*Extended Abstract*

# Concept of Information: The Point of Convergence for Philosophy and Science or the Vanishing Point of Parallels?

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**Abstract.** Science and philosophy parted their ways much earlier than it is usually considered. The sources of the divergence were in their foundations set in the works of Aristotle. His division of inquiry made the explicit double distinction between theoretical disciplines and "other disciplines", and within the theoretical disciplines tripartite division into physics, mathematics and first philosophy (i.e. ontology). Even more important was the implicit distinction between what now we call epistemology and ontology. Every attempt to converge science and philosophy has to transcend the conceptual framework introduced by Aristotle reflecting those divisions. The concept of information defined by the author with the use of the categorical opposition of one and many satisfies this requirement. This new conceptual framework has application to scientific analysis and philosophical reflection. Moreover, language itself which is the means of inquiry can be considered a special instance of the use of the concept of information. Thus, we have the common conceptual framework for epistemology and ontology, for science and philosophy.

## Science and Philosophy: The Origins of Divergence

There is a popular belief that the divergence of science and philosophy began recently, but more careful look at the intellectual history of Europe can trace this divorce much earlier. Thus, sometimes it is associated with the division into the Two Cultures denounced by P. C. Snow originally in 1956, sometimes with the period of popularity of Logical Positivism and its crusade against metaphysics, with the period of the Enlightenment, with the views of Francis Bacon revolting against philosophical tradition in his *Novum Organum* and his promotion of the inductive method, or with the much earlier distinction between philosophers and mere "mathematicians" whose only concern was "saving the appearances".

It was mainly the influence of Aristotle and his philosophical views that, if not immediately, then inevitably led to the divergence. His views on the division of knowledge, which gave the priority to the theoretical sciences over "other sciences" and then divided the former into mathematics, physics and first philosophy (Aristotle, 1955: *Metaphysics* $1025^{b}18$-$1026^{a}31$) contributed to the divorce, but they were not the most important. At least equally important was the less explicit, but equally fundamental division into the two aspects of inquiry expressed in the questions – "What do we know?" and "How do we know?"

The division was reflected later in the pair of parallel divisions in philosophy and science. In the former, it is now reflected into the two domains of philosophical reflection – ontology and epistemology. In science, we have the division into research outcomes (empirical data and scientific theories) and research methodology (inductive methods of proceeding from the data to scientific theories, deriving logical consequences of theoretical generalizations, and their empirical testing). Without any doubt, the division was of tremendous value for the progress of both philosophy and science in the next two millennia. But, the progress had its limits. In modern physics and biology the division into the two initial questions – "What do we know?" and "How do we know?" lost its original sense. For instance, relativity theories and quantum mechanics showed that the answer to the first question depends on the answer to the second. The presence of an observer (human or not) cannot be eliminated from the description of the observed.

These strategic, fundamental divisions organizing the streams of intellectual activity into parallel directions of development had their influence not so much through Aristotle's declarations, but through the conceptual framework of his philosophy, which is present, sometimes in a hidden way or through an apparent negation in the entire later European intellectual tradition. It is this framework which has to be examined when we want to search for the methods for convergence of science and philosophy.

## Problematic Relationship of Science and Philosophy

Since the main objective of this paper is to explore the potential role of the studies of information in reuniting science and philosophy, it is necessary to examine the points where science, especially science in Newtonian and post-Newtonian paradigm (i.e. with the adaptations to Relativity, Quantum Theory, etc.), is in a problematic relationship with philosophy. Some of these problems were already mentioned above, but there are other equally important ones which require examination. The influence of Aristotelian concepts of the four causes and of generation on the way of thinking had its constructive role in the early development of biology, but only to the point when the theory of evolution entered.

This original conceptual framework became even more problematic with the development of genetics and the studies of metabolism bringing back the old question "What is life?" Ironically, the answer given by Aristotle referring to "self-generation", i.e. natural generation, change with the internal source, as opposed to artificial generation (Aristotle 1955: *Metaphysics* $1032^{a}12$-$1034^{a}8$), may seem at first as identical with the answer given by Maturana and Varela when they introduced the concept of autopoiesis, literally self-creation (Maturana & Varela 1980). But, while the terms are basically identical, the actual philosophical meaning of them is fundamentally different.

The examination of the concepts which have been carrying Aristotelian conceptual framework through the millennia and contributing in the past to the progress of inquiry, but reached the point where their role became questionable can help to justify our search for reunification or at least realignment of science and philosophy, and at the same time we can identify the problems, which can be solved with the help of the new conceptual framework of information studies.

**Conceptual Framework for Information**

Thus far there was only reference to information studies without any clarification of their scientific or philosophical status. Here is the key point of the paper. If information studies are supposed to become the point of convergence for science and philosophy, they have to assume the dual role of both. To overcome the divisive tendencies in the comprehension of reality based on the intellectual tradition inherited from the Classical Antiquity, it is necessary to reach to the point beyond the origins of the present conceptualization in philosophy and in science. In order to be a bridge between science and philosophy, the concept of information cannot belong to only one of the separated sides. This is the reason why information, to assume this role cannot be defined in the terms of any specific scientific theory or any specific philosophical system. Of course, we have to prevent trivialization of this concept by reducing it to a common sense expression which through the lack of precision and rigor allows arbitrary interpretations satisfying uncritical intuitive feeling of understanding.

There is a legitimate question whether the task of finding concepts defining information transcending scientific theories, philosophical systems, and escaping triviality of the common sense is possible. The author believes that it is possible and as a justification of his belief gives an example of own definition of information defined and elaborated in earlier publications (Schroeder 2005, 2009, 2011a).

The definition is referring to the categorical opposition of one and many. Categorical are concepts or relations which are most general and which by this reason cannot be defined by any more general genus. They are undefinable. The opposition of one and many belongs to categorical relations (or dual categories) in every European philosophical system, which was mature enough to specify its conceptual limits, from the Pythagoreans, through the Platonism, Aristotelean philosophy, Epicureanism, Neo-Platonism, Scholastic philosophy, to the philosophy of Kant and modern philosophical systems. Of course, it was in the center of attention of the philosophy of mathematics, especially of the set theory at the time of its formation (Schroeder 2005).

There is another aspect of the universality of the one-many relation. It can be found as a central theme of Eastern philosophy in particular in the discussions of the relation between Atman and Brahman in the ancient philosophical schools of Hinduism and Buddhism (James, 1967). The relation between one and many could be described and understood not necessarily as an actual opposition, in Buddhism and Taoism for instance the opposition is considered illusionary. However, the question about its status and understanding is the most fundamental of all questions in every school of thought, and the answer to this question is frequently considered the defining statement of the school.

Thus, when we are using the opposition of one and many as the only concept defining information, we are safely beyond any point of divergence in the conceptualization of reality, and for sure beyond any division into science and philosophy. The cross-cultural universality makes this one-many relation not only universal for human intellectual activity, but also a necessary condition for the comprehension of reality. We can observe the presence of this opposition in languages of the tribes whose cultures remained unchanged for thousands of years, which lack words for numbers beyond one and two, but which have a clear recognition of the opposition of the words of one and of many.

Some philosophical systems have multiple categorical concepts and the one-many relation is not always considered the most-fundamental. Kant for instance gave special role to the categorical concept of time. However, the present author believes that the other categories can be eliminated by defining them with the use of the relationship of one and many. For instance, time can be conceptualized in terms of the multiplicity derived from the change. There is no time, if there is no change. Change requires differences, and differences require some multiplicity to be differentiated. Gregory Bateson observed that "it takes at least two somethings to create a difference" (his fundamental concept defining information as "any difference that makes a difference"), we have to have at least two of something (Bateson 1988: 72). The multiplicity is called usually moments of time, but we can disregard at this point this terminology. On the other hand, time requires unity, as an arrangement of this multiplicity. The arrangement is in the standard conceptualization of time a linear order, and therefore we are making a choice of one of several possible ways the unity is achieved.

## Concept of Information

Information as defined by the author as identification of the multiplicity, i.e. anything that makes one out of, or of the many. One out of the many is a selection of one element out of many, which can be called a selective manifestation of information. Making one of the many is giving the many a binding structure, which can be called a structural manifestation of information. It can be shown that these two manifestations are always coexistent, but for different multiplicities, or as they were called by the author for different information carriers. The degree of the determination of selection (for instance in terms of probability distribution and the value of entropy for this distribution) can be used as a quantitative characteristic of information when we focus on the selective manifestation. The degree in which the structure can be decomposed into a product of components describes the level of integration of information (Schroeder 2009). Both manifestations can be given one mathematical formalism, which due to the high level of abstraction of the concept of information is developed in terms of set theory and general algebra (general closure operators or closure spaces) (Schroeder 2011b).

With the tool of a general concept of information, we can proceed to the analysis of concepts which create problems in aligning science and philosophy, such as concepts of a physical system (isolated or open), the state of such system, inertial reference frame, etc. It may be a surprise that even if they have correlates in the scientific formalism (in the example of a state of the physical system, a point in the phase space or a vector in the appropriate Hilbert space), they are not clearly defined as general concepts.

## Conclusion

Why should we believe that the concept of information, no matter how general and inclusive, when defined as above with the use of the categorical relation transcending the original sources of the division between science and philosophy can help in their convergence? What makes us believe that it will be the point of convergence, not the vanishing point of the parallels?

The author's answer is that the concept of information has an exceptional status. Recent development of science shows that information (defined as above or in a more narrow way) can be used as a fundamental concept which can replace the traditional concepts of ontology such as matter, substance, cause, etc. But, at the same time the inquiry of reality is carried out with the use of language, or languages, if we consider the distinction between natural languages and formal languages of mathematical or logical formalizations. Thus, in the past, the precipice between epistemology which had as its universe linguistic conceptual framework of inquiry within the mental realm ("mind"), and ontology whose interest was in entities of the "physical" realm of objective reality ("body"), was impassable. The concept of information can be applied in both realms equally well. We can develop generalized logic of information with its special instance applicable to the traditional logic (Schroeder 2012), or we can think about information in the scientific terms of its dynamics, for instance to describe the process of computation (Schroeder 2013a, 2013b).

**References and Notes**

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