate a fundamental eternalistic level, a bottom devoid of causal direction, with complex organizations possessing an expanding present, between two outcomes which are independent levels of reality.

The three models of the universe are no longer in competition but integrated into *Surimposium*.

As soon as we speak of time, a hidden hierarchy manifests itself. Time is *the property of the representation which is the discourer*. At its level of complexity. The representation is always decomposable. Its own time as well. The concepts of point, instant, object, being, are defined in the level of the discourer. Their relations with their equivalents in other fields are understandable only by revealing the complex hierarchy.

What do these notions represent when they have zero value? What are the *point without length*, the *instant without duration*, the *being without substance*? These are simplifications brought about by horizontal thinking, which thus flattens the complex verticality. As, downward, the length of a point can always be shortened, the instant shortened, the substance diluted, these values are declared infinitely small by horizontal thinking. Approximation that works remarkably well in most levels, but is unrealistic. Does this explain why infinities create contradictions within mathematics applied to reality, as observed by physicists?

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Interlude

Escape from the structuralist vision of time? The structuralist vision of time has conquered the Real pole. It is important to notice how it wrongly reduces the alternatives of the Spirit pole. This in fact has two ways of seeing time: as a *succession of information* and as a *substance that changes*. The difference is profound. In the first case it is not necessary to wonder what becomes of the initial information. The result is simply attached to it. We can study the mathematical relationships between the two, but there is no such thing as a *persistence* of the initial information in the result. This only keeps track of the relationship. This relationship could be identical with different initial information.

Whereas for a substance the form changes but something intrinsic persists. Identity of the substance *under* the form. Energy, for example, is a constant.

The effect is cartoonish on the notion of time. With the structuralist vision, the mind loses it. It sees nothing more than a juxtaposition of reduced states with their information. The only essence of these is to be mathematically related to their neighbors. It is possible to browse the chain in both directions. The arrow of time disappears.

While with its substantial vision the mind attributes an identity to the thing, an essence within the form. This binder allows it to suppose that the thing is self-experienced, in the association of the substance and its successive forms, however simple the form may be. The supposition then extends without difficulty to the fact that the thing experiences the passage of time, as the mind itself experiences it in parallel with being a succession of sophisticated states. Time reappears, and so does its arrow. It is a property of the level of organization of the thing.

A provisional conclusion is in order: let us not hasten to decide between a real that is substantial or only informational. It is not the Real pole, even equipped with its extraordinarily precise instruments, which can provide definitive proof. It is through its dialogue with the Spirit Pole that it escapes its blinders.

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Conclusion

Mistakes to pin down the inaccessible truth.
Shade to be dazzled by the light.

We are approaching the moment to close this *Surimposium*. Maybe it gave you a few migraines? Early dozing off (would you have renamed it '*Somniferarium*')? What arguments does it have to convince you?

It brings into concrete reality notions that scientific eliminativism has reduced to the state of illusions, but which are nevertheless essential beacons of our thought. These notions are: consciousness, substance, time, free will, identity, the collective as important as individuals.

I don't need to convince you of the importance of languages. It is by multiplying them that one preserves the independence of one's thought. Language is not passive. To practice one of them exclusively is to intimately model the thought processes in its image. The mind can be constrained by a single language, or escape by practicing them all. Here the double look offers a new dimension to each of these languages. Here they are with a complex hierarchy. Potentially capable of self-observation. Living languages.

You live in a complex world that has never been so monistic. No more virtual multiverses, world of possibilities or ideals, expulsion of mysteries in inaccessible places[43]. The mysteries are there, but within our reach. The imaginary has never been so healthy… as the open summit of our mental complexity, also within our grasp. Monistic, the reality is. Nevertheless its aspects are independent, enough that it is not easy to appropriate it.

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[43] No, I can't let myself say such a thing. There is certainly a parallel universe for concepts. There, they frolic and proliferate like viruses, copulating to create an endless suite of new species. All these parasites are on the lookout, ready to pounce on the passing brain, insinuate themselves there to whisper their words to it. Everything I wrote was dictated to me. Throw this book away before that last note of lucidity wears off.

The double look leaves many areas where I know nothing,
but none where I understand nothing.

The double look allows us to approach a mystery apparently beyond our comprehension: How does individuation and whole come together when they are the most ultimate opposites we can think of? According to the look, precisely, the unit is a whole and a whole unit.

The double look is a divinity with two heads. For the downward, the spirit is sanctuarized. And the divine above it. Life is a Creation, backed by a Higher Intention. For the upward look, the divine is located below, at the origin of things. Also endowed with an intention but inferior. An elemental force. Equally fundamental and powerful indeed. The two looks meet in the immeasurable, delimiting our suspended reality.

Diversium Quantum Matterium Stratium Societarium, you are now familiar with these terms which designate complex reality (*Surimposium* being its model) and its parts: fields, matter, spirit, society. Physicists can add the *Vacuum* to the base. Establishing the continuity of these sections is not so easy. The dualism, which would like to prohibit the matter-spirit continuity, is still alive. Rather than contradict it, we chopped it up so thin it takes on the same appearance as monism.

Stratium solves the transition problem between data and knowledge. Process schematized as follows: knowing the data (sensory sensors), representing them (1st rank neurons), establishing a joint organization of regularities (neural hierarchy) which is knowledge itself, retrocontrol (conscious observer). A layer of knowledge is added to the data at each neural stratum. No arbitrary border between data and knowledge. Sensory data already knows something about the world.

Surimposium completes this data/knowledge entanglement in matter. Reality represents itself, by the approximation it makes of its own data. The inanimate begins to know long before the mind takes hold of that knowledge.

Stratium is a conceptual neuro-cognitive stack integrated into the general stack of reality. It attempts to pair up with the *Matterium* by simulating its organized levels. But it does so using rough approximations. Most of the information is lost, the levels are flattened into horizontal representations, these are juxtaposed rather than layered. In the final image, revealing the micro-mechanisms involves changing the magnification, down to pixels if necessary. But the observation paradigm remains horizontal. It is easier to see the layering upstream: knowing the detail of the pixels does not always lead to the same image. This is how we can straighten our thinking. The mental image in turn becomes a stack, better paired with the *Matterium* described. It adapts more flexibly to it. Each level owns its paradigm. They observe each other. There is no longer any reduction to impose itself on everything.

With such flexibility, the *Stratium* stack may very well be a *reverse stack* of the *Matterium*. The micromechanisms occupy the top. Phenomenon observed in researchers, who assemble reality upside down. Discover unknown micromechanisms from a known stage? You have to create a variety of models and verify them. Variety in the number of researchers, each group defending a hypothesis and working on its model. The inversion is this: at the top of the *Stratium*(s), the diversity is that of the base models. They seek to come together in official theory. Inverted mask of reality per se. Which effectively continues the synthetic work of the Real pole. What we are experiencing is this proprietary mask. The only place where we are authentic. We have an identity realized *by being the mask*. This is how we are reductionists or philosophers, upward or downward, with perfect conviction. To threaten it, your favorite game must be to stand in front of another mask. But it's not that easy, since we are one too…

If you have to remember one essential thing about the notion of emergence, it is this: *the reduction of emergence is useful for understanding it, but you have to give up your understanding in order to experience it*, to allow your own intention to operate. In psychology, is it neutral to *understand* the mechanism of our emotions? Of course, visualizing their networks in fMRI is useful in neuroscience. But does this change their role as a psychic constituent? Can this role be altered? There is no disembodied homunculus in the mind capable of keeping these representations at bay. Reducing an

emotion to its neurological description instantly changes its influence. The model is not neutral but *interventionist*.

The neuroscientist at the controls of fMRI is most influenced by the model. The reduction in the guinea pig's emotions more dramatically changes the way she experiences her own. The danger of robotization of the mind is real. Emotion *translated* and no longer experienced. Manipulated and not directly constitutive of the acting force. Control could be beneficial if emotions were just archaic obsolete instincts. But they have found no equivalent as a starter of the decision. They are not wild but already domesticated within behavioral patterns. The task of consciousness is to refine them, not to replace a drive with its representation.

Reduction is valuable for carefully controlling our thought processes. But *the fact of experiencing is a prerequisite for any higher organization*. It is through this experience of fused emotions and reasons that their coherent organization is formed. Representative fusion erases small flaws in the arrangement. Without it, the psyche would be perpetually busy rebuilding its foundations. The fusion is a necessary blindness. To experience constitutes the very principle of its concretization.

The universe is deterministic and unpredictable, because the only calculator is itself, and it cannot go faster than its own process.

Uncertainty is everywhere. In the modeling of the past, in the fidelity of our representation of the essence of the thing, in our extrapolations. Our conceptual cloud floats around the thread of reality without being able to adhere to it, except at the knot called consciousness where it experiences itself as reality. What then to do with determinism? Determinism has proven to be a remarkable way of thinking. It brought us closer to an ideal: that of knowing everything, understanding, guessing. Divine posture. Unfortunately, the ideal is burdened with an intrinsic flaw. Sticking to it blinds you to the rest. The conflict is gone. Progress no longer makes sense. From ideal, we can no longer move, or only go back. Regress.

History teaches us to view ideals with suspicion. But that does not apply to the means of approaching them. Striving for the ideal ensures stable

thinking without weakening it by extreme rigidity. It can leave its solution if the circumstances are urgent. The ideal is an attractor. Mark where to center but not to stop. Determinism is fundamental to discovering order, to exercising our intentions. It becomes sterile only when it thinks of itself as the ideal.

How to give back its place to determinism by ridding it of its stiffness? How to reinstate it in the face of probabilism, the excesses of which are even more worrying? To consider all the eventualities without being able to cancel any of them assassinates the decision. Idealized probabilism, twin of ideal determinism, has led us to the draconian principle of precaution. A killer. Any action that may lead to a result other than that expected should not be taken. A principle so unnatural to mind that it takes a lot of laws to implement it. Let us be fairly wary of this probabilistic ideal, which produces pure contemplative minds. But let us also seek to reach out. It is the shock that loosens the grip of certainty, obliges us to seek new solutions.

If determinism is a tool, it has a *function*. It is the function that shifts it from its ideal as a tool. The ideal is an indivisible quality, but the function is quantifiable. It is by quantifying its function that we can define *useful* determinism.

The function of determinism is to make our retrocontrol effective, that is, to approximate the result of the forecast. Let us see that we are already using a double language, that of determinism (effective result = expected) and probabilism (satisfactory result = approaching). Through the deterministic lens we are blind to the imprecision of the result. The probabilistic lorgnette blinds us to its precision. The mind, let us remember, is itself a management of conflict.

Effectiveness, therefore, can only be defined by what we expect from the outcome. Precision is only of interest in the context of the questions asked. It has nothing to do with illusory ideals, which are there only to direct our thinking and not to install it. This relativism of thought therefore concerns only the ideals themselves and *not the means they propose*. The mind cannot

be other than deterministic. Its withdrawal reveals *the disorganized probabilism of its absence*.

Efficiency has become a layered notion for us. It can be close to the absolute within the framework of the question asked, and relative within other questions of the same level, which must be organized together in a higher level efficiency. Some solutions take the place of another in response to the same question. The great theories organize together conflicting questions to perch on them. Theory of theories. This stratification is that of our conceptual edifice, not of reality per se. The ontology of the Real pole is not that of the real. The first hopes to join the second and the second welcomes the first to change its appearance.

The effectiveness of determinism is judged very simply by our immediate satisfaction. The mind is delighted with its certainty, a new stone that consolidates it. Rest assured, it is not at risk of sclerosis. Bliss is a sensation carefully selected by Nature not to last. Our neurochemical balances ensure this. New uncertainties are necessary for its resuscitation. Wonderful *questioning*. The death of the spirit occurs when it can no longer accommodate it.

Determinism reconciled with uncertainty. Should we shower all quarrels? Perhaps you have noticed this apparent inconsistency of *Surimposium*: it promotes conflict as a principle, but patiently extinguishes, page after page, all its fires in the field of knowledge. Are there just a few soggy, unreadable pages left?

The conflict is impossible to remove. It is contained in each individuation. The embers never go out. Dangerous conflict is fire out of control. The existing organization is no longer strengthened but destroyed. Conflict uplifts and collapses. Our management is that delicate process that piles up grains of sand. Catastrophic avalanches continually threaten the heap which, despite everything, rises. In conflict we seek order and fear explosion.

Certainly we will still face violent crossings. *Societarium* wars, *Stratium*(s) rivalries, ecosystem slavery. The matter, which we believe to control the

best, is the most dangerous. A cosmic catastrophe in the *Matterium* can wipe us out in the blink of an eye. It is easier to control who we are. Let us use the polite form of conflict in the *Societarium*: argument. Let's walk, argue, walk…

There is at least one level of reality, the quantum, which can only be defined through the relationships between its elements. Exclusive bottom-up causation failure. Disappearance of the classic substance of things. Reductionism falls into a vacuum. No micro-mechanism fundamental to the whole of reality. Each higher level is as necessary as the basal to replenish it. The notion of emergence has materialized. The problem of retrograde causality disappears with the complex dimension since the causal sequences become independent, property of their level.

Our benchmarks are weakened. The discoverers of *Quantum* sought to distance themselves from the implications of this strange and disturbing structuralism. Easier to plant your mental roots in a space-time frame. The spirit is meant to be a hundred-year-old oak in an unchanging soil for the following generations. Yet quantum theory has prevailed. The Real pole is not the real per se but undergoes its dictatorship, through the experimental results. Now our benchmarks are *suspended*. Their solidity is founded otherwise. It refocuses on the dynamic relationship established between reality and model. The exchange between *Matterium* and *Stratium* is the stable core of our representation of the world. The universe is no longer a backdrop. The consensus between our minds, their Real pole(s), has become a priority.

In the complex dimension, this heart is surrounded by the unknown. Above and below. Previously the unknown was located between our minds and the backdrop. We felt like we were surrounding it. We are now isolated as never before, while paradoxically science is progressing continuously! But this isolation is also a more intimate meeting in the world. We have discovered a new way of looking at it. Vertical thinking. We identified it as such, because everyone was doing vertical thinking without knowing it, Mr. Jourdain!

Without complex thought another stranger surrounded us: time. So tyrannical and unperturbed that our minds could only oppose one thing against it: fatalism. Surrounded by the mysteries of the future and the distant past. Science has patiently set out to extract the past. Our insurance has improved. Our prediction arrows began to enslave more of the future. Knowledge is no longer a bubble suspended in the unknown. It is a drill, which leaves a well-supported gallery behind it. The bedrock of our reality has taken off from a hypothetical original anchor, but its subsoil has never been so thick, so resistant to earthquakes.

We have entered a *permaculture of knowledge*. We may have the illusion that our benchmarks have lost solidity, but doesn't progress actually destroy illusions? This means that these benchmarks have gained in authenticity. Closer to the real per se than they have ever been. And it's easier to get away from it. *Diversium* without bottom, without cover. Our *Stratium*(s) can frolic in the unknown.

Laws and forces are not ontological but epistemic. Our mind installs in these frameworks the organizational properties of a level of reality. Ontologically they are found by the constituent elements. Interaction of structures. The stability of laws reflects that of structures. Staggering observed throughout the complex dimension. No reason to think a priori that there are ontologically 'elementary' forces. In this hope hides that of an origin, which would simplify our task of understanding the world. If this origin exists, we do not know what is organized there.

The major argument in favor of an origin is the increasing similarity of elements towards the onset of complexity. Impossible to differentiate two excitations of a quantum field. Their behavior respects increasing predictability. Individual intention disappears, raising the suspicion that there is originally a Great Whole homogeneous in its possible discontinuities.

One should be wary of this argument, for two reasons:
1) Our means of observation become coarser in proportion to the smallness of what they detect. They are unable to analyze the differences between elementary particles.

2) A too homogeneous Great Whole could not generate the asymmetries which found the observed world. Too homogeneous to split elements. We need an additional factor to this perfect immobility to explain our existence. A *conflict*.

Upward, every element of reality is a result. A crossroads of an immeasurable number of influences. It cannot locally contain such a calculation. It is the whole that is the process of ontological computation. It said to the element: « You are ». However, upon entering into existence, the element emerges in a different level of reality. It discovers a local identity, endowed with specific properties. Owner observation. The element says, « I am ». An element *self*-calculates downward.

The double look is intimately *the creator* of complex reality.

> *The principle T<>D as builder of complexity is written as follows: the one contradicts the whole, but the contradiction is erased in the appearance of an additional level of reality.*

Surimposium is one of those books that can be exposed and then only updated, never finished. This is *Surimposium 1.0*, which I struggled to award its majority. It emancipates itself and claims the status of an autonomous entity, like the real/virtual elements it describes. Are you surprised that the newborn has a pyramidal face, from foundational concepts to metaphysics? It is already trying to seduce and reproduce. Born of an accident of life, of a thwarted loneliness. Nothing very original actually if it wants to pass itself off as human.

Pyramidal, *Surimposium* is a structure of thought, not a dogma. No more than the mind would be a dogma of biology. Everything is modifiable in its structure. The diversity of its appearances grows towards the top. Everyone invents their own personality. The stiffness is hidden in the foundations. More difficult to correct the basic paradigms, the genesis of order through conflict. However, the principle I have proposed, the T<>D conflict, can be seen in many ways. Imagine it as neurosis of an unwanted birth, boredom of God, pretense of 1 riding 0, pox stinging a Zeus known for his escapades,

annihilation of nothing producing something… The same story, told differently by seven billion directors.

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Jean-Pierre Legros, La Terramoa 010, March 28, 2021