An Outline of Reality

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Abstract
This paper aims to provide a basic explanation of existence, fundamental aspects of reality, and consciousness. Existence in its most general sense is identified with the principle of logical consistency: to exist means to be logically consistent. The essence of the principle of logical consistency is that every thing is what it is and is not what it is not. From this principle follows the existence of intrinsic, indescribable identities of things and relations between them. There are three fundamental, logically necessary relations: similarity, composition and instantiation. Set theory, mathematics, logic and science are presented as relational descriptions of reality. Qualities of consciousness (qualia) are identified with intrinsic identities of things or at least a certain subset of them, especially in the context of a dynamic form of organized complexity.

1 Existence

Reality is all that exists, and existence, in the broadest sense, is identical to logical consistency: to exist means to be logically consistent, non-contradictory, that is, logically possible.[1] For every thing it means that it is what it is and is not what it is not. In other words, every thing is identical to itself and differentiated from what it is not. We can also choose other definitions of existence, for example "to exist means to be part of a temporal-causal system," which may be more useful in practice because it offers the possibility of the empirical verification of the existence of a given thing and generally of interacting with it, but these definitions of existence will always be narrower than the definition solely on the basis of logical consistency and will be to some extent arbitrary or anthropocentric. What all definitions of existence have in common is the necessary criterion of logical consistency because things that are impossible cannot exist – they are actually not even things because they don't have their identity and are not differentiated from what they are not. Moreover, abandonment of the principle of logical consistency would also erase the difference between existence and non-existence and the very question of what exists would lose meaning.

We can say that all possible things exist "at least as possibilities." But why would some things exist only "as possibilities" while others also, additionally, "in reality"? What would it even mean? It seems that there is no fundamental difference between possibility and reality and therefore every possible thing also exists in reality, but of course only in the sense in which it is defined (defined ultimately in the most fundamental, logically necessary way – more on that in part 2 of this paper). And so, since it would be arbitrary and without a fundamental

[1] This is the strictly logical version of the metaphysical view known as the "principle of plenitude." The principle of plenitude holds that everything that is possible exists. It was given this name by philosopher Arthur Lovejoy, who in his book *The Great Chain of Being* (1936) traced its historical forms from as far back as Plato. It is also present in philosopher David Lewis's modal realism according to which reality contains all possible spatiotemporal worlds and in physicist Max Tegmark's mathematical universe hypothesis according to which reality consists of all possible mathematical structures. Lewis D. (1986): *On the Plurality of Worlds*; Tegmark M. (2007): *The Mathematical Universe*, https://arxiv.org/abs/0704.0646

reason to restrict the definition of existence to selected possibilities, reality in the fundamental sense consists of all possibilities.

Identification of existence with logical consistency gives a simple answer to two fundamental philosophical questions: why there is something rather than nothing and why there is what there is rather than something else. The answer is that all logical possibilities exist – necessarily from the definition of existence. To deny the existence of something that is logically consistent would mean to deny its logical consistency and thereby to contradict oneself and refute one's assertion. In our world we of course observe only some logical possibilities but that means only so much that our world is just a part of reality, one of possible worlds. There may be a number of reasons why we live in this particular part of reality: chance (we are simply what we are – one of logical possibilities in reality), suitable conditions for life of our kind (we would not be able to live in those parts of reality that lack such conditions), and various causal factors (that is, various things that stand in the position of causes in relation to our existence in a particular place at a particular time).

We need to be careful with the assessment of the logical consistency of theoretical ideas and thus of whether they correspond to reality because ideas that at first sight look consistent may turn out to be inconsistent on closer inspection. On the other hand, ideas that appear inconsistent may actually be consistent.

Example 1: Outside Mary's house is a lawn with no trees. It seems that it would be logically consistent (possible) for a tree to stand on that lawn at this moment, and yet there is none. If logical consistency is existence why does no tree exist on that lawn? Didn't we just find a possibility that doesn't exist? The answer is that if it is indeed consistent for a tree to stand on that lawn then a tree does stand there – but in a different possible world, which is an exact copy of our world except for the tree. Strictly speaking, the tree does not stand on the lawn outside Mary's house but on a copy of that lawn in a different world. However, one might object that it seems consistent for the tree to stand on the lawn, at this moment, in *our* world, not in a different one. But such an idea would not in fact be consistent, because inserting a tree in a world changes the definition (constitution) of the world at that moment, thereby making it a different world.

Example 2: In mathematics we can find statements that (1) sum of interior angles of a triangle is always 180° but also that (2) sum of interior angles of a triangle is different from 180°. If these statements are understood in an appropriately limited sense, that is that the first statement applies only to triangles in a flat (Euclidean) space and the second applies to triangles in a curved (non-Euclidean) space, then the statements will be logically consistent (mutually and each in itself). But if they are understood in an absolute sense (that each statement applies to all possible spaces) or in an inappropriately limited sense (for example that the second statement applies to triangles in a flat space) there will be a contradiction. The flat and curved spaces are different possible worlds and different possible worlds are actually different things, with different identities – their simultaneous existence is not a contradiction as long as there is no inconsistent mixing of their identities. Propositions (meanings of statements), including axioms (such as Euclid's axioms, which define the flat space, or Euclid's axioms with Euclid's parallel postulate replaced by its negation, which define the curved space), are properties of a certain thing and may not apply to other things. Only if a

proposition is a tautology (necessary truth) does it apply to every thing, and if a proposition is contradictory it applies to no thing (and is itself nothing).[2]

Example 3: It seems possible that there would be nothing (no consistent thing), but if this possibility existed, it would mean that there would indeed be nothing, which is obviously not true. However, "there is nothing" is a proposition/axiom, a property of a certain thing, and a property as well as the thing that has it are something, making the proposition inconsistent and therefore impossible. The proposition would be consistent if its meaning was limited to the content of some world, thus defining an empty world, a world in which there is nothing. And if "there is nothing" is not a tautology there is also a world to which it does not apply (the logically necessary way of defining things described in part 2 of this paper generates also non-empty worlds).

In any case, it is necessary to define ideas with sufficient precision so that it is clear to what and in what sense they attribute existence and so that we can assess their consistency. In order to make these ideas maximally clear we would have to define them in the most fundamental, logically necessary way. However, it is evident that the ability of pure reason to define ideas/theories and assess their consistency, and thus to find out what exists, is limited. Moreover, according to Gödel's first incompleteness theorem, a consistent theoretical system that is sufficiently complex to include arithmetic and thus infinite numbers would need uncountably many axioms to prove (deduce) all its truths. And according to Gödel's second incompleteness theorem it is impossible to prove that a theoretical system that is sufficiently complex to include arithmetic is really consistent. (Both incompleteness theorems also apply to contemporary physical theories.) Due to these limitations of pure reason, to know reality we also need senses, that is, causal interaction with our environment, because if we interact with something then it must exist, and this interaction also reveals to us in which part of the reality of possibilities we live. Of course, senses have their limitations too (limitation to certain aspects of reality, limited reach/range, speed of light – maximum possible speed of signals, susceptibility to sensory illusions...).

2 Fundamental aspects of reality

As has been noted, the principle of logical consistency essentially means that every thing is what it is and is not what it is not. And so every thing is defined/constituted both positively, that is, by what it *is*, and negatively, that is, by what it is *not*. The positive definition (nature) of a thing is indescribable, in the sense that it can only be "described" self-referentially, by referring to the thing itself: the thing is what it is. At most we can give the thing a label/name. On the other hand, the negative definition (nature) of a thing can be described by presenting the thing in relations to other things; it sets the thing apart from and connects it with other things. And so every thing has both an intrinsic (self-referential/qualitative) identity and an extrinsic (relational/structural) identity. Reality is a system of things and relations between them, where things are indescribable/ineffable identities and relations are connections between them. These two fundamental aspects of reality, or identities of every thing – intrinsic and extrinsic – are inseparably connected like two sides of a coin.

[2] A "possible world" doesn't have to be a thing that has no spatial, temporal or causal relations with other possible worlds; in general it can be any thing that provides a context for the truth of a proposition. For example, the proposition "Spanish is the official language" is true in countries like Spain or Mexico but not true in countries like Germany or France. These countries (or their internal regions, cities etc.) are possible worlds for this proposition.

The most fundamental relations seem to be the following:
- similarity,
- composition (relation between part and whole), and
- instantiation (relation between an abstract thing and its instances).

It seems that these three fundamental relations apply to every thing and are necessary for the definition of all other relations and for logical reasoning. The negative definition of every thing is reducible to these three relations. While the relation of similarity can be hierarchical or non-hierarchical, relations of composition and instantiation are based on a hierarchy in the sense of "one over many": a whole "contains" or "encompasses" parts and an abstract thing (also called a universal) is "instantiated" or "exemplified" in instances/examples. The composition and instantiation relations are special kinds of the similarity relation. Similarity of things is the closeness of their definitions; it is connected with the fact that they instantiate the same abstract thing and are parts of the same whole and simultaneously they also instantiate different abstract things and are parts of different wholes. An abstract/general thing is a property that is had by its instances, for example concrete red things have the property of red color/redness, or concrete circles have the property of circle. An abstract thing has instances and it can itself be an instance of an even more abstract thing (for example circle is an abstract thing that is an instantiation of geometric object). A concrete thing has no instances. Abstracta and concreta constitute another two fundamental aspects of reality that are inseparably connected like two sides of a coin.[3]

The maximum similarity is between things that are exact copies of each other. They differ only by thisness (particularity), which is a property of each copy connected with the copy's position in space or time. At a minimum, all things are similar in that they are things, that is, that they have qualities (intrinsic identities) and stand in relations to other things. Thing and relation are instantiations of the most general property – the property of existence (logical consistency).

Unlike things, fundamental relations have no intrinsic identity; they are a consequence of the existence of things (and things are a consequence of the existence of fundamental relations). According to a radical version of the metaphysical view called ontic structural realism there are only relations in reality;[4] but if there is a relation of similarity then there must also be something that is similar. Or if there is a relation between a part and a whole then there must also be something that is a part and something that is a whole. And if there is a relation between abstract and concrete then there must also be something that is abstract and something that is concrete. This something is not a relation but a thing. This does not rule out the existence of relations between relations or relations between relations and things, but relations must ultimately be grounded in things, otherwise relations would lose their meaning.

A thing can be described by its relations to other things – to which things it is (in a certain way and to a certain extent) similar; which things it is a part of; which things are its parts; which things it instantiates; from which things it is abstracted. But all these descriptions refer to *other* things than the thing we describe. They actually describe what this thing is *not* – they are negative descriptions of the thing. Although the description of a thing by its parts defines what the thing is in the compositional sense, that is, parts taken together as a whole/collection

[3] Philosopher James Franklin defines pure/mathematical structure in a similar way, with "concepts of same and different, part and whole." Franklin J. (2008): *Aristotelian Realism*, http://www.maths.unsw.edu.au/%7Ejim/irv.pdf, p. 113.
[4] See e.g.: https://plato.stanford.edu/archives/win2016/entries/structural-realism/

(this is the compositional identity of the thing, which is a kind of structural/relational identity), since this thing is not identical to any of its parts this, too, is a description of the thing by what the thing is not. Alternatively we can describe this thing in the compositional sense by the abstract things it instantiates, since these instantiations are parts or overlapping collections of parts of the thing. Similar to how a whole has parts (interior things) that constitute its structural identity in the compositional sense, an abstract thing has instantiations (exterior things) that constitute its structural identity in the instantiating sense (the thing is abstracted from its instances as their common property). These are all negative descriptions of a thing. A positive description – a description that gives what the thing *is* – cannot be based on relations and therefore does not exist. Or, if someone wills, it can only be based on the "relation" of self-reference/intrinsic identity. Intrinsic identity is an unstructured/indivisible quality.

As for relations, since these have no intrinsic identity they are only defined negatively, for example by the things (or relations) between which they hold. Thereby is determined the extrinsic identity of relations.

To sum up, the constituents of reality can be classified into these four combinations:[5]

	Abstract (has instances)	Concrete (has no instances)
Thing (has intrinsic identity)	1	2
Relation (has no intrinsic identity)	3	4

Properties (abstracta) that are instantiated by things are themselves things (abstract things), while properties that are instantiated by relations are relations (abstract relations). Some properties, however, can be instantiated by both things and relations (existence, abstractness, concreteness); for these properties it is not defined whether they are things or relations, that is, whether they have an intrinsic identity.

It seems that pure set theory captures all logically possible structures of fundamental relations between concrete things (that is, collections of other concrete things), between concrete things and abstract things (properties), and indirectly also between abstract things themselves, through their instantiations in the form of sets. A set is a collection of objects called members, and a pure set is a set whose all members are themselves sets, all members of its members are sets, and so on, down to an empty set or without end; the complete compositional structure of every concrete thing is a pure set.[6] The relation between a whole and a part is here the relation between a set and its member (or the derived relation between a set and its subset); the relation of similarity can be seen in that the members of the set have something mutually different (and also different from the whole), which are properties that make them distinct parts, and they also have something in common, for example the property based on which they belong to this set (predicate); and the instantiation relation is the relation between a property and a member that has the property. A common property is reflected in the fact that

[5] Let us give an example according to this table: 1 – apple (in general sense), 2 – ten concrete apples, 3 – number ten, 4 – instantiation of number ten as a relation between ten concrete apples.

[6] By pure set theory I mean the collection of all consistent axiomatizations of naive pure set theory with the possibility of "multisets," which are sets that contain repeated copies of their members. Here sets are concrete things because copies are concrete instances of the same abstract set. Naive set theory defines a set by listing all its members or by defining a property that all its members and only its members have. The latter way of definition needs to be replaced by more specific axioms to avoid contradictions. A consistent axiomatization of naive set theory that is sufficiently complex to include arithmetic (such as Zermelo-Fraenkel set theory) would need uncountably many axioms to prove all its truths, as per Gödel's first incompleteness theorem.

structures of the individual members (their structural identities) are similar in a certain way and to a certain extent (they have the same structural feature/property) and thus qualities (intrinsic identities) of the members or qualities of parts of the members are similar too (they have the same qualitative feature/property). Also note that sets cannot be reduced to their members: for example, a set whose members are sets x, y, z is a different set than a set whose members are all members of x, y, z.

Mathematics and logic are inseparably intertwined with set theory. Every abstract mathematical object/structure with its mathematical properties (numbers, spaces, geometric objects, combinations, permutations, groups, functions…) can be interpreted as a pure set, that is, it can be instantiated as a pure set or as a relation between pure sets. Although these instantiations involve things, namely sets, every set is defined here purely relationally, by its members; its intrinsic nature is irrelevant for mathematical purposes. The same mathematical object/structure can be instantiated by different sets or inter-set relations whose structures are similar in a relevant way; it is a structural feature (property) they have in common.[7] Pure set theory is regarded as a foundation of mathematics. (Category theory, which is another foundational system for mathematics, captures the similarity relation between mathematical structures as morphism, a mapping/transformation from one structure to another.)

Logical relations can be interpreted as relations between sets too. Predicate (property) corresponds to the set of all objects that satisfy this predicate (have this property) while subject is a member of this set. Logical deduction is based on the transition from general to particular, hence from sets to their members or subsets, while logical induction vice versa.[8] Logical connective "and" between properties corresponds to set intersection, while logical connective "or" between properties corresponds to set union, and the negation of a property corresponds to set complement.[9] (Other logical connectives can be defined as combinations of "and", "or" and negation.) Proposition is a property with a subject-predicate structure that is instantiated in those possible worlds in which the proposition is true, and application of logical connectives "and", "or" and negation to propositions corresponds to intersection, union and complement of sets of possible worlds.[10]

Science is based on mathematics and logic because it focuses on mathematical/logical relations. Of particular importance in science are causal relations, which are a special case of mathematical/logical relations in the context of the arrow/flow of time, where consequences logically follow from causes (if we use a broad definition of "causes" as initial conditions plus time-invariant structures which we call laws of physics and which manifest in force/acceleration interactions between things in spacetime). Unpredictability/randomness in quantum physics represents an interruption or weakening of causality because some events (measurement outcomes) cannot be derived (deduced) from preceding events and only the probabilities of possible outcomes can be derived. Time can be understood from the structural

[7] Franklin J. (2008): *Aristotelian Realism*, http://www.maths.unsw.edu.au/%7Ejim/irv.pdf, p. 110.
[8] It may appear at first sight that this principle does not apply in such cases where we can deduce a property of a whole from the properties of its parts (e.g. calculate the mass of a whole by adding up the masses of its parts) but such a deduction also assumes general rules that apply to all parts and thus correspond to a set that encompasses the whole.
[9] For example, the connective "and" between properties "red" and "apple" corresponds to the intersection of the set of all red things and the set of all apples. The compound property "red and apple" is instantiated in all the things that are in this intersection.
[10] For example, the compound proposition "Peter watches TV and Paul sleeps" corresponds to the intersection of the set of all possible worlds in which Peter watches TV and the set of all possible worlds in which Paul sleeps. The proposition is true in all the worlds in this intersection.

viewpoint as a certain connected order (sequence) of mathematical structures that are embedded in a space (space itself is a mathematical structure) and this order makes up a more complex mathematical structure with the additional dimension of time – spacetime. The direction of this order ("the arrow of time" from the past to the future) is identical to the entropic gradient of mathematical structures in the order, in accordance with the second law of thermodynamics according to which entropy (disorder and probability of a state) of a causally isolated system tends to increase with time. In other words, asymmetry between the past and the future is the consequence of the fact that later states of a system (mathematical structures in the order) have a higher entropy than earlier ones.[11]

Although reality consists of timeless, eternally existing possibilities (uncreatable and indestructible – logically necessary), among these possibilities are arrangements in certain orders that we experience as time.

3 Consciousness

Science, mathematics and logic give us a rich and useful picture of reality but it seems that something important is missing in this picture – our consciousness. In the 1990s philosopher David Chalmers coined the term "hard problem of consciousness," which expresses the absence of qualities that characterize our consciousness (e.g. the experience of red color, sweet taste, pain etc.) or the difficulties with explaining these qualities in the mathematical-scientific description of reality – in contrast to "easy problems of consciousness," which science tackles relatively successfully and which include the explanation of reactions to stimuli, integration of information, behavior control, functional differences between sleep and waking, verbal reporting of experiences, and so on.[12] According to neuroscience, qualities of consciousness (qualia) are related to spatiotemporal configurations of electrical and chemical signals in the brain (neural correlates of consciousness). If we arrange neurons in a certain way and let them exchange electrical and chemical signals in a certain spatiotemporal configuration, suddenly there appears – as if by waving a magic wand – for example the experience of red color. The mystery is not only why red color, of all things, appears but why anything appears at all. It seems that nothing at all would have to appear and neurons would just keep exchanging their signals.[13]

However, the hard problem of consciousness could be a consequence of the fact that science, mathematics and logic focus on the description of things, which is necessarily relational, and thus they leave aside the intrinsic identities of things, which are relationally indescribable and thus cannot be derived either. There seems to be a natural explanation for the hard problem: qualities of consciousness are exactly intrinsic identities of things, or at least a special kind of intrinsic identities of things.[14] The experience of red color is apparently connected with neural configurations but cannot be satisfactorily described by them. We can describe red color by reference to neural configurations, electromagnetic radiation of a certain wavelength,

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[11] This applies at least in our world, where all physical laws except the second law of thermodynamics (and some very rare radioactive processes) hold in both time directions, hence they describe perfectly reversible processes and thus do not differentiate between the past and the future.

[12] Chalmers D. (1995): *Facing Up to the Problem of Consciousness*, http://consc.net/papers/facing.pdf, p. 1-4.

[13] In science we know properties that do not exist on the level of atoms/molecules but appear on the macro-level, e.g. viscosity of a fluid or temperature. However, these macro-properties can be derived (calculated) from micro-properties, in contrast to qualities of consciousness, whose derivation from the neural micro-structure appears impossible.

[14] This metaphysical view is known as Russellian monism; see e.g.: http://philpapers.org/browse/russellian-monism

tomatoes and various other things that are *not* red color, but it will still not be satisfactory (thanks to these descriptions a person who never saw red would be able to learn about relations of red color to various things but would probably still not know what red looks like). It is because the complete definition of red color is not only negative but also positive, but that is self-referential, ineffable. Red is red – nothing else can be said about what red *is*.

The spatiotemporal structure of firing neurons forms a whole and this whole has its ineffable identity, which might be for example red color (as a concrete quality), or more accurately the experience of red color. It seems that we can only know this ineffable identity by *being* it – by being the spatiotemporal configuration of firing neurons whose ineffable aspect is red color – or by creating in our minds a sufficiently precise representation of it (looking at a bared brain is not enough because sight only gives us part of the information about the neural structure). When we perceive a quality of some external thing, for example the red color of a tomato, the relevant part of the structure of the tomato is mapped via causal relations onto its neural representation in our brain and we are then conscious of the ineffable identity of this neural representation as of red color. The structure of the neural representation, that is, its identity in the compositional sense, should be (significantly) similar in some way to the structure of the tomato and so we can also assume a certain similarity between the ineffable identity of the tomato and the ineffable identity of the representation. But the structure of the representation will also be (significantly) different, not least because it is constituted by neural relations but also because the representation has significant neural relations to other things in our brain which too influence and shape it. So the ineffable identity of the neural representation is different from the ineffable identity of the tomato and we perceive the representation in the context of other things in the brain, which together create our overall conscious experience. Therein lies the difference between "having red color" and "being conscious of red color." If we tried to experience red color as the original (unprocessed) quality of the tomato, this experience would probably be indistinguishable for us from the experience of unconsciousness because the red color of a tomato in itself has no or just negligible consciousness.

Intrinsic identities of things, or a certain subset of them, are a natural candidate for qualities of consciousness because:
(1) qualities of consciousness and intrinsic identities of things are indescribable,
(2) qualities of consciousness and intrinsic identities of things are connected with relational descriptions (in the case of qualities of consciousness, with neural correlates of consciousness).

We can also note further similarities between qualities of consciousness and intrinsic identities of things:
(3) qualities of consciousness and intrinsic identities of things are graded,
(4) qualities of consciousness and intrinsic identities of things can be blended.

By "graded" in point (3) I mean the following. The structure, that is, the structural identity of a thing is inseparably connected with the intrinsic identity of the thing, because both kinds of identity define the same thing. Now, if we changed the structure a little, the intrinsic identity of the thing would change a little too – it would be *almost* the same thing. In the case of consciousness, for example a small change in the wavelength of electromagnetic radiation, and the correspondingly small change in the neural structure, is connected with the change of color into a similar shade.

Regarding point (4): when blending two things, there is a change in their structures into a new but (significantly) similar structure because of mutual causal relations, and the intrinsic identity of this new structure will therefore be similar to the intrinsic identities of both things before blending. In consciousness we perceive blending of qualities in a similar way. For example, if we blend a drop of red color with a drop of white color we will perceive the resultant product as having a different but similar quality – pink color.

If we identify all intrinsic identities with consciousness then the whole reality is conscious (a view known as panpsychism). But we should at least distinguish the level of consciousness, which is connected with the "intensity" of qualities. The consciousness of a stone is probably so weak that from a practical (and moral) view it doesn't even make sense to talk of consciousness. Similarly, there is negligible consciousness on the level of a group of people, although the consciousness of the individual persons in this group is obviously intense. What does the intensity of a quality depend on? On the basis of study of neural correlates of our consciousness it appears that the level of consciousness and thus the intensity of the quality of a thing is connected with the complexity of its structure. There are various measures of complexity and two basic approaches to their formulation are "disorganized" complexity and "organized" complexity. Disorganized complexity is high in those systems that have many different and independent (random) elements, while organized complexity is high in those systems that have many different but also variously dependent (integrated) elements. For consciousness the organized complexity in a dynamic form appears to be important, that is, the joint result of the processes of integration and differentiation (attractive and repulsive forces); it seems that integration strengthens (intensifies) the quality of the whole by more tightly connecting its parts but at the same time weakens it by homogenization of differences which give it novel contributions, while differentiation works in the opposite way, by strengthening the quality of the whole with different contributions but weakening it by fragmentation of the whole. Therefore there are qualities of different intensity on different levels of structure. Our consciousness is in general somewhere between fragmentation into parts and merger into one thing and can flexibly change the intensity of its parts by focusing on some of its contents or relaxing into a less differentiated state.

The ability to differentiate and integrate also appears to be important from the evolutionary viewpoint because it helps the organism to survive and reproduce in a complex and changing environment: in order for the organism to find food, a mate, and avoid or remove threats it needs to identify things on different levels of the composition of reality, that is, intensify certain parts or wholes in its representation of reality by concentrating in them sophisticated causal power (processes of differentiation and integration) so that they can effectively influence its behavior.

As an example of the measure of organized complexity proposed for the determination of the level of consciousness we can mention "integrated information" of neuroscientist Giulio Tononi.[15] The basic principles of this theory of consciousness are that the conscious experience is differentiated and simultaneously unified into a whole (overall experience), to which correspond differentiation and integration of the underlying structure of the conscious system (brain), and a fundamental role is played by the information structure of the system, which is the repertoire of possible states of the system, and by causal relations in the system. Integrated information Φ, which is a quantitative indicator of consciousness, is then the amount of information of the whole that exceeds the sum of information of its parts when they

[15] Tononi G. (2008): *Consciousness as Integrated Information: a Provisional Manifesto*, http://www.journals.uchicago.edu/doi/full/10.2307/25470707

are considered independently. It is maximized on that scale of space and time where parts are tightly integrated and simultaneously richly differentiated. Integrated information theory denies that all things have consciousness as it attributes zero consciousness to systems with zero integrated information. Among such systems can also be complicated computational systems that are capable of imitating our behavior but (in contrast to naturally evolved organisms) do not contain internal feedback circuits.[16] The concept of integrated information continues to evolve in an effort to better capture the connection between information structure and conscious experience.

The human mind as a product of the processes of differentiation and integration, symbolized by the analytically oriented left brain hemisphere and the holistically oriented right brain hemisphere.[17]

[16] Tononi G., Koch Ch. (2014): *Consciousness: Here, There but Not Everywhere*, https://arxiv.org/abs/1405.7089, p. 8.
[17] My interpretation of the cover of Pink Floyd's album *The Division Bell*.

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