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Philosophy of information: range and tenets

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This paper highlights some concepts related to the philosophy of information (PI). Various philosophical queries about the nature and characteristics of information and varying ideas and concepts of information as they appear in the diverse fields of study are discussed. Philosophy of Information makes relevant queries in order to understand the role of information in the physical and organic world, in the evolution, and in society by constructing various models. The paper also introduces the reader with the main queries and prominent models of the philosophy.

Keywords: Emergent information; Info-computational model (ICON): Informational structural realism (ISR); Meta theory; Philosophy of information (PI): Triple – c; Super concept; Unified theory of information (UTI)

Introduction

Philosophy of information is a comparatively new field of study. In a sense, Luciano Floridi's *What is the Philosophy of Information*, published in *Metaphilosophy* in January 2002 was the foundational paper in PI[1]. The title phrase 'Philosophy of Information' was coined by Floridi in 1996 and mentioned many times since, and was offered in the 2002 paper to the area of studying various philosophical issues about information. In his paper in 2002, Floridi argued that PI had emerged as a new independent discipline of study, as '*philosophia prima'* or the first philosophy and made an attempt for the first time to define the field. Although it will be seen that researches had been advanced in all of those areas covered by PI long before the field came into existence, but the convergence of several fields to understand the very nature of information was becoming so compelling that ultimately they had to be merged in a holistic approach to study information under the umbrella term philosophy of information (PI).

Literature review

The inputs for this paper about the nature and extent of meanings the term information carries comes from a number of papers like Capurro and Hjørland's, *The Concept of Information*[2] and an individual paper by Capurro viz. *The past, present and future of informations*[3]. Both papers deal with the historical and the modern concepts of information, and also its range of meanings in different subject areas. The very diverse meanings of information is reflected in these papers, some of which are mutually inclusive to some extent, some of which are not. Literature of physical science especially physics, both quantum and classical including very common text books like Beiser's *Concept of Modern Physics*[4] freely uses the term information. The illumination about the intrinsic relation between the thermodynamic concepts of entropy and its equivalence can be very well understod from Landauer's *The Physical Nature of Information*. Daniel Bell's concept of information has been reflected in his idea of the post industrial society and his paper *Welcome to the Post Industrial Society* further explains the role of information in the social perspective. Scanning these papers for more and more aspects and meanings for the word information leads only to a very tempting tendency to understand the very nature of information at a higher plane of abstraction. This methodological query simply initiates further enquiry about the nature of information at a philosophical level. While Luciano Floridi's two papers, *What is the Philosophy of Information*[1] and *Open Problems in the Philosophy of Information*[5] introduce the newly developed field of PI and explains what, why and how of PI, in the other

paper i.e. *A Defence of Information Structural Realism*,[6] Floridi launches his own line of contribution in the PI research in the name of Information-Structural Realism(ISR), a major PI tenet of the time. In these papers Floridi suggested that a holistic view of information may be our new field of study, rising above, but taking into consideration, all the possible meanings of the term in the different, immediate contexts of all sciences and social sciences. In other words, not only information is important in all fields according to their own paradigms, but all aspects of information can indeed be studied under one umbrella concept of PI, if not they can be unified in a grand theory. Thus PI exists. *Floridi's "Open Problems in Philosophy of Information", Ten Years Later*, is a very useful paper by Dodig Crnkovic and Hofkirchner[7], themselves major philosophers of information, which surveys in a nutshell the various advancements and potentialities hidden for further study in the 18 open questions and other related questions in the range of PI. Hofkirchner's individual paper *Four Ways of Thinking about Information*[8] introduces with novel ideas of how to advance futher in PI research, while the paper by the same author titled *How to Achieve a Unified Theory of Information*[9] shows probability of unification of different information concepts perhaps in a reductionist level. Lessons learnt from the surveying and studying literature about the philosophy of information are discussed in this paper.

What is information: difficulty with the definition

It is said that information is both an interdisciplinary and polysemantic concept[1,2]. Indeed, the term information as it is used today has multiple connotations. It is used outside library and information science in many other different fields of study-in physics, in engineering, in IT and signalling, in biology, in social sciences etc., and in each context with meanings varying from the other in some way, but still similar in some other way.

Information has been defined in a number of ways, some of which are mutually inclusive in more than one aspect, and some are apparently contradictory. For example, information has been defined as processed and meaningful data[10], a definition after Davenport and Prusak. On the other hand, according to Shannon, information only 'sometimes' has meanings,[11] a definition used in communication engineering where evidently, it is not mandatory for information to carry some meaning. But then, what is the significance of this added meaning when data is processed to information? Is meaning in any way equivalent to the Information content of the message? We remember that information is also defined to be the communicated message that shapes the receiver[12]. Thus the significance of meaning may be that it has some effects on the perception and judgment of one who receives it, or makes some difference in the construct of mind of one who receives it. Therefore, it seems that the significance of 'meaning' lies in its capacity to 'shape the receiver' of information. But meaning is to a large extent subjective. It is possible to have more than one interpretation of a single data set, and thus the same piece of information then can have different effects on different receiver; and on some receiver it may have no effect at all. Therefore, from one angle information is user specific; it is the user or receiver who decides whether what he or she has received is information or no information.

Nowadays the concept of information presents a complex body of knowledge incorporating various views coming from such diverse fields as natural, social and computer science. Also according to van Bentham and Martinez, information can be understood as range of possibilities (the opposite of uncertainty); as correlation (and thus structure), and information can be viewed as code, as in DNA[7].

Therefore, theorising about information – aiming at a domain independent definition and conceptualization, has been a rather problematic task, and no consensus can hitherto be claimed over this. Moreover, it is well suggested that there should always be a crucial distinction maintained between a concept and a definition as Belkin put it[13]. Belkin pointed out rightly that a definition should say what a phenomenon being defined actually is, whereas a concept is a way of looking at or interpreting, the phenomenon. Sometimes we mistake just a concept for a definition. On the other hand, a definition can be formulated in a persuasive manner, i.e. in order to impress people rather than to arrive at a specification of the meaning[14]. While defining information this danger sometimes became predominant.

Capurro and Hjørland[2] discuss at some length about the problems of defining information in a satisfactorily generalised perspective. They believe that the equation offered by Brookes (1977) such as:

$K(S) + \delta I \rightarrow K(S + \delta S)$ is rather pseudo-mathematical and a persuasive one serving little purpose to understand the very nature of it.

Information: its meanings and significance in various fields of study

The polysemantic and transdisciplinary nature of information is already a known fact to us; and our understanding of the concept and our attempt to define the term information is mainly domain specific. In this section, the most significant meanings and concepts of information will be discussed mainly in some major fields of study.

In physics the concept appears in such pure fields as thermodynamics, and quantum physics, relativity and cosmology. Information is measured by the same unit of system disorder i.e. entropy. The physical quantity entropy is used mainly in thermodynamics, but Shannon successfully used the same mathematical form of entropy in his mathematical theory of communication. But the relation between information and entropy is deeper than simple mathematical formalism. Zilard and then Landauer[15-17] showed that information has real physical cost taxed by nature in form of energy equivalence. In modern physics, information is physical is the maxim. Vedral[18] stated about a 'strong information theoretic flavour' in quantum physics. In quantum theory it is said that the probabilistic wave function contains all the information about the particle or of the system[4].

Quantum Information Science (QIS) is a new area of study which is based on the quantum entanglement property of particles. Information is now seen as the basic property of the universe, as fundamental as matter and energy. In modern cosmology Bekenstein and Hawking's work show that the properties of a black hole can be described in terms of Information[19].

In mathematical science Chaitin's Algorithmic Information Theory[20] tries to measure how much information content is there in a set of axioms and how much information is there in a theory[21]. Classical mathematical approach of Shannon to information has already been mentioned. Kullback's relative entropy theory can be seen as a supplement to Shannon entropy. Some of the difficulties associated with Shannon entropy, in the general case, can be overcome by the use of relative entropy, which is also known as Kullback-Leibler Divergence[22].

The work of Alan Turing was particularly influential to the artificial intelligence research. Floridi recognized the philosophy of AI that deals with the algorithmic information processing as a premature paradigm of PI[1].

Information matters in biology too. Genetic information is a very common term today, so is the information in the DNA code. Biological agents self-organize themselves (autopoesis) and in a way reduces entropy by capturing or generating information. There is constant interaction between an organism and its environment. Biological morphogenesis was studied by Alan Turing as an information computation process. Developments have been made in bioinformatics, computational biology, neuroscience, cognitive science and related fields confirming that in practice biological systems have been studied as natural information processing systems and are modelled using computation-theoretical tools[23].

In psychology, information is sometimes used as a variable dealing with sensory perception, comprehension, or other psychological processes[2]. These senses of information are very different than the one in information science.

In the social and human sciences the term information is generally used to mean 'knowledge communicated' in a human sense i.e. human intellect and intelligence are involved in creating, sending and receiving and the evaluation of the message which has significance in human life and society. When used in IS, it should always be kept in mind that information is what is informative for a given person; and what is informative depends on the interpretative needs and skills of the individual[2].

Within the scope of social sciences, LIS included, sometimes it is as tangible as a thing; some other times it is as abstract as knowledge. Sometimes it is a commodity or product, especially in the information economy, and in the information industry context it is a resource too, and a very important part of an industry like land, labour, capital and organization. In the information society and information economy too, information plays the crucial role of the chief economic, social and cultural motor, a role assigned to Information by Bell[20,24]. By information, Bell referred to data processing "in the broadest sense". He clarified that "the storage, retrieval, and

processing of data becomes the essential resource for all economic and social exchanges" in the post industrial society he envisaged[25]. Evidently, when information is used in social science, the role of humans engaged in the informational activities like storage, retrieval, and processing etc. are also recognised. This use differs from the pure engineering sense of Shannon or the mathematical sense of Kullback or in the sense it is used in physics.

Belkin's idea for the conceptualization of information was from the perspective of eight requirements. Based on these requirements Thellefsen et al. have summed up the Belkin's concept of Information thus:

"It must be purposeful, meaningful; it must enter into human communication. It must be requested and desired. It must have an effect on the recipient. It must affect the knowledge state of the recipient. It must be general and able to predict the effect of information." [13]

Machlup too, took information as the human phenomenon as addressed to human minds and is received by human minds, and opposed to the view of signal transmission in the sense Shannon defined information. In the book *The Study of Information: Interdisciplinary Messages* published in 1983, he proposed that information should mean 'telling something' or 'something that is being told'. According to Machlup, all other senses information is used beyond the human context are metaphoric[2,3]. We also observe such usage as 'perfect information' in game theory or decision theory in the sense of full information of all facts acquired by the consumer in the market etc[26].

In linguistics there have been attempts to apply the communication model involving a source, channel and receiver or information sink for natural language communication. In case of natural language the signal is phonetic, produced in the form of acoustic units[27]. Also there is an information theoretic approach to grammar and language which helps advancement of AI research viz. NLP and speech recognition[28].

In system theory a dynamic system can be considered as an information processing machine that computes a present state as output from an initial state of input[29]. Cognition science also seeks to understand human capacity of information processing as a process similar to computing or algorithmic Information processing[2].

By referring to information as a *superconcept* or a *generic concept* Hofkirchner, the originator of the Unified Theory of Information (UTI), a prominent branch in PI, recognizes the diversity of the concept saying that it (information) covers all different manifestations of real-world information processes regardless of the realm in which they appear[30]. Hofkirchner offers a (incomplete) list of possible concepts across the various fields of study which are either related to or to varying degrees overlapping with the information concept:

> i. Structure, ii. Data, iii. Signal, iv. Message, v. Signification, meaning, sense, vi. Sign, vii. Sign process, semiosis, viii. Psyche, ix. Intelligence, x. Perception, xi. Thought, xii. Language, xiii. Knowledge, xiv. Consciousness, mind, xv. Wisdom, etc.

Similarly, Bhattacharyya has explored several definitions and identified sixteen senses that the term information bears[31]. Thus it may be very easy to ask *what information is*, but the answer to the question is difficult to give.

What is philosophy of information (PI): the nature of philosophical queries

Evidently, there are two basic facets involved in the concept of philosophy of information; one is *philosophy* and the other is *information*. If the phrase *philosophy of information* is analysed it is understood that the *philosophy* is an operator functioning over the concept *information*. While philosophy itself has been a self consistent discipline of study from the very ancient times, comprising as its core logic, aesthetics, ethics, metaphysics, and epistemology[32] amongst which epistemology is the *sin qua non* which means "the study of the justification of claims to knowledge" or in other words the constant attempt to answer the question "how do you know?"[32], a 'philosophy of ~ *' approach is often confronted in the scholarly canon of literature e.g. the philosophy of science, philosophy of mathematics, philosophy of physics, philosophy of chemistry, philosophy of religion, philosophy of computation, etc. This is perhaps because of the very philosophising nature of human. But what actually is the fundamental nature of this philosophical query? Why we need philosophy at all? What are the

questions that we do expect philosophy to answer? And then, what does this particular "Philosophy of ~*" approach to a subject or discipline amount to? Does the discipline itself not sufficiently give answers to the questions it raises so that we need to take a philosophical approach to it? John Hospers in his bestselling book *An Introduction to Philosophical Analysis* attempted to reach the kernel of the problem about the nature of the philosophical query[32] from a *netty–netty* approach (reaching the truth by negativity saying what it is not rather than what it is, an approach used to define the *Atma* in the *Upanishada*). Hospers enumerated the following points:

1. A philosophical question cannot be answered empirically i.e. by applying senses measurements and perceptions or from results of experiments.

2. It follows that questions which sciences can satisfactorily answer are not of any philosophical nature.

3. Questions about the incidents in the past are not philosophical.

4. Mathematical questions are not of philosophical nature.

What is the nature of the philosophical query, then, if we ask directly? Primarily, therefore, what remains for philosophy to take care of is (arguably, though) the *left over* kind of questions that the other branches of studies cannot answer. In Bertrand Russell's words, "philosophy is merely the attempt to answer such ultimate questions, not carelessly and dogmatically, as we do in ordinary life and even in the sciences, but critically after exploring all that makes such questions puzzling, and after realizing all the vagueness and confusion that underlie our ordinary ideas.[33]" Moreover, philosophy is the study of justification of the claims that we make. Philosophy can also be seen as the analysis of various concepts central to our thought[32].

Following the analogy of the above argument we can say that philosophy of information is there for answering, or seeking the ways of answering the left over questions about information; the study of justifications we make about the various aspects of information ranging from the definitional to the application-oriented, and in all the practical and potentially existing contexts the term information is or can be used; and also it is for analysis of various concepts of information along with its all the aspects suggested above that occupy our thought.

Floridi claimed more than a decade ago in the journal *Metaphilosophy*[1] that PI had emerged as a 'matured discipline', at least as '*philosophia prima'* or the first philosophy. According to Floridi the three main criteria requiring for emergence of a new philosophical field are fulfilled by PI; as it is capable of

a) representing an autonomous field comprising unique *topics*

b) treating old and new philosophical topics by its original *methodologies*

c) standing beside other branches of philosophy and formulate new *theories* about its own field.

But more fundamentally, what makes a field of study apt to be called the 'Philosophy of~*'? Primarily, the aim of thus philosophizing a subject or an area of study, generally speaking, seems to be to reduce the issues or theories or concepts of that subject or discipline to the very elementarily philosophical level of the, metaphysical, epistemological, logical, aesthetic or ethical nature. In the main, 'philosophy of ~*' tries to put an ontological query about it, or about the very nature or essence of the thing itself, thus making a quest for a theory of a theory or a metatheory. Floridi believes that the very task of the 'philosophy of ~*' is to ask the classic *ti esti* question or 'what is the nature of~' type question[1]. Applying this generalization to the philosophy of information we can say that PI should ask the fundamental question 'what is the nature of information'. Floridi defines PI as the philosophical field concerned with

(a) the critical investigation of the conceptual nature and basic principles of information including its dynamics, utilization and sciences, and

(b) the elaboration and application of information-theoretic and computational methodologies to philosophical problems.

He clarifies that PI is not to be confused with the quantitative theory of data communication or with the information theory like Shannon's. Rather it attempts to develop 'an integrated family of theories that analyse evaluate and explain the various principles

and concepts of information, their dynamics and utilization, with special attention to systemic issues arising from different contexts applications and interconnections with other key concepts of philosophy, such as being, knowledge, truth, life, and meaning[1,34].

Early systematic approach to information and the range of PI

In 2004 Floridi published another paper titled "Open problems in the Philosophy of Information"[5] based on the Herbert A. Simon Lecture in Computing and Philosophy given at Carnegie Mellon University in 2001. In this paper he listed *five* of the most interesting areas and formulated *eighteen fundamental questions* which were covered by those five areas in PI[1]. These were the open problems in PI on which Floridi thought the PI researches in the future should pivot. The five areas and the appending questions are mentioned below to help readers grasp the range of PI at a glance.

But before that it would be useful to mention the other significant approach that attempts to tackle systematically the confusing and enigmatic issue of information. PI approach would perhaps be more easily understood in comparison to this.

In the early 70s, when PI was in its prenatal stage, Wersing and Neveling identified six different approaches to information[35].

> i) The structure approach, ii) The knowledge approach, iii) The message approach, iv) The meaning approach, v) The effect approach, vi) The process approach.

The structure approach states that the structures of the world – whether perceived by man or not – are information. Information is independent of whether a human being gathers it or not.

The knowledge approach states that knowledge developed on the basis of perception of the structure of the world is information. Wersing and Neveling alert us against this, and call it a dangerous approach because of the very probable confusion often made between knowledge and information.

The message approach is the continuation of tradition of Shannon and Weaver's mathematical approach, information is the message itself.

The meaning approach states that the meaning assigned to signs or data is the information. We have seen that the mathematical, message oriented approach of Shannon neglects the meaning at large. Antithetically, the meaning oriented approach equates information to the meaning of the message.

The effect approach states that information is a specific effect of a specific process, usually on the part of the recipients in a process of communication. This is evidently an approach where the importance is shifted to the recipient from the sender of the message.

The process approach states that information is not one of the components of processes but as a process itself. This may be a process of human data processing or a communication process with a specific purpose[24,35]. In all the cases there are more than one varieties or versions recognised by the authors.

But when we come to the term 'philosophy of information' it is expected that the philosophy approach should cover all the above mentioned broad areas and any other area or approach that one may address with regard to information.

Floridi's open problems thus happily include those approaches of Wersing and Neveling[35], and also reserves room for many other questions, concepts and approaches as is expected. But Floridi's grouping of the 18 questions are not mere restructuring of any earlier approach of categorizing. Floridi's approach shows its philosophical spirit in which he relates the philosophical components: epistemology, ontology, ethics, the age-old Cartesian mind-body problem etc.[5,7] as mentioned elsewhere, with the queries about information. Moreover, the fundamental *ti-esti* about information is asked at a metaphysical level, a higher level of abstraction than any of the existing definitions of information. Thus PI hardly attempts to give any consolidated definition of information. Instead, it studies the concept in various contexts and tries to distil them at a *metatheoretic* level, and attempts to make models with Information at its centre, recognizing the various Informational activities like creating, processing, encoding and decoding, transporting, transforming etc. as the basic dynamics of the system.

Following are the 18 open problems under the 5 respective heads as Floridi offered them.

Group 1: Analysis of information and its dynamics or information definition

Prob 1: What is information?

Prob 2: What are the dynamics of information?

Prob 3: Is a Grand Unified Theory of Information (GUTI) possible?

Group 2: Semantics or Meanings of information

Prob 4: The Data Grounding Problem: How can data acquire their meaning?

Prob 5: The problem of *alethization*: How can meaningful data acquire their truth value?

Prob 6: Informational truth theory: can information explain truth?

Prob 7: Informational semantics: can information explain meaning?

Group 3: Intelligence or cognition

Prob 8: Decarte's problem: can cognition (C) be fully analyzed in terms of information processing (IP) at some level of abstraction (LoA)? How is the triad C, IP, LoA to be interpreted?

Prob 9: Dennett's reengineering problem 1994: can natural intelligence (NI) be fully and satisfactorily analyzed in terms of IP at some LoA? How is the triad NI, IP, LoA to be interpreted?

Prob 10: Turing's problem: can NI be fully and satisfactorily implemented non-biologically?

Prob 11: The MIB (Mind-Information-Body) Problem: Can an Informational Approach Solve the Mind-body Problem?

Prob: 12: The Informational Circle: If Information Cannot Be Transcended but Can Only Be Checked against Further Information—If It Is Information All the Way up and All the Way Down—What Does This Tell Us about Our Knowledge of the World?

Prob 13: The Continuum Hypothesis: Should Epistemology Be Based on a Theory of Information?

Prob 14: The Semantic View of Science: Is Science Reducible to Information Modelling?

Group 4: Nature of information or information and the universe

Prob 15: Wiener's Problem: what is the Ontological Category of Information?

Prob 16: The Localization problem: can information be naturalised?

Prob 17: The "It from Bit" Hypothesis (Wheeler 1990): can nature be informationalized?

Group 5: Values or ethical problems

Prob 18: The uniqueness debate: Do computer ethics have a philosophical foundation?

Anyone who reads Floridi's seminal paper and track the subsequent development in PI research would be amazed to see the fullness of the approach applied to the concept of information. It covers almost all fields of human's studies ranging from incorporating aspects of ontology, epistemology, values and truth, and subjects ranging from physics to biology, including computation and semantics.

A brief note about semantic information in PI

A General Definition of Information (GDI) has been formulated for information as semantic content[34] thus:

A piece of information would be information proper, if and only if-

i) it consists of n-data; $n \geq 1$;

ii) the data are well formed

iii) the well-formed data is meaningful.

Thus data in GDI is *alethically neutral* in the general definition*;* which means even false data can constitute information if processed with meaning. But the Special Definition of Information (SDI) imposes a fourth condition about *alethic neutrality* and says that the well formed data have to be truthful.

In Floridi's open problems the question of truth value has been handled in Group 2, problems 4 to 7.

Epistemological queries about information in PI

Within the range of PI epistemological aspects related to Information need special emphasis and this section is dedicated to the brief discussion of the theory of knowledge and the human knowledge process, and its relatedness to the Informational issues. Knowledge has been most generally defined as Justified True Belief (JTB)[36] and information is believed to be unprocessed knowledge, or in other words, knowledge is processed information. Knowledge is a belief held by someone, and that belief has to be true. But to be called knowledge, this knowledge must be justifiable. True belief which is not justified but a lucky guess only thus cannot be called Knowledge. Information, on the other hand, when thought of in the human context, has semantic values and is processed by humans. It is mind independent and objective, but goes into the cognitive process of humans. In the semantic aspect, information has been defined as meaningful data.

The defining questions of epistemology include the following[37]:

1. What is the nature of propositional knowledge, knowledge that a particular proposition about the world is true?
2. How can we gain knowledge?
3. What are the limits of our knowledge?

Two broad divisions of epistemological debate is that one existing between Rationalism and Empiricism, the former believing in the predominance of reason and the latter in experience as the source of knowledge. Rationalists virtually always assert or imply that, in addition to knowledge of analytic truths, there is knowledge of synthetic a priori truths[36]. Empiricism (or often empiricisms as there are several forms of it) is the epistemological view that experience is the source of all our justified, true beliefs. In the first place, they develop accounts of how experience provides the information that rationalists cite, insofar as we have it in the first place. Empiricists will at times opt for skepticism as an alternative to rationalism: if experience cannot provide the concepts or knowledge the rationalists cite, then we don't have them[36,37]. Locke, Berkeley and Hume are the main exponents of empiricism, although the philosophies they advocated were markedly different from each others.

Of the continental rationalists Descartes claims to take his inspiration from mathematics which is based on reason. According to Descartes the first principles are derived from reason all other knowledge is deduced from there. While knowledge from reason is trustworthy, knowledge based on senses are often deceptive and mislead our mind. Spinoza too believes in the supremacy of intuition or reason as a source of knowledge. Spinoza argues that we cannot have adequate ideas of the world through sensation. Although he recognizes the role of senses in what he called the knowledge of the first and the second kind, the role of senses can be excluded from his third kind of knowledge. German rationalist Kant too vindicated the supremacy of reason as a source of knowledge.

Spencer on the other hand was the advocate of positivism, that the only reliable knowledge of the universe can be formed from the sciences, which is a belief in the scientific realism.

In the PI approach developed by Floridi we find several older philosophical problems have been related to newer informational issues. For example, the traditional mind-body dualism of Descartes in problem 8. Descartes proposed his theory to solve the problem how the physical or material body influence the non material mind[14]. Secondly, can cognition be described or explained in terms of Information processing! Both the issues are intrinsically related because cognitive organisms acquire Information as a sensory perception, a process involving the physical body, as in problem 11. But cognition is believed to be a mental process rather. Related to this is the even more abstract epistemological problem reflected in Floridi's question no. 12 & 13, asking what does Information which is believed to be so ubiquitous tell us about our knowledge of the world, and can there ever be an Information theoretic approach to epistemology?

Major tenets of PI research

In 2011, a decade after Floridi's announcement of PI as a unique and self sufficient field of research, and seven years after his launching the open problems, Gordana Dodig-Crnkovic and Wolfgang Hofkirchner published a joint paper in the online journal *Information* titled *Floridi's "Open Problems in the Philosophy of Information", Ten Years Later* revisiting those 18 open problems[5,7] and reviewing progresses in research connecting to those suggested

topics[7]. It would be instructive for the PI enthusiasts to look into their paper to delve deep into the details and trace the historical development since the inception of the field. In this section four major tenets of PI research would be mentioned and discussed in brief.

Earlier we mentioned that the fundamental *ti-esti* is the *sin qua non* of any philosophical query, and of the PI too. And to answer the *ti-esti* about Information is as very much challenging as to give answer to questions like what is being, what is truth or what is knowledge. However, there are three broader approaches to answer this ti-esti (Floridi, Information, 2004) viz. Reductionist, Anti-reductionist and Nonreductionist. All these three approaches are identifiable in the currrent PI tenets.

The reductionist approach preserves hope for a Unified Theory of Information (UTI) i.e. to arrive at a general theory to be inclusive of all the major concepts of information much like a Unified Field Theory in which all the physical laws will be unified. What the reductionists believe is that all the concepts of Information are ultimately be reducible to a *Ur-concept* or a mother concept, conceptually, genetically, or genealogically[34]. Certainly, there is a hierarchical structure underlying the reductionist concept in that one level of meaning seems to be transcendent of the next level of generalization and so on to reach the ultimate level of unification. But there is a probability of what is known to be the reductionist syndrome, i.e. the fear of 'reducing human beings to an information-processing machine giving up social and cultural dimensions'[3].

The anti-reductionist approach refutes any suggestion of such unification and believes that the different connotations of a single term and that these various meaning were not descendant of a core meaning or born in the womb of the Ur-concept.

The non-reductionists break the middle path. Neither they completely defend the multiplicity and radical irreducibility of the anti-reductionists approach nor do they fully support the hierarchical model of the reductionists. Their approach is that of a "hypertextual analysis" or a network of connected concepts of Information linked by mutual and dynamic influences that are not necessarily genetic or genealogical. There is a centralised and a decetralised concept under this approach. In the former there is a core notion of information which is theoretically most poweerful, and other notions are gravitationg around it[34].

In the light of the above discussion, some current PI tenets are briefly mentioned below, which to some extent seem overlapping. However, all the existing and potential approaches to find the basic *ti-esti* seem to coagulate in these PI tenets mainly. However, we will see that of the four main tenets mentioned below, the first three corroborate issues mainly from different branches of sciences including cognitive science, computational science, aspects of biology etc. and also insights of social sciences, and their intrinsic philosophies, in order to formulate pseudo-scientific models to explain various informational acts in the various systems including biological non-cognitive, biological cognitive, natural, social, and natural-biological interactive systems. The fourth one that comes from Floridi himself, seems to have a much more philosophical outlook, with possibility to be reduced to be a more generalized and abstracted Philosophical view point of Information.

Informational Computational Model of Reality (ICON)

Gordana Dodig-Crnkovic mentioned that the Informational Computational Model of Reality or the ICON model is an approach 'in which universe is viewed as a structure (information) in a permanent process of change (computation)[38]. ICON model derives its strength from combining two major paradigms: Floridi's scheme of *Informational Structural realism* mentioned in the last section, with the pancomputationalism or naturalist computationalism propounded mainly by Zuse, Wolfram, Chaitin, Lloyd which takes the universe to be a sort of digital computer [23].

According to this view, information and computation constitute two aspects of reality, and like the wave -particle duality in quantum physics, matter and energy, represent different facets of the same physical world. Owing much to Gordana Dodig-Crnkovic, this line of thinking looks upon information as a result of natural computation. It presupposes a hierarchy of levels, 'starting from the basic proto-information as a stuff of the universe and building a number of levels of organization in an evolutionary way, through computational processes.'[7] It is identified as a new philosophy of nature that provides the basis for the unification of knowledge from the

existing disparate fields like natural sciences, philosophy, and computing [23].

Emergent Information and the Triple C-model

It is the view that conceives informational dynamics as processes of self-organization. Whenever self-organizing systems in their behaviour relate to the environment, they create information, that is, they rather generate information than process it and are thus information-generating systems. This concept might be called "emergent information". The difference between ICON and emergent information model lies in the background dynamics of the process. Info-computationalism takes into account any natural process that can be described by a definable model as computation, which is equal to information processing. For example, the emission of a particle from a radioactive creates information. In the 'emergent information' approach only self-organization processes are deemed to produce information[7] One major approach to this emergent information is the Cognition-Communication-Cooperation or the Triple C- model introduced by Hofkirchner[39] in 2002. The Triple C was drawn from and applied primarily to information dynamics at societal organizational level. But attempts were made to fit this model into all self organising systems like evolutionary systems and physical and chemical self organizing systems. It looks upon information generation by self-organizing agents in a 3 layer process. First comes cognition which refers to the information generation of a self-organizing system vis-á-vis its environment that is unspecified as well as less-than deterministic;[7] the coupling of cognitive processes of at least two self-organizing systems yields then communication; and sustainable communicative processes lead to cooperation of co-systems for the sake of a commonly established meta- or suprasystem of which the co-systems are elements. Layer models for bio-cognition, bio-communication and bio-cooperation in living self organizing systems, and layer model for a more complex human-cognition, human-communication and human-cooperation for human systems have been proposed as an attempt to apply Triple –C model in the context of emergent information systems[30].

UTI and the Triple-C Model

Primarily, a unified theory of information looks like an 'intra-scientific issue' to grasp the 'big picture' of the universe in which attempts would be made in order that 'the whole variety of different manifestations of information processes in society and in the world at all might be understood[9].

The unified theory of information is not simply a case of 'pure scientific curiosity'[26] . Rather, UTI considers the social aspects of information and add more values to the various information processes involved in the way human interacts with environment and society. UTI accepts this extrascientific undertaking as a social responsibility in the advent of the information age when most people are involved in some information based activity. UTI thus tries to establish a connecting thread between the social/societal and scientific concept of information, and it uses the Triple C model as a tool[30].

But UTI not only considers information as a concept applying only to humans but takes into account the 'precursors of the human information processes as well'. Hofkirchner writes:

> Cognition is not only a process on the human level, you will find it with other organisms as well. The same holds for communication. And for co-operation, too. Furthermore, it depends on the intension of the "information" concept whether or not also precursors of organismic cognitive, communicative and co-operative information processes can be identified in the prebiotic world[30].

UTI develops a perspective from which this integration can be achieved 'without doing harm to any of the ideas in question'[9]. It is claimed that this perspective is the perspective of unity-through-diversity. Hofkirchner defines and suggests the four ways of thinking: reductionism, projectivism, disjunctivism and integrativism in order to yield guidelines for how to conceive of information[8,9].

Informational Structural Realism (ISR)

Floridis informational structural realism is a new philosophical approach that applies the concept of information as a fundamental ontological entity in the scheme of structural realism. Thus ISR turns out to be a new version of Ontic Structural Realism in which he fits Information as the basic ontology of being. The details of Structural Ralism (SR) and its versions cannot be dealt with in the limited scope of this paper. It is sufficient here just to quote a few words from Floridi here:

> [T]he ultimate nature of reality is informational which is to say, ISR looks upon reality as mind-independent and constituted by structural objects that are neither substantial nor material but informational[6].

Conclusions

Information has gained supreme importance in the modern scientific and philosophical parlance. The discipline called philosophy of information has undertaken to explore all the real and potential ways one could define information and see the basic nature of information under the lenses of the updated scientific knowledge contributing to the philosophical insight of the worldview in which information is now already believed to seat in the kernel. The PI culture does not look like very strong in India. Only few or none of the Indian scholars have yet mentioned PI, at least in so far as the present author's knowledge goes. But information scientists of the century must turn to PI as natural science has significantly taken an informational turn and PI handles distilled knowledge from various disciplines and attempts a synergetic understanding of the issue. Of course there are many more issues left out from this brief study. The present paper has only suggested in outlines the very basics of the PI fields with the hope that it will draw more critical and innovative attentions from scholars.

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