Materialization and Idealization of Information

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Information is an important phenomenon in nature, society, and technology. This situation brought some researchers to the conclusion that information is physical (cf., for example, (Landauer, 2002)).

At the same time, according to the general theory of information (GTI), information belongs to the ideal World of Structures, which is the scientific incarnation of the World of Plato Ideas or Forms (Burgin, 2011; 2017). This place of information looks contradictory to the assumption that information is physical and to the fact of the incessant presence of information in nature, society, and technology. The goal of this works is to solve this paradox explaining the connections between the ideal and material and further developing the approach to materialization introduced in (Burgin and Markov, 1991).

We begin with the global structure of the world. It is described by the Existential Triad of the World, which consists of three components: the Physical (Material) World, the Mental World, and the World of Structures (Burgin, 2010). The Physical (Material) World represents the physical reality studied by natural and technological sciences, the Mental World encompasses different forms and levels of mentality, and the World of Structures consists of various kinds and types of ideal structures.

While the Physical and Mental Worlds are accessible by human senses, the World of Structures can be achieved only the intellect as Plato predicted (Burgin, 2017). To better understand the World of Structures, it is helpful to perceive its necessity for the completion and elucidation of the interplay between two sensible Worlds. With the stipulation of the increase of sophistication of science and complexity of studied phenomena, the world of ideal structures becomes indispensable for correct understanding of the Physical and Mental Worlds. Starting with physicists, who understood the key role of abstract mathematics for physics, people will begin to comprehend necessity and expediency of the structural reality.

According to the Ontological Principle O2 of the GTI and its additional forms (Burgin, 2010), information plays the same role in the World of Structures as energy plays in the Physical (Material) World.

However, according to the Ontological Representability Principle of the GTI, for any portion of information *I*, there is always a representation *Q* of this portion of information for a system *R*. Often this representation is material, and as a result, being materially represented, information becomes physical. Consequently, a physical representation of information can be treated as the materialization of this information.

Moreover, according to the Ontological Embodiment Principle of the GTI, for any portion of information *I*, there is always a carrier *C* of this portion of information for a system *R*. This carrier is, as a

rule, material, and this even more makes information physical. A physical carrier of information can be also treated as the materialization of this information, or more exactly, the materialization of the second level.

Now we can see that the paradox of the existing impact of such an ideal essence as information in the physical reality is caused by the very popular confusion of information per se, its representations, and carriers.

The difference between a portion of information, its representation, and its carrier is demonstrated by the following example. Let us consider a letter/text written/printed on a piece of paper. Then the text is a representation of information in this text while the piece of paper is a carrier of this information. Note that the text is not information because the same information can be represented by another text.

In this context, the materialization of information has two meanings. First, materialization of information is the process of representing this information by a material object/system. Second, it is a material/physical representation of this information, that is, a result of the materialization process.

Note that material/physical representations of information can be natural or artificial. For instance, DNA is a natural representation and carrier of information while a computer memory is an artificial carrier of information and the state of a computer memory is an artificial representation of information

There is also the process of information idealization, which goes in the opposite direction and is reciprocal but not always inverse to the materialization of information.

Both these processes are formally represented as named sets and chains of named sets. This allows utilization of named set theory as a tool for exploration of information materialization and idealization.

Burgin, M. *Theory of Information*: *Fundamentality, Diversity and Unification*, World Scientific, New York/London/Singapore, 2010

Burgin, M. (2011) Information in the Structure of the World, *Information*: *Theories* & *Applications*, v.18, No. 1, pp. 16 - 32

Burgin, M. (2017) Ideas of Plato in the context of contemporary science and mathematics, *Athens Journal of Humanities and Arts*, v. 4, No. 3, pp. 161 – 182

Burgin, M. and Markov, K. *A formal definition of materialization*, in *Mathematics and Education in Mathematics*, Sofia, 1991, pp. 175-179

Landauer, R. (2002) Information is Inevitably Physical, in *Feynman and Computation*: *Exploring the limits of computers*, Westview Press, Oxford, pp. 76-92