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THE NEW VIEW TO WHOLE AND PART IN POST-METAPHYSICAL CONTEXT

Related topics: *probability, information, quantum information*

My departed point is the assessment that plurality in broadest sense characterizing any post- (for example: post-modernity, post-metaphysical, etc.) context is first of all *plurality of whole*. We may speak about *wholes*, ***movement** of whole*, ***and lack** of any universal whole*. Part do not already belongs to whole implicitly granted and common of all other parts. Now we may speak of *parts* in another relation: non of parts as parts of some common of all parts whole, but parts of difference wholes, and at the same time without any universal whole common of all the wholes.

The paper is devoted concretely to the influence of such a comprehension of whole upon some basic notion of physics (especially quantum mechanics and information, relativity) and mathematics, namely probability, set, movement, time. Their changes exert influence upon the fundamental philosophical concepts of being and time, knowledge and being-in-the-world. The new conception of fractal, and its meaning in philosophy points out, too. Constancy and always existing of whole is equivalent to Newton time, energy conservation law, local realism and "hidden parameters" of any correlations, a union of sets exists always if the two sets are granted.

Foremost, changing notions of part and whole tells on that of probability, the latter being defined as (a mathematical) relation between whole and part:

(1) $\mathbf{P=M\{Pa\}/M\{W\}}$, i.e.:

P(robabilty) = **M**(easure of a) {**Pa**(rt) }/ **M**(easure of the) {**W**(hole)}

As the whole is not the same always, information as (a mathematical) relation between probabilities acquires fundamental meaning:

(2) $\mathbf{I=\int P_1 \ln P_2 dP}$

Our new interpretation of that formula is also as describing a change, which may mean such one of part, of whole, and of the both together.

We are going to use the formalism of Hilbert space to differentiate a change of whole from that of part.

So, the basis of a Hilbert space serves as a designation of the whole, and any point in it as such one of a part. Any operator in it represents a change of a part, as it represents a transformation from a point to another.

In quantum mechanics, it was granted that the Hilbert space, and hence the basis is always the same since Hilbert space possesses an infinite number of dimensions. That's why, any common Hilbert space of a system was regarded to be decomposable in tensor product of Hilbert spaces. Vice versa, entanglement in quantum information is defined as such a common space of a system, which is impossible to be decomposed in tensor product of any Hilbert spaces. In that case, we may speak about motion of whole, because no common whole to embrace its subsystems, i. e. that kind of movement can not represented principally as motion of parts (subsystems). In quantum mechanics, whole is always the same, but, in quantum information, whole may be as the same, as different. Quantum information generalizes quantum mechanics in that relation.

Now, let us examine a comparison between the definition of information already given and that of physical quantity in quantum mechanics. The latter is:

(3) $\mathbf{A=\int\Psi(q)\ A\ [\Psi^*(q)]dq}$,

where A is the concrete physical quantity, A is its operator, which must be linear, and Hermitian one. $\Psi(q)$ is psi-function of the micro-object, to which the quantity A is being attached, and q are generalized coordinates. Comparing (2) and (3), and having in mind that complex logarithm function but transforms trigonometric kind of psi-function in algebraic one, we see that they express the same.

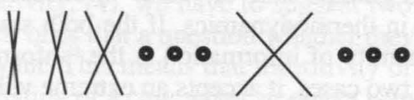
Further, we may construct a comprehension of $\mathbf{\ln[\Psi(q)]}$ as world line in relativity:

Really, there is a transformation, which transfigures the domain of main values of complex logarithm (a multiple-valued function)—for example, with y-coordinates $[-\pi, \pi]$ and any x-coordinates—into the imaginary domain of Minkowski space, i.e. into a "world tube".

More exactly, the following chain of proper domains of complex logarithm:

(4) $\mathbf{[-\pi, \pi], [-2\pi, 2\pi], [-3\pi, 3\pi], \ldots, [-n\pi, n\pi], \ldots}$

into surfaces similar and converging to the light cone, where the x-coordinate is transformed into σ ($\sigma^2 = -t^2+r^2$, σ is space-time distance):



We may draw the following conclusions:

1. Any physical quantity in quantum mechanics, and hence in physics at all, should be interpreted as information. The operator corresponding to the quantity must be Hermitian. In that case, the information and the quantity is a real number. It means that the quantity and information value related to

a given moment of time is impossible to turn out to be different when this moment will be considered as a past moment, i.e. the past is unchangeable, and it is the same as the present.

2. In (2), $\mathbf{lnP_2}$, and in (3), $\mathbf{A\ [\Psi^*(q)]}$, serve to designate a world tube, or in other words, a state of space-time.

3. Information (and any physical quantity) connects whole (for example, given as a basis of a Hilbert space) with part (for example, given as a development in time), or connects whole with its change (for example, given as a Hermitian operator, which displays the way for the whole to be transformed), or also it may connect a part (e. g. given as development in time) with another (again, a development in time, but another). The latter is the case discussed by special and general relativity.

4. So sketched, the information approach allows for quantum mechanics and relativity to be united as different views to the same, namely the relation between whole and part, or the motion of a part towards another, or the change of whole. All those cases are generalized in the following table:

Table 1.

	Whole	Part
Whole	Quantum mechanics (3) $A=\int\Psi(q)\ \mathbf{A}\ [\Psi^*(q)]dq$	Theory of information (2) $\mathbf{I=\int P_1 lnP_2 dP}$
Part	Theory of information (2') $\mathbf{I=\int P_2 lnP_1 dP}$	Relativity (4) $A=\int W1(\sigma).W2(-\sigma)d(\sigma)$

In (4), the one **W**orld line (e.g. $\mathbf{W}_1$) serves as a reference frame, and $\boldsymbol{\sigma}$ is the quantity of space-time distance. The other (e.g. $\mathbf{W}_2$) represents a moving object.

By considering all the four cases as quantitative measures of information, we may find some parallels between them. There is always a starting point: in (3), it is the psi-function $\mathbf{\Psi(q)}$; in (2), the basic probabilistic distribution $\mathbf{P_1}$ [or $\mathbf{P_2}$, in (2')], in (4), the reference frame world line $\mathbf{W}$ (e.g. $\mathbf{W}_1$). It designates a granted state of "zero" information such as the maximum entropy state in thermodynamics. If the both states coincide, then in (2) and (2'), the quantity of information is the "informational entropy" itself; and in the rest two cases, it accepts an extreme value.

It is possible to allude to a connection of space-time as ordering and to a comprehension in the theory of discrete information when **lnP** means number of binary digits to be coded **P**.

We may think about space-time as an "empty ordering" in the following sense. Let us first generalize the notion of set this way: the usually understood "set" is such one when the number of its elements coincide with the number of its position, or its cardinal number coincides with its ordinal number. It is necessary to be introduced "unusual sets" when the number of elements does not coincide with number of elements, accordingly the cardinal with the ordinal number.

If the elements are more than the positions of a set, it will be designated as *chaotic set*. If a set has elements, but it is does not have positions, then it is a *purely chaotic set*. If the elements are less than its position, it is an *ordering*, and if it does not have elements at all, but it has positions, then it is a *pure ordering*. We consider space-time as *pure ordering*. Bose and Fermi particles correspond to chaotic sets and pure orderings, but in energetic space.

Armed by Table 1, we are able to extend the notion of entanglement beyond quantum information as a doubling of basis, which is available in all the four cases although in a different form. Entanglement means that a part is related to two different comprehensive wholes, and that a common whole, which units those two wholes, does not exist. Then, emergent properties of such a system are all of its, i.e. no property of it, which might be reduced to properties of its subsystems. The latter allows for us to differentiate motion of whole as such a motion, which does not permit principally to be represented as motion of part.

In (2) and (2'), if a generalized entanglement is available, there must be two probabilistic distributions mutually absolutely irreducible:

(5) $\mathbf{I = I_0 + iI_1 = \int(P_{10} + iP_{11})lnP_2dP}$, where $\mathbf{i^2=-1}$.

So, complex information is introduced and complex numbers are used as a model of mutual absolute irreducibility. Complex information is always available when no property of a system might be reduced to any properties of its two subsystems.

Returning to quantum information, (3), and properly entanglement, the said suggests that complex physical quantities and non-Hermitian operators corresponding to them must be defined in quantum mechanics and information to describe any entanglement quantities. Of course, it means for unitary to be sacrificed.

In the case of relativity, (4), we have to suggest two different reference frames, however such ones that a question whether they are in mutual relative motion is irrelevant. This means that transitivity of motion is rejected. We have to admit existing of a case when an object is moving in relation to two different reference frame, but it is impossible for them themselves to be said whether they are in relative motion or not. They are as if in relation of incommensurability. Both plurality and incommensurability turn out to be inferable from the idea of wholes, and motion of the latter is irreducible to motion of part.

We may compare the viewpoints of classic mechanics and of quantum information (the quantum mechanics itself takes an intermediate stand):

Table 2.

Assertions:	CM*	QI**
1. The whole is always the same	Yes	No
2. Time is Newton one	Yes	No
3. Energy is conserved	Yes	No
4. Correlation requires for a hidden cause to exist	Yes	No

* **CM**—classic mechanics; ** **QI**—quantum information

All the four assertions are equivalent. The standpoint of quantum information accepts a new kind of motion: motion of whole. Besides, introducing motion of whole, we have to reject some fundamental statements as of set theory as of causality and to reduce them to a special case of identical (or "immobile", "fixed") whole. Those statements are the following:

A. An element remains always the same independent of that, to which set it belongs. In other words, if we move an element from a set to another, then the element remains the same, or any element is independent of that set, to which it belongs.

B. For any two sets, their set theory union (sum) exists. Really, if each of the sets is a subset of a different universal set, and a super-universal set, such one that both the universal sets are its subsets, does not exist, then their union can not exist, too.

C. We will speak about *probabilistic causality* when a correlation without any hidden "deeper" cause (or "parameter") is available. In such a case, if cause is available, then effect is available with a probability $P \leq 1$. The special case $P=1$ is that of classic causality. In the latter frame, if effect is available with probability $P<1$, then a hidden, and "deeper" classic cause is necessary to exist. This is Einstein's point of view who endevoured to reveal an assumed incompleteness of quantum mechanics by means of "local realism" and "hidden parameters". As it is well known, the famous article (1935) of Einstein, Podolski, and Rosen is accepted as the beginning of quantum information in spite of the fact that its conclusions are incorrect since they rest on the precondition of an immovable, fixed whole.

In the general case of probabilistic causality, any motion in time represents some transformation of probability, and consequently, some information and a corresponding number value of its quantity. Since logic is possible to be thought as an inferring in time (premises are as if before conclusion in time, and any inferring in time is similar to causality), then information generalizes not only causality as probabilistic causality but also logic as a theory of information and probabilities understood logically.

In classic physics, time is the universal argument of any function model. Generalizing time dependence as informational dependence, information turns into such a universal argument of any physical change. Informational dependence includes as all the usual time dependences as interactions in time including retro-causality, as also interactions, which are out of time, or in other words are irrelevant to time. However inasmuch as such informational dependences are generally principally chance, then they are a challenge to science, because they are also, and consequently, principally irreproducible phenomena. So-called para-sciences, and the most famous among them is parapsychology, display how it is difficult and maybe impossible for the contemporary science to investigate irreproducible appearances. Informational dependences might be thought as proceeding in non-Newton time ones. Non-Newton time is: non-uniform, structured, inhomogeneous, and as discrete and "spasmodic" as continuous. Since Newton time, and more exactly existing of a continuous group of time-direction translations, is equivalent to energy conservation law (according to "the first Emmi Nöther's theorem", 1918), then its rejecting means also suspending of that, perhaps the most fundamental physical law. Instead of it, we may formulate a new law about information conservation.

A suspicion of long standing about availability of a more general law than energy conservation existed in physics, thermodynamics, and physical chemistry. That suspicion was become pointed by quantum mechanics, and it was turned into a categorical certainty by quantum information. Let us remember some works of Gibbs, Planck, Onsager, Prigogine, and Shahparonov, also the debate between Niels Bohr and Wolfgang Pauli about the validity of energy conservation in quantum mechanics (Penchev 2007). The refutation of Einstein's local realism and of any theory of "hidden parameters', the theoretic and experimental revealing of entanglement phenomena (any violation of the Bell theorem) in quantum information made unprotectable any retention of unitary. The latter remained as a special case when there is no entanglement.

But far-reaching consequences concerning philosophy are not investigated enough, and even such an investigation has not yet started. As an example let us mention but the important conception of subjective and objective probability, which are directly connected with one of the most fundamental philosophical relation, namely that between being and knowledge.

Subjective probability is our waiting (for) happening or not some future (or at least unknown) events. So, subjective probability is always a hypothesis, or an inductive judgment. Objective probability is our knowledge about happening of past or present events. So, objective probability is always an assessment or an empirical (or experimental) judgment. Then, what does it mean for subjective and objective probability to coincide? It means that past and future overlap. Such an overlapping is granted as "present". Really, in the period of present, it is impossible to be differenced subjective from objective probability. Knowledge and being coincide. The length of present is such a measure of overlapping of as past and future as objective and subjective probability. According to Newton conception of time, present is just a point. Consequently, past and future are independent. According to the Christian theologian conception of eternity, in the latter, as past and future as objective and subjective probability, as also being and knowledge coincide. At last, an intermediate case exists between those two extremes, namely the length of present is not zero. When we say that no experience might differentiate subjective from objective probability, we mean just the latter case since no experience out of present, or other words, any experience as an indivisible atom is lasting for some period, in which it is granted for past and future, for objective and subjective probability, for being and knowledge to coincide.

The length of present is neither zero nor constant. It is a relation between the lengths of de Broglie waves of micro-object and apparatus, or in another way, of object and subject, and consequently, as such a relation, it corresponds to some information.

As a conclusion, information is that substance, which is as the substance of knowledge as the substance of being, ant it represents that relation of the indiscernible for any present moment subjective and objective probabilities.

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