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Ontological Information—Information as Physical Phenomenon †

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Abstract: This paper presents the properties of ontological information. We claim that ontological information is characterized by epistemic neutrality (EN), physical embodiment (PE), and formative nature (FN). We also have formulated the following two corollaries for ontological information: (C1) information is quantifiable; (C2) changes in the organization of physical objects are denoted as computation or information processing.

Keywords: ontological information; information as a physical phenomenon; General Theory of Information

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1. Introduction

We view information from two perspectives, namely epistemic and ontological. In the epistemic view, information is associated with meaning (understood quite widely), semantics, and knowledge. In the ontological view, information is understood as an objectively existing "entity". Epistemic/ontological division is that of John Searle's division of concepts into epistemic (what is known) and ontological (what exists) classes.

What does "physical phenomenon" mean in the context of ontological information? Being physical may be understood in the following two ways: (1) being physical as in matter, electrons, or substance, or (2), being physical as in forming or shaping physical phenomena. We claim that ontological information relates to physical phenomena in the second sense.

Ontological information denotes information conceived as a natural phenomenon, i.e., an element of the physical world. We will refer to such information with the predicate that "ontological" should be thought of as "ontological information", as well as by the indexed term "informationo."

The properties attributed to ontological information [1,2] reflect its physical nature. We claim that ontological information is characterized by epistemic neutrality (EN), physical embodiment (PE), and formative nature (FN). We must state that this study does not claim to have discovered of physical nature of information; it has been done by many researchers already. However, the previous studies, while recognizing the physicality of information, did not try to establish its comprehensive, minimal set of properties. This study is trying to do is to fill in that gap, i.e., this study is attempting to establish the set of properties that can be attributed to such information.

2. Properties of Ontological Information

Epistemic neutrality (A concept is "epistemically neutral" when it does not have intrinsic epistemic importance, or in other words, it does not mean anything by itself) (EN) means that informationo has no meaning by itself. From specific ontological information, an agent may derive some value or meaning that has significance for that agent's

existence or functionality. The same ontological information may result in different meanings for different agents. Likewise, this information may have no meaning at all to some agents. An agent can, in principle, be any system, whether organic or artificial, if it senses ontological information.

The property of physical embodiment (PE) means that informationo is a physical phenomenon, i.e., it is subject to physical laws. Further, informationo may be conceptualized within a matter-energy-information complex (The matter-energy-information complex has a status of conjecture, not theory) (one not directly implying Aristotelian hylemorphism), and it is fundamental to nature (i.e., whatever exists physically contains information). The claim that "ontological information is a physical phenomenon" means several things. Ontological information is not an abstract concept in the way that mathematical objects, ideas, or thoughts are abstract. Ontological information does not belong to the Platonic realm of Forms in either the classic or neo-Platonic sense. Ontological information is real, observable, and measurable. Thus, we can claim that information exists much like other physical phenomena exist, because it exhibits the same class of properties (quantifiability and operational properties) as physical phenomena do. Furthermore, it seems that whatever exists in a physical sense contains information, so there is no physical phenomenon without information.

Finally, the property of formative nature (FN) means that information is responsible for the organization of the physical world, i.e., information is expressed through structures/forms and the organization of things (The synonymity of the terms "structure", "form", "organization", and "information" should not be accepted as a priori despite the fact that these terms are often used synonymously), but information is not structure itself. Organization is a fairly broad concept that may be, and is, interpreted as structure, order, form, shape, or rationality (if perceived by a cognitive entity). We do not posit that information is structure, although this has been claimed several times. The problem with such a statement is that we do not know precisely what a structure is and what kinds of structure we would associate with information, as well as how this would be achieved. Information is certainly not the visible structure or shape of an object, but we concede that the shape or structure of an object is how information discloses itself or how we sense its presence. Thus, the shape of a teacup is not information, but information is being expressed in the shape of a teacup.

We also have formulated the following two corollaries for ontological information: (C1) information is quantifiable; (C2) changes in the organization of physical objects are denoted as computation or information processing. These claims are less fundamental than the three properties (EN, PE, and FN) and they are open to larger discussion with regards to the metaphysics of reality, which we try to avoid at this stage.

Corollary C1, namely that information is quantifiable, is supported in almost every study we reviewed. Functions quantifying information are almost foundational to the idea of information, even if they do not represent what information is, but rather, how it discloses itself. These quantifications are used to measure certain utilitarian aspects of information, such as optimal communication channel coding, error recovery, optimal computer program size, and such like. They play very important roles in a variety of aspects, but they do not explain the nature of what they seek to quantify.

Corollary C2, meanwhile, states that changes in the organization of physical objects can be denoted as computation, but what does this mean? Computing refers to information processing, and most would agree with this. Computers process information (i.e., they compute). This is quite often one of the definitions of what computing is. This would be a generalization of the concept of computing conceived as symbolic processing. Whether such a generalization may be defended against orthodox views (i.e., computing is what TM models do), a consensus has not yet been achieved.

The analysis of studies of ontological information [1,2] shows that the three properties (P1, P2, and P3), plus the two corollaries (C1 and C2), are good candidates for a minimal description of ontological information. Future research may change this view.

A more thoroughgoing discussion of ontological information is provided by Krzanowski's study [1]. The study also addresses other issues connected with the concept of ontological formation, such as the relationship between ontological information and the GTI Theory of information [3], other models and theories of information [4], the concept of data, infons [4], natural information as defined by [5], epistemic or semantic information [6], abstract-concrete dichotomy [7], Popper's Three Worlds [8], and its relationship with such proto-information concepts as, Tao, morphe, and Leibnitz' monads. Burgin's GTI theory of information [2] is particularly critical to the concept of ontological information as it establishes its causal properties, something not explored in this study.

3. Further Studies

The study leaves several questions open about the nature of ontological information. The problem of "the conservation of information" as should be studied, specifically in connection with the relation between laws of nature and ontological information. This problem has been suggested by the writings of Carroll [9] Next, the meaning of the claim that information is fundamental to nature should be clarified. Fundamentality of information has been suggested in the writings of Heller [10], Dodig Crnkovic [11], and Stonier [12]. Last but not least we should ask whether ontological information implies some form of modern hylemorphism? A link between hylemorphism and information has been suggested by the writings of Polkinghorne [13] and Turek [14]. The problem of the nature of information, matter, and energy has resurfaced in the works of many authors (see the references in this paper) and they all seem to echo Aristotelian metaphysics.

A more detailed list of questions can be found in [1,2].

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