Contribution to the Ontological Status of Information: Development of the Structural-Attributive Approach

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Abstract

This paper proposes to appeal to the structural-attributive approach to help establish a useful ontological categorization of information. Specifically, it argues that a framework for library and information science (LIS) based on Stonier's theory of information would be helpful, with the intention to advance one of the unfinished dialogues of LIS, the so-called Wiener's problem, or *statutum ontologicum*. This proposal advocates the possibility of developing a theory based on the assumption that information is a basic property of the universe. Stonier's perspective is an evolutionary type, so the basis of this research is interdisciplinary, such that his ideas can help describe the development of society in the information age. It also explains the two main categories or forms of information, which Stonier called "applied," for the library scope. In other words, there are the information *contained in a system* and the *transformed and processed* information. He argues that information is an ontological category that exists independently of being perceived. This paper asserts that information characterizes the world in itself, since it is through it that all knowledge is obtained.

Introduction

In the epic poem *Metamorphoses*, Ovid narrates: "Before there was the sea and the earth and the sky which covers everything, / Nature appeared the same throughout the whole world." This extract is an appropriate epigraph for the trilogy of Tom Stonier. While it is true that nature reveals a face from so-called chaos, the meaning for this *chaos* (this "confused and unordered mass of things") is not similar to *entropy* (a function of disorganization or disorder, a loss of organization or a loss of structural information).

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The original Greco-Roman definition of *chaos* established it as the origin of the world of time, space, energy, and, of course, information —that is, the Gaia. In this sense, entropy is simply the measure of a change in organization, not necessarily an opposite concept.

For Charles Sanders Pierce (2012), this chaos is a dynamic and complex system, an amalgam that joins the characteristics of mind, matter, force, and life. Also, chaos had an additional attribute: to give form. The Latin concept *informatĭo* (giving form) was related to the ancient Greek concepts *eidos* and *morphé*, which literally mean "form, figure, image." These were used in different ways, the first in a philosophical sense (shaping the thought, conform, configure), the second in a technical and material sense (as Vulcan forging the iron). Transitive verb "*formo, -āre*" expresses "giving form, conform, construct, organize, shape." On the basis of the etymological root *inform-*, it is possible to clarify the idea of instilling a "form" on the receiver of the action; the form is an organization, the configuration of a structure (content). In the classical concept, the two natures coexist: material origin and mental representation (Von Weizsäcker, 1962, pp. 47–62).

Wiener's problem is expressed many times through the pattern of an overriding physical representation (Floridi, 2004b, p. 572). Although Stonier analyzed authors like Ralph Hartley and Ludwig Boltzmann (influences on the later work of Shannon), his opus cannot be pigeonholed only in the category of physicalism. The "professor of futurology" said that information is a physical property of the universe, and actually that is, in part, a claim that establishes that information is as real as matter and energy. For example, according to Stonier (1992) and Devlin (1992), the basic units of information are the *infons*, but those "would not show up in any traditional physics experiment since such particles would possess neither mass nor energy—they would, however, manifest their effect by changes in organization" (Stonier, qtd. in Furner, 2014, p. 164; Stonier, 1992, pp. 10–11). The structural-attributive approach does not believe restrictively in either material or immaterial reality because it recognizes both realities. Both Devlin and Stonier think that we should not research the substance without seeing the form, the structure, the order, and the interrelations of the various parts.

Stonier's vision may seem physicalist, but his position with respect to information (to disciplines like LIS) is of the noetic type. The physical implementation is just one of the "faces" of the information. Some disciplines expose primarily its "physical face" (as computer science), but this does not imply that it is the only face. According to Stonier, the physical representation of information is only a first approach to its study. His intellectual position contributed to giving shape to a new conceptualization of knowledge organization, and he also changed the traditional concept of *library service*, seen as a service in situ. Stonier (1990) spoke of a

service without limitations of physical space, a logical space determined by the organization of information flow (pp. 181–182; see also Floridi, 2011, pp. 166–168).

As an information theorist, Stonier (1990, p. 1) clarified that energy and matter involve only the surface structure of the universe, which is easily perceived by our senses and is only an interface with which we interact. There is information that is not easily perceived, but no less real. Information is in another plane of existence as the *internal structure* of the universe, but it is as real as the *surface structure*; in fact, without the internal structure, it is impossible understand the surface structure. Both coexist, or rather "exist as a dynamic interaction"; both are two sides of the same coin (as an Aristotelian hylomorphism). The information "is generated in the reflective medium of the system in relation to both internal (structural) and external (environmental) processes" (Faucher, 2013, p. 27; see also Farina, Bogaertb, & Schipania, 2005).

Of course, this internal structure appears as a metaphysical conceptualization. This category is nonverifiable (Floridi, 2011, p. 245). From a metaphysical standpoint, Dretske (2008) established that information is delivered directly or indirectly from the objects that contain it and with which we interact. Martins (2005) noted the "syndrome of physics envy": that science is merely physics. Stonier's metaphysical realism is actually an ontological realism: through science, we can get closer to that internal reality (Fresco, 2013). It is very risky to say that information is an ideal entity that does not exists in our world or is impossible to discover. Perhaps this conceptualization serves to abandon first-level ontology; it is also risky to state that information is an underlying structure that forms and shapes the way we think about the world.

Stonier's (1990) vision regarding information is of the realistic type, meaning that it exists independently of human intelligence and beyond the world of phenomena (the objects, insofar as they appear and are known). The realist position is not limited to studying the biological or physical information: "The book contains information whether it is read or not. The information is there even if it is not transferred to a human reader" (p. 21). He does not deny that the information in libraries should contribute to strengthening the cultural and intellectual life of the community and develop an intelligence infrastructure based on goal achievement (conceptualization knowledge organization). Regarding this, Stonier says that "information *exists*. It does not need to be *perceived* to exist. It does not need to be *understood* to exist. It requires no intelligence to interpret it. It does not have to have *meaning* to exist. It exists. . . . Information is a quantity which may be altered from one form to another. Information is a quantity which may be transferred from one system to another" (pp. 21, 26; emphasis in original). A general theory of information should represent the subtle character of the internal structure (while recogniz-

ing the surface structure) and epitomize, in the words of Hegel (1978), a "secret revolution that is not visible for all" (p. 149).

On the Structural-Attributive Type of Information

Flückiger (1999) describes two categories of information theory: *structural-attributive* and *functional-cybernetic*. Hofkirchner (2011) says that information is created "if there is a surplus of effects exceeding causes in a system. Information occurs during the process in which the system exhibits changes in its structure, or in its state, or in its behavior" (p. 54). The first category, structural-attributive, is represented by MacKay and Stonier as a key structure for understanding human nature (Doucette, Bichler, Hofkirchner, & Raffl, 2007). MacKay (1969) held an epistemological position in which *information* is a kind of knowledge while a *datum* is potentially significant because when "we have gained information, when we know something now that we did not know before; when 'what we know' has changed" (p. 10). Zins et al. (2007) state that "according to Stonier [1993, 1997], data is a series of disconnected facts and observations" converted into information (unit of difference) "analyzing, cross-referring, selecting, sorting, summarizing, or in some way organizing the data" (p. 11). When these data are connected, Furner (2004) talks of "information-as-action" and "information-as-process" and defines *information* as "sequences of events that involve humans either as agents (subjects) or as patients (objects) or both, and that may thus be treated as acts or actions" (p. 442). This information can be constituted into a coherent body of knowledge. Knowledge consists of an organized body of information and forms the basis of the kinds of insights and judgments that we call "wisdom." Furner also uses the category of "information-as-universal," which includes conceptions of information that apply the term to certain attributes, or properties, of objects or events. Floridi (2004a) adds the following comparison:

> The following analogy may be helpful, even if it is not really fair to the philosophical thesis at stake. Imagine looking at the whole universe from a chemical level of abstraction: you are 70% water and 30% something else. Now consider an informational level of abstraction. You are 100% a cluster of data. More precisely, you (as any other entity) are a discrete, self-contained, encapsulated package containing (i) the appropriate data structures, which constitute the nature of the entity in question: state of the object, its unique identity, and attributes and (ii) a collection of operations, functions, or procedures, which are activated by various interactions or stimuli, namely messages received from other objects or changes within itself, and correspondingly define how the object behaves or reacts to them. (p. 664)

Beginning with the Boltzmann constant and Schrödinger equation, Stonier (1988) studied the order/disorder phenomena, as inverses. He

argued that the content of the structural information of a system is a function of order because it is a measure of the quantity of two open and antagonist systems: *structural information* and *organization* are directly and linearly related. Although Stonier's entropy corresponds to the thermodynamic equilibrium, he subsequently extrapolated it to implications about the order of living organisms, both in the constitutive structure of the attributes of human intelligence and in the future life of the species. The speculations of Schrödinger and Stonier made it possible to see information from a completely different theoretical perspective. This new way of understanding information is similar to what Cassirer (1989) had indicated at the time when Wiener worked out the principles of cybernetics: "Between the receptor system and the effector system, which are to be found in all animal species, we find in man a third link [intermediate link] which we may describe as the 'symbolic system.' This new acquisition transforms the whole of human life" (p. 47). In Stonier (1990), this "symbolic system" can be the letters of the Latin alphabet or the nucleotides of a DNA fragment (pp. 61–65). Wiener (1985) wanted to refute the materialistic positions of thinkers like Shannon and Stonier and declared that "information is information, neither matter nor energy" (p. 165). However, any system that maintains organization contains information; the higher organization of a system, the larger its information content.

Burgin (2002) considers that the structural-attributive theory does not represent information as such, in itself, so he prefers to talk about "information carrier." Stonier thought that human information may have a physical reality of its own, apart from its human origin, and that the message simply comprises a data pattern underlying on carrier. Burgin seeks to establish some axiological and ontological principles for a general theory of information, saying that

> the principal achievement of the general theory of information is that it explains and determines what information is. The new approach changes drastically our understanding of information, this one of the most important phenomena of our world. It displays that what people call information is, as a rule, only a container of information but not information itself. This theory reveals fascinating relations between matter, knowledge, energy, and information. The general theory of information is built as a system of principles that represent intrinsic properties of information and information processes. The set of the main principles consists of two parts: basic ontological and basic axiological principles. Basic ontological principles . . . reflect the most essential properties of information as a natural, social, and technological phenomenon as well as regularities of information functioning. This provides a foundation for the development of the general theory of information. (p. 2)

Burgin (2003) argues that *structural information* can be divided into three main types:

- *External*: An external information measure reflects the extent of exogenous changes; for example, the extent of changes in the environment of a system. This information measure (similar in some ways to the functional-cybernetic approach) is referred to by some authors as the "value of information."
- *Intermediate*: An intermediate information measure reflects the extent of changes caused in the links between a system and the environment of this system.
- *Internal*: An internal information measure reflects the extent of endogenous changes caused by a system; for example, the change of the length (the extent) of a thesaurus (p. 149).

Stonier (1989) says that "what mass is to matter, or momentum to mechanical energy, organization is to information" (p. 43). Entropy is the measurement of a change in organization and not information's adversary (Faucher, 2013, pp. 27, 34).

Information and Meaning

On this topic, Stonier's (1990) main thesis says that "'information' is not merely a product of the human mind—a mental construct to help us understand the world we inhabit—, rather information is a property of the universe, as real as are matter and energy" (p. 107). Information and meaning are not the same: "The information conveyed by a book is a function of the intellectual information environment present as knowledge structures already existing inside the reader's brain" (p. 22). Namely, our mental perception does not determine that something contains less or more information: the information is there. The fact that we cannot comprehend a text in another language does not mean that there is no information but rather that our minds cannot interpret it; although the "reader" does not fully understand the message, anyone can recognize the letters, and the book still makes sense on two levels: the book as an object, and the letters as signs. The reader does not understand the message but knows that the letters represent a message; for example, that lyrics belong and structure a code. Further, recall the anecdote of the Pioneer 10 space probe and its "interstellar message in a bottle." The satellite carried an aluminum plaque anodized in gold that showed some diagrams: a hydrogen atom; an schema of the relative sizes of the planets in our solar system (noting the place where the satellite was launched); figures of two human bodies, male and female, the male's hand raised in greeting. NASA's intention was that, the satellite traveling beyond the confines of the solar system and arriving at a place with intelligent life (perhaps millions of years from now), an alien race might encounter the ship and know something about life on planet Earth. The curious aspect of this story is the unlikelihood that these extraterrestrial beings could fully understand

the message. How could they know that the hand signal was a greeting and not a threat? Maybe the message could be assumed by patterns of organization. The fact is that the information was there independently of patterns, as "latent information" (so to speak), regardless of any possible intelligence to interpret it. As Stonier (1990) says, "Information exists. It does not need to be perceived to exist. It does not need to be understood to exist. It requires no intelligence to interpret it. It does not have to have meaning to exist. It exists" (p. 21). "Meaning is achieved when the perceived information can be put into a context; information becomes meaningful only if it can be analyzed, compared and integrated with other information which already exists within the perceptor system" (1991, p. 261).

From the above examples, three mutually exclusive positions can be identified, restructured as Stonier's (1990) trilemma:

- The information carriers (aluminum plaque, the book, the roll) contain no information *if it makes no sense to anybody.*
- The carriers contain a sort of information, which however does not constitute real information until somebody can comprehend it.
- The physical structure of information carriers contains information (*surface structure*) even though its message (*subtle structure/internal structure*) conveys no information (pp. 23–24; emphasis added).

Consider also the positions of Floridi (2005) related to *false information*, which enhances the vicissitude of "information as internal structure":

- False information could have been genuine information had the relevant situation been different (counterfactual).
- False information can include genuine information.
- False information can entail genuine information.
- False information can still be genuinely informative, if only indirectly.
- False information can support decision-making processes.
- False information is meaningful and has the same logical structure as genuine information (pp. 361–362).

Floridi indicates that the information cannot be *dataless*, and also explains which types of data constitute information: primary data, metadata, operational data, or derivative data (p. 354). But to differentiate between *information* and *meaning* (sense/significance spectrum), raises the question: What kind of data do we need to have an idea of the horizon of interpretation? (Priani, Flores, Galina, Gómez, & Ocampo, 2013, p. 250).

From another point of view, Capurro, Fleissner, and Hofkirchner's (1997) trilemma (a trilemma of information) is a conditional for a unified theory of information (not as dogma). They propose a "dialectical informatism" that strives to return to the etymological definition of *informatĭo* or *informātio*, which means "concept, configuration, conforma-

tion," and the suffix "-tion," which indicates a final action. This trilemma exposes three ontological perspectives of the world, with their respective disadvantages:

- *Univocity*: The concept of information means the same in *all* areas. Disadvantage: reductionism.
- *Analogy*: The concept of information has its original meaning in *a* field (for example, human communication), and it only applies analogously to other levels. Disadvantage: anthropomorphism.
- *Equivocity*: The concept of information has different meanings in different fields. Disadvantage: Babel syndrome, speeches, and scientific theories are mutually encapsulated (pp. 213–215; see also Fleissner & Hofkirchner, 1995).

Univocity implies a single discipline, namely, a single object of study, intentions, and procedures; *analogy* involves an interdisciplinary regime; and *equivocity* promotes multidisciplines by which the object of study would be shared intent and procedures but would differ. Saračević (1999) possibly would opt for the *analogy* because he argues that

> "information" has a variety of connotations in different fields. For instance, from the standpoint of physics and biology, a number of highly ambitious (and as yet unsuccessful) attempts have undertaken to explore information as a basic property of the universe. . . . In psychology, information is used, at times, as a variable dealing with sensory perception, comprehension, or other psychological processes. These senses of information are very different than the one in information science. In some fields, information science included, the notion of information is broadly associated with messages. For this sense, a number of interpretations exist, which are assumed in different theoretical and pragmatic treatments of information. We can present them as related, but differing manifestations of information in an ordered sequence or a continuum of increasing complexity. (p. 1054)

Saračević proposes some categories that oscillate between a *lato sensu* and a *strictu sensu* (similar to the notation of the thesaurus):

- *Narrow sense*: Information is considered in terms of *signals or messages for decisions* involving little or no cognitive processing, or such processing that can be expressed in algorithms and probabilities. Information is treated as the property of a message, which can be estimated by some probability.
- *Broader sense*: Information is treated as directly involving *cognitive processing and understanding*. It results from interaction of two cognitive structures, a "mind" and, broadly, a "text." Information is that which affects or changes the state of a mind. In cases of information services, information is most often conveyed through the medium of a text, document, or record.

- *Broadest sense*: Information is treated in a context; that is, information involves not only messages (first sense) that are cognitively processed (second sense) but also a *context*—a situation, task, problem at hand, and the like. Using information that has been cognitively processed for a given task is an example (p. 1054).

The language of a discipline occupies an important place because it is the tool with which concepts are designated. The concepts are the meanings of various logical and grammatical forms and statements of speech. Therefore, we should aspire to own adequate and accurate terminology. We can say that the correct formation, introduction, and standardization of terms contribute to further development of a particular field of knowledge. We should avoid *equivocity* (tautologism and relativism) so that we do not fall into confusion, vagueness, ambiguity, and a lack of meaning; it also means the danger of creating confusion if the criteria for cataloging and classifying are not unified.

Stonier (1992, 1997) distinguishes between *information* and *meaning* (as does Bateson, 2000); the spectrum that divides them is determined by a magnitude of variation or significance—namely, between *tangible information* and *mental interpretations*. Just as Stonier notes the dissimilarity between information and meaning, Floridi (2002b, p. 137; 2004b, p. 563) does the same with the concepts *information flow* and *knowledge*, saying that the first "operates at a much more basic level than the acquisition and transmission of knowledge" (2008, p. 127). For him, *information* is an elusive notion though at the same time a powerful conception. Although it is less definitive than knowledge, so that it is a "lock-pick" concept (2007, p. 48) inasmuch as it can be associated with several explanations, one can dispose of it for privileged access to other concepts (2002b, p. 137). "Information is acquired, for example, without one's necessarily having a grasp of the proposition which embodies it" (Dummett, 1993, p. 186; cited in Floridi, 2002b, p. 141). In addition to the above, present in the Floridian discourse are the rules of engagement between information and reality (2012, p. 215).

Library and Information Science (LIS)

The relation between LIS and the concept of *information* is interlaced by notion of *organization*. Regarding this, Stonier (1990) develops the following theorems:

- All organized structures contain information; as a corollary, no organized structure can exist without containing some form of information.
- The addition of information to a system manifests itself by causing a system to become more organized, or reorganized.
- An organized system has the capacity to release or convey information (pp. 25–26).

The organization of information and the structural-attributive perspective not only refer to the *physical structure* of biological information or energy, but the organization of information is also found in applied issues (the applied part of the general theory of information). This organization is the order of *subtle/internal structure*. According to Bates (1999),

> In applied information science, we find ourselves primarily concerned with the form and organization of information, its underlying structure, and only secondarily with its content. In the sciences and humanities, it is the content that is of dominating concern. In fact, the organization of the information they are using is usually virtually or entirely invisible to the practitioners of those disciplines; they have simply never thought of it, never realized that extensive and intellectually demanding work is needed to develop index and database standards, to select and catalog resources, etc. . . . The average person, whether Ph.D. scholar or high school graduate, never notices the structure that organizes their information, because they are so caught up in absorbing and relating to the content. And, in fairness to them, they are not interested in the structure. *We* are interested in the structure. As a practical matter, when one does the work to gather, store, organize, retrieve, and disseminate information—the classic elements of the formal, above-the-water-line paradigm definition of information science—one necessarily gets involved with understanding and manipulating its form, structure, and organization. One's attention is drawn, again and again, to these features of the information, simply to get the job done. (pp. 1044–1045)

In the above extract, *information* is an abstract force that promotes organization in systems of all kinds: physical, biological, mental, and social, including records in libraries and documentation centers. Bates (2005) presents two definitions of *information*: the pattern of organization of matter and energy; and some pattern of organization of matter and energy given. She also finds a difference between *information* and *meaning*, expressed in the idea that in the cognitive process, information *gives* meaning, not *is* meaning; that is, information has "no inherent meaning." Information contributes to the forming of insights, judgments, and social attitudes (Stonier, 1983, pp. 124–125). For Stonier, knowledge is composed of structured things, the so-called information structures.

Information Flows and Space

In the third-phase transition of LIS, electronic media wrought substantive structural modifications in libraries, exemplified by the slogan "service more than a place." New technology did not replace libraries but increased their dependence on networks (Baker, 2003; Neustadt, 1981; Nitecki, 1993). The library and its components were redefined; collections changed their size and how they were disseminated, and how information was transmitted. The nature of the object of study was re-ontologized.

For Stonier, the traditional concept of *library service* is not encapsulated by the physical space; rather, it is determined by the wide spectrum of

"information flows" (material or immaterial, organized or chaotic) and by logic (dynamic, epistemic, modal, local) through an order or organization in a system. For Bates, in contrast, information *is* the order in the system. Consistent with Barwise and Seligman (1997), Floridi (2004b) said that the information flow is understood as "the carriage and transmission of information by some data about a referent, made possible by regularities in a distributed system" (p. 562). For Stonier (1997), the word *regularities* refers "to the purely structural properties that any such theory must satisfy. Any theory with these properties can be obtained from a suitable classification" (p. 117). For him, a book is able to convey a lot of information because the information has meaning for us. The reason that the information has meaning for us is that we are able to place the information conveyed into a personal context. A book not only *contains* much information, it also *conveys* much information. For example, Stonier, Ottley, Silverstone, and Steele (1990) describe what an electronic library would (or should) be:

> The library will hold material in digitized form and its users will communicate with it over a telephone link or a coaxial or a fibre-optic cable. Its purpose is to supply its users with copies of textual, audio or video materials on request. Because supply is effected by sending a digitized signal down the communication link, and the original does not leave the possession of the library, supply is not strictly a loan any more than the issue of a photo copy of a request article. (p. 176)

Can seeing an informative coexistence between the physical structure and other structures be more "subtle"?

Of course, our image of a library is based on the *surface structure* (physical world); even the virtual library is based in the physical world. Nonetheless, digital information is not as easily noticeable as is a conventional book; digital information is much more subtle, since we cannot interact with this information (kinetic information) without an interface, but only with superficial information of the material disc or the polyethylene of a USB drive (structural information), not with its *internal structure*. As Lyre (1996) writes,

> For this purpose one has to be aware of the difference between *syntactic* and *semantic information*. I call syntactic information an *amount of structural distinguishability* which can be measured in *bits*. Beyond this the semantic aspect of information takes care of the fact that information only exists under a certain concept or on a certain semantic level. For example, a letter printed on a paper refers to different amounts of information if it is regarded under the concept "letter of an alphabet of a certain language" or under the concept "molecules of printer's ink." (p. 2224; emphasis in original)

Dretske (2000) argues that we can interact with certain objects much more easily than others. Just remember the example of a bacterium and a cow: the bacterial agent requires a microscope (interface).

Forms of Information

Stonier (1991) distinguishes between *structural* and *kinetic information*. Structural information is contained by a system; kinetic information is transmitted, processed, or transformed. The following example concerns not the book but the library. We can establish that the structural information is the building, consulting rooms, the organization (involving the division of departments, as well as the shelving, which is but an objectification of cataloging rules), architecture, and so on—namely, space, place. Kinetic information is latent information contained in and the foundation of all organized documents; it is transmitted through services and determined by some logics (dynamic, epistemic, modal, local) (pp. 259–260).

In the case of the evolution of the printed book to an electronic one, we can see a structural change, but kinetic information remains. Furthermore, this latter form implies new forms of information flows and even new services. As Slavkovský (2013) establishes:

> While the relation between information and alignment or inner organisation of a system is obvious, postulating information as another physical constant is a more challenging intellectual endeavour. For example, if we take matter organisation, a book is a material containing aligned areas, with each area carrying a certain set of colours and forms we recognise as specific characteristics by a human eye. Modern electronic e-book readers enable identical ways of text reading, while using only one allows visualizing the information saved in a much more economical way—in a form of tiny areas using electromagnetic qualities of the materials. (p. 55)

A system can only interact with its relevant environment according to the dynamics of its own structural organization.

Rocchi (2013, pp. 3–4, 45–47) recapitulates the different forms of informational theories: statistical, semantic, algorithmic, descriptive, pragmatic, autopoietic, hierarchical, dynamic, physical, and others. According to Rocchi, Stonier's approach (the "organizational") is seen as the product of the interaction between material signs and human interpretations; he took the same approach, proposing a framework for a unified understanding of information in various domains.

Swedish librarian Taeda Tomic (2010) shares the following reflection:

> Information science is not a discipline with clear boundaries that would in a unified way describe its research questions, theories and methods. It is rather a complex, dynamic field that addresses many different research problems grounded in a variety of theories and methodologies. This results in a plurality of *theoretical and methodological sub-domains of information science*. . . . What is the relation between the knowledge bases of these sub-domains? Does information science necessarily develop through the plurality of theories and methodologies each of which analyses some particular dimension of information? Are these different approaches related to each other; and if so, in which way? Is it

> meaningful to see the diverse theoretical and methodological frames as sub-domains of a unified theory of information science? Is there any need for such a unifying theory of information science? (n.p., emphasis in original)

Herold (2001), meanwhile, says that "these endeavors to unify information theories are themselves beset by the staggering diversity of research, such as within the Foundations of Information Science movement." The general theory of information of Stonier promotes organization in systems of all kinds: physical, biological, mental, and social, including recorded information (Rocchi, 2013, pp. 132–133). Data, which for Stonier is a series of disconnected facts and observations, is understood by Floridi as simply a lack of uniformity—a noticeable difference or distinction in something in line with Bateson's (2000) "a difference which makes a difference" (p. 272). According to Robinson and Bawden (2014), for Floridi, "to count as information, individual data elements must be compiled into a collection which must be well-formed (put together correctly according to relevant syntax), meaningful (complying with relevant semantics), and truthful; the latter requires a detailed analysis of the nature of true information, as distinct from misinformation, pseudoinformation and false information" (p. 133).

In her inquiry, Tomic (2010) points out that the nature of a unifying theory for LIS must be metatheoretical, which "would study the ways in which the varying sub-domains deal with the phenomenon of information. A unifying metatheory would also analyse the possibilities of relating the different sub-domains, and their results, to each other" (n.p.). Consistent with Floridi (2002a, pp. 42–43), who uses a metatheoretical analysis for determining the degree of relevance of some semantic information, the metatheoretical perspective will allow us to distinguish the identity of LIS as a system of knowledge and to differentiate it from other areas of knowledge. No longer is it an amorphous situation in which the LIS has some indeterminate boundaries and crosses over into the territory of other disciplines or vice versa. Librarians have full awareness of its importance, at the same time as they try to build a link between innovation and tradition. According to Tomic, it seems that this unifying metatheory is the philosophy of information.

Present in both Mikhail Bakhtin and Peter Burke is a condition that is "polyphony." At its foundation, LIS has multiple voices in its diversity of research and proposals, and I believe that the philosophy of information is not simply one more voice that adds to the concert of voices but rather an overriding voice that comes to orchestrate all the other voices. Thus, a general theory of information should be a polyphonic theory. A starting point would be the Nitecki's (1993) model, which

> accounts for the logical objectivity of the process describing the reality, and its subjective interpretation by individual patrons, by incorporating seemingly unrelated individual experiences into a totality of cumulative society's as well as the individual's understanding of reality. This approach should satisfy the pragmatic goals of practicing librarians and the theoretical objectives of information scientists, since it recognizes the existence of different goals and habits in both practical and abstract thinking and suggests a common denominator for both the empirical and metaphysical interpretation of reality. (p. 368)

This model represents the physical, philosophical, and cultural realities in librarianship, and also an unknown reality. *Physical reality* represents procedural aspects and records; *philosophical reality* symbolizes conceptual aspects, as a continuum: data – information – knowledge (the so-called α, β, γ relation); and *cultural reality* depicts contextual aspects as human interpretations (p. 368; Floridi, 2002a, pp. 38–43). The *unknown reality*, according to Twining (1999), is

> the place to which Nitecki has led us and where he has firmly planted the cornerstone of librarianship's future. It is the space without a literal guide; the space beyond the textual processing capability of the human mind; the space beyond the "five plus or minus two" object capacity of the human short-term memory. It is the space for which technology has failed to come up with the diagrammatic reasoning tool we might use to guide us to our future. (n.p.)

This reality would be the *infosphere* environment, and the human processing would correspond to the *inforg*.

In fact, the philosophy of information is congruent with library tradition. From Bliss and Danton's discussions on the 1930s, through Egan (without Shera), Nitecki, and Floridi, there stands a very definite genealogical line (Morán Reyes, 2013, pp. 85–86). This evolution shows that the question is not whether to replace knowledge for something else but to deepen, complement, and develop the knowledge you have, and then, only if necessary, change some schemes.

Conclusion

The structural-attributive approach is a discourse that contributes to the foundations to LIS; the recognition that LIS is a complex discipline; and the establishment of a general theory of information. The philosophy of information is the principal voice of study of the conceptual nature of information, and Stonier is an important precedent for other perspectives about information phenomena. The contrast between *physicalism* and *idealism* is not easy to determine. Stonier's position with respect to the information study is of the noetic type, and he articulates both perspectives. Contemporary LIS requires a rich conceptualization of information to recognize its complexity and to advocate for research trends releasing the

library to modify its structure. Information becomes meaningful only if it can be compared and integrated with other information.

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