

INFORMATION ETHICS IN THE INFORMATION AGE

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ABSTRACT: Information ethics (IE) is a field of fundamental and applied study that lacks the firm foundation of a definition of information. The at times ethereal, at times pervasive nature of information contributes to the elusiveness of a definition. Paradoxically, everyone seems to recognise information when they see it, but there is great difficulty in arriving at a common perspective. This is partly due to its wide-ranging applicability in many and disparate fields of knowledge, e.g., business, finance, media communications, physics, biology, computer science, engineering, library science, to name a few. All of which share the commonality of dealing with digital information and communication technologies (ICTs) which seem to be the trigger for issues in IE. The purpose of this paper is to suggest the definition of information by Bateson as a basis to seek a fundamental and applied understanding in IE.

KEYWORDS: Information ethics; Information; Information and communication technologies; Distributed cognition; Unified Theory of Information

INTRODUCTION

The contributions by Norbert Wiener in cybernetics and its impact on the human condition serve as the starting point for Information Ethics (IE)^{2,3}. One quote is particularly influential,

Information is information, not matter or energy. No materialism, which does not

¹ The author would like to express appreciation for the reviewer comments.

² Terrell Ward Bynum, 'Flourishing Ethics', *Ethics and Inf. Technol.*, vol. 8, no. 4, 2006, pp. 157-73.

³ Terrell Ward Bynum, 'Computer and Information Ethics', *The Stanford Encyclopedia of Philosophy*, Edward N. Zalta (ed.), 2016. p. 162

admit this, can survive at the present day.⁴

While defining information, in this instance, in terms of itself, Wiener does go on to develop a definition of information that parallels that of Shannon in this major work. Further, Wiener's statement implies that information is, in addition to matter or energy, another fundamental element in nature. His authoritative stature has remained unquestioned in this by many and is taken as gospel in his affirmation of this fundamental nature of information. Thus, posing an impossible quandary for materialism and motivating the persistence of information as an independent and/or objective entity. Wiener's fundamental point of view qualifying information as a fundamental quantity in the Universe is reflected in numerous works, including those by Wheeler⁵, Stonier⁶, Yockey⁷, Lloyd⁸, Umpleby⁹, Burgin¹⁰, Floridi¹¹, Vedral¹², Hidalgo¹³ and Zukerfeld¹⁴, among others.

Also, Bynum quoting Wiener shows the societal and ethical context that is of interest to Wiener:

Information is a name for the content of what is exchanged with the outer world as we adjust to it, and make our adjustment felt upon it. The process of receiving and of using information is the process of our adjusting to the contingencies of the outer environment, and of our living effectively within that environment. The needs and the complexity of modern life make greater demands on this process of information than ever before.... To live effectively is to live with adequate

⁴ Norbert Wiener, *Cybernetics: or Control and Communication in the Animal and the Machine*, New York, John Wiley, 1948. p. 132

⁵ John Archibald Wheeler, 'Sakharov revisited: "It from Bit"', in M Man'ko, *Proceedings of the First International A D Sakharov Memorial Conference on Physics, May 27-31, Moscow, USSR*, Nova Science Publishers, Commack, NY, 1991.

⁶ Tom Stonier, *Information and Meaning - An Evolutionary Perspective*, Berlin Heidelberg New York, Springer-Verlag, 1997.

⁷ Hubert P. Yockey, *Information theory, evolution, and the origin of life*, Cambridge, UK, Cambridge University press, 2005.

⁸ Seth Lloyd, *Programming the Universe*, New York, NY, Alfred A. Knopf, 2006.

⁹ Stuart A. Umpleby, 'Physical Relationships among Matter, Energy and Information', *Systems Research and Behavioral Science*, vol. 24, no. 3, 2007, pp. 369-72.

¹⁰ Mark Burgin, *Theory of Information - Fundamentality, Diversity and Unification*, Singapore, World Scientific Publishing Co. Pte. Ltd., 2010.

¹¹ Luciano Floridi, *Information: A Very Short Introduction*, Oxford University Press, 2010.

¹² Vlatko Vedral, *Decoding Reality - The Universe as Quantum Information*, Oxford, UK, Oxford University Press, 2010.

¹³ Cesar A. Hidalgo, *Why information grows : the evolution of order, from atoms to economies*, New York, Basic Books, 2015.

¹⁴ Mariano Zukerfeld, *Knowledge in the Age of Digital Capitalism*, London, University of Westminster Press, 2017.

information. Thus, communication and control belong to the essence of man's inner life, even as they belong to his life in society.¹⁵

It is instructive that information is viewed by Wiener in a dynamic human organism-in-its environment context.

Comprehensive treatments of the history and definitions associated with the term information as well as attempts to bring about the realisation of the ever-elusive Unified Theory of Information (UTI) with the intent to bring clarity to the discussion have been compiled^{16,17,18,19}. But no such clarity has been forthcoming. But even when no such clarity exists an effort by Floridi has set forth an ambitious project that does not require a UTI but rather an integrated perspective of information. As quoted in Allo, Floridi²⁰ states,

On the whole, its task is to develop not a unified theory of information but rather an integrated family of theories that analyse, evaluate, and explain the various principles and concepts of information, their dynamics and utilisation, with special attention to systemic issues arising from different contexts of application and interconnections with other key concepts in philosophy, such as being, knowledge, truth, life, and meaning.²¹

In short, IE lacks a viable UTI. The integrated perspective proposed by Floridi provides an alternative, pragmatic approach to solve ethical and philosophical problems involving information.

This paper, consisting of five sections, discusses a UTI based on the definition of information by Bateson and proposes its use to redefine IE. First, the definition of information by Bateson is presented to discover the dynamic nature of matter/energy. Second, the role of humans as cognizing beings in a process of distributed cognition is shown to be central to information. Third, a clear identification of endogenous and

¹⁵ Bynum, 'Flourishing Ethics'. p. 162

¹⁶ Rafael Capurro, Peter Fleissner and Wolfgang Hofkirchner, 'Is a unified theory of information feasible? A dialogue', *Informatik Forum*, vol. 1, 1997, pp. 36-45.

¹⁷ Rafael Capurro and Birger Hjørland, 'The concept of information', *Annual Review of Information Science and Technology*, vol. 37, no. 1, 2003, pp. 343-411.

¹⁸ Rafael Capurro, 'Past, present, and future of the concept of information', *tripleC*, vol. 7, no. 2, 2009, pp. 125-41.

¹⁹ Wolfgang Hofkirchner, 'Chapter 1: The Dawn of a Science of Information', in Wolfgang Hofkirchner (ed.), *Emergent Information — A Unified Theory of Information Framework*, Singapore, World Scientific Publishing Co. Pte. Ltd., 2013a, pp. 3-34.

²⁰ Luciano Floridi, 'What Is the Philosophy of Information?', *Metaphilosophy*, vol. 33, no. 1-2, 2002, pp. 123-45.

²¹ Patrick Allo (ed.), *Putting Information First: Luciano Floridi and the Philosophy of Information*, West Sussex, UK, John Wiley & Sons Ltd, 2010. p. 3

exogenous information is made. Fourth, this leads to the fundamental problem of the science of information as a means to clarify the centrality of human beings in the process of information. Last, the definition of information by Bateson is posed as an alternative means on which to base IE.

BATESON AND INFORMATION

Bateson is well-known for stating that, “In fact what we mean by information – the elementary unit of information – is a difference which makes a difference...”²². This is an often-quoted statement that seems to have lost its lustre over time but somehow captures our imagination when we hear it for the first or even umpteenth time. The reason might be that it is easily recognised as being of a general nature and having the potential to serve as a starting point for a UTI.^{23,24} But what does it mean in practical terms, in terms that can make a difference in our understanding of information? The simplicity and generality of this definition suggests qualitative and quantitative characteristics.

An important qualitative characteristic of this definition of information is its self-referential, subjective nature emphasising the self as the centre in ascertaining differences that make a difference. It suffices to say that human beings engage in an interactive recursive process with their environment in gathering information by way of our senses to act on the environment, to allow satisfaction of physiological and social needs. An example of one such physiological need is the need to breathe, a physiological need that denotes consciously or unconsciously a subjective, self-referential difference that makes a difference.

A significant related quantitative characteristic of this definition of information is revealed when we realise that human beings are shaped by material occurrences in the environment – real things and processes – that result from sensory experiences, as well as by their actions in the environment and the effects of those actions. When we identify differences what we are really doing is recognizing that our natural world is dynamic. This is true in our physical world as every element of matter or energy in our universe, from the smallest to the largest, is in perpetual motion above an absolute temperature of zero degrees.

A difference requires a comparison. In this milieu, two instances of sensory data are needed in order for a living being to recognise or process a difference, i.e., two

²² Gregory Bateson, *Steps to an Ecology of Mind*, Northvale, New Jersey, Jason Aronson Inc, 1972. p. 321

²³ Capurro and Hjørland, ‘The concept of information’.

²⁴ Wolfgang Hofkirchner, ‘Emergent Information. When a Difference Makes a Difference...’, *tripleC*, vol. 11, no. 1, 2013b, pp. 6-12.

sensory maps that are spatially and/or temporally separated, which are differentiated or compared. Such a comparison results in differences that acquire physicality in our brain as adaptable and changing neural networks, promoting further processing and associations that are pertinent to the satisfaction of physiological and social needs, leading to related learning. More importantly, our sensory organs transform these sensory perceptions into electrochemical signals that travel through our nervous system to our brain. There is no distinction between signals emanating from touch, auditory, olfactory, gustatory or visual sensory organs as they travel to the brain. But what the brain processes are the detected differences in incoming signals, i.e., information. This processing of information is done for the purpose of satisfaction of physiological and social needs. The related learning is not a contemplative act, but rather it leads to developing human capabilities that allow successful recursive interaction with the environment. The physical/material representation of information in the neural networks of our brain allow this cumulative process to develop during our lifetimes. The resulting learning process in our brain shapes how historically we are able to deal with our environment, not only as individuals but socially.

This process is akin to what Wiener (1954) refers to when dealing with information as "... a name for the content of what is exchanged with the outer world as we adjust to it, and make our adjustment felt upon it. The process of receiving and of using information is the process of our adjusting to the contingencies of the outer environment, and of our living effectively within that environment."²⁵ The impossible quandary posed by Wiener for materialism, quoted above, is fundamentally resolved when it is recognised that our world is dynamic and the senses of all living beings, including humans, cannot but take notice of this material/physical aspect of moving matter or energy. The identification of difference/information in always moving matter or energy is fundamental to our existence. Missing in Wiener's interpretation is that information is differences. Differences that human and living beings learn to interpret in satisfying their physiological and social needs. Indeed, Wiener is right, information is "not matter or energy". Further, differences/information do play the role that Wiener envisioned but not in the way that he envisioned it. Information is not "exchanged with the outer world as we adjust to it, and make our adjustment felt upon it". Rather, in the brain, differences/information take the form of preferred pathways where behaviour and ideation are due to synaptic changes in organization as a result of conditioning, brought about by our sensory and activity experiences, impacting neural network

²⁵ Bynum, 'Flourishing Ethics'. p. 162

dynamics.²⁶ The human brain becomes an ever-evolving human organ that reflects the physical world in its organization, but at the same time has the capacity to affect the organization of the world by the actions of the human being in the environment. Particularly in the act of labour to eke out an existence in and from nature, in efforts to satisfy physiological and social needs. There is no need for postulating the existence of agency for the organism-in-its-environment. The motivations for the motivations of the organism-in-its-environment are physiological and social needs.

Another notion advanced by Bateson is that fundamentally ideas and information are synonymous²⁷. So, differences, information and ideas are one and the same notion. Cognitively by way of our senses, we are able to deal with differences and characterise these differences as ideas that allow us to discern, categorise, describe and share what we learn about our world, orally and otherwise. Ideas that can be gesturally and/or orally expressed or, sharing ideas by extending our memory into the world using pictographs, sculptures, language and/or writing. In other words, the differences/information/ideas that take hold or acquire a material representation in the neural circuits of our brain, reflecting the material nature of our world, then find themselves reflected back into our world in multifarious physical forms and actions. A bonus is the fact that information may be built upon information, i.e., higher levels of differences/information/ideas may be built on top of lower levels of differences/information/ideas, never losing the intrinsic connections that such a process entails.

In short, our universe is only composed of matter or energy and differences/information/ideas are a reflection of the dynamic nature of the universe in the sensory organs of living beings. Matter or energy are fundamental, difference/information/idea is a derived element only useful to living beings who perceive and interact with the dynamic nature of matter or energy to satisfy physiological and social needs.

In summary, one advantage of this definition of information by Bateson is its generality and therefore its applicability to every type of situation in which human beings generate and interact with information. Also, it allows extrapolation and use of the concept of information as a physical/material entity, with corresponding attributes as any other physical/material entity, with which we are familiar and feel comfortable manipulating and using. There is no need for us to imagine the need for anything other than matter/energy as fundamental to our universe once we understand this.

²⁶ Donald O. Hebb, *The Organization of Behavior: a neuropsychological theory* New York, NY, John Wiley & Sons Inc., 1949.

²⁷ Bateson, *Steps to an Ecology of Mind*. p. 318

THE AUTOPOIETIC HOMEOSTATIC ORGANISM-IN-ITS-ENVIRONMENT

The human-organism-in-its-environment may be represented preliminarily as a single organism-in-the-environment, as shown in Figure 1. This represented human-organism-in-its-environment is interacting asymmetrically with its surroundings as indicated by the distinctively different double arrows. This is an idealized representation since no human individual lives alone in its habitat. The basic unit of analysis is the autopoietic homeostatic human-organism-in-its-environment²⁸ represented by a circle, with an arrow pointing in the counterclockwise direction to indicate the autopoietic or self-productive nature of all living beings. The internal workings of the central nervous system resulting from the interactions with the surrounding environment is conveniently represented by an Internet meme identified as the “Eye of Horus” where the symbols for smell, sight, hearing, taste and touch are depicted, with the implication that in general the organism is capable of distinguishing externally and internally generated stimuli. Additionally shown, as tied to the sensory elements, is the development of ideation or the capacity of the organism for formation of ideas, thoughts or concepts that allow for organism higher-level memory formation in dealing with its environment.

To the left of the autopoietic homeostatic human-organism-in-its-environment shown in Figure 1, is a set of three interlaced circles representing the types of information that a human organism generates and deals with. In the general case, these circles or types of information may have a myriad of size relationships, as may be surmised from the explanation that follows. These are labelled, going from top to bottom as: (PSR-I) or Personal/Subjective/Relative Information, (IOA-I) or Impersonal/Objective/Absolute Information and (SD-I) or Shannon/Distilled Information. PSR-I and IOA-I are further identified as Internalized (Endogenous) Information; and, SD-I as Externalized (Exogenous) Information. Overlapping arrows pointing away from and back to each of the information circles depicted imply the ongoing and ever-present processing and recursive interactions between information types. Processing and recursive interactions that are fully dependent on the needs of the human-organism-in-its-environment. Each of these types of Information is explained in turn.

²⁸ Humberto Maturana and Francisco J. Varela, *The Tree of Knowledge: The Biological Roots of Human Understanding*, Boston, MA, Shambhala Publications, Inc., 1987.

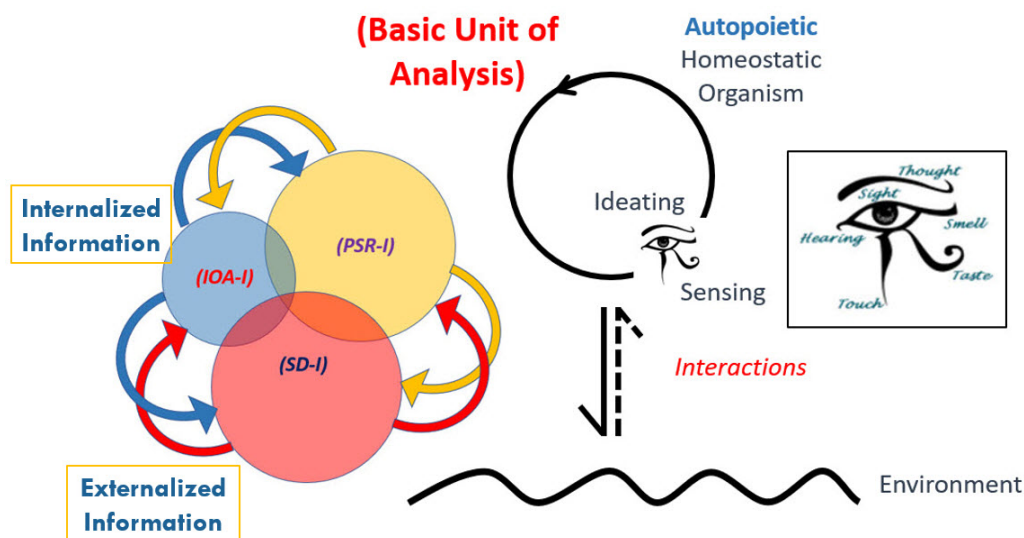


Figure 1 – The idealized autopoietic homeostatic organism-in-its-environment

PERSONAL/SUBJECTIVE/RELATIVE INFORMATION (PSR-I)

The circle closest to the homeostatic organism is identified as embodying Personal/Subjective/Relative Information (PSR-I), where these three words are taken in the context of the dictionary definition of these terms²⁹. There is also the connotation that in dealing with PSR-I³⁰ we are dealing with a first-person perspective and a qualitative assessment.

One of the main characteristics of PSR-I is that it may be considered as intrasubjective arbitrarily generated information, motivated by the satisfaction of physiological (internal and external) needs, where feelings and emotion play an important role. Emphasizing that the concept of physiological needs is a dynamic concept and is to be considered in the context of particular individuals. As our experiences and tastes over our lifetime accumulate and/or change so do our physiological needs. No one else has access to our PSR-I except as a result of the exteriorization of our feelings and/or emotions, which can take many artistic and non-artistic forms such as gestures, language, poetry, symbols, etc. This is comparable to the

²⁹ Cárdenas-García, Jaime F., 'Distributed Cognition: An Ectoderm-Centric Perspective', *Biosemiotics*, vol. 6, no. 3, 2013, pp. 337-350.

³⁰ Cárdenas-García, Jaime F. and Timothy Ireland, 'Human Distributed Cognition from an Organism-in-its-Environment Perspective', *Biosemiotics*, vol. 10, no. 2, 2017, pp. 265-278.

concept of the Umwelt put forward by von Uexküll³¹, albeit von Uexküll's Umwelt concept is species specific whereas what we articulate is individual specific.

IMPERSONAL/OBJECTIVE/ABSOLUTE INFORMATION (IOA-I)

As noted above, the unequal double arrows refer to the asymmetrical interactions between the organism and the environment. The environment comprising physical objects of a multiplicity of forms and texture apart from other living beings. In this process of an asymmetrical relationship, the organism encounters physical objects and other living beings that make it realize that some objective accounting has to take place if it is to continue its capability of satisfaction of physiological needs. Physical objects or other living beings that need to be taken into account are ones which might have the capacity to cause pain/harm and pleasure/help to the organism-in-its-environment. This brings forth the need for the organism to develop predictions as to what it believes to be true about the workings of its environment. Some of these predictions might simply reflect the PSR-I of the organism-in-its-environment, while others might reflect its experience of pain/harm and pleasure/help in its interactions with its environment. In particular, when some actions lead to pain/harm the organism-in-its-environment takes notice and in so doing reflects that it has access, however small, to the beginnings of Impersonal/Objective/Absolute Information (IOA-I). Here again these three words are taken in the context of the dictionary definition of these terms³². There is also the connotation that in dealing with IOA-I³³ we are dealing with a quantitative assessment and a third-person perspective.

In short, the organism-in-its-environment of Figure 1 is characterized as capable of discovering Internalized Information in the form of PSR-I and IOA-I, where its own preferences and beliefs take centre stage but are capable of gaining access to greater objectivity, avoiding solipsism, in contradiction with Maturana and Varela³⁴. The interlacing of the PSR-I and IOA-I circles is to express their dependent connection, where IOA-I is dependent on PSR-I. PSR-I is primary and IOA-I is secondary. The overlapping arrows between PSR-I and IOA-I serve to emphasize this dependence as well as the recurrent and ever-present interactions between them. Also, not all PSR-I is capable of becoming IOA-I. The part of IOA-I that is outside of PSR-I may be

³¹ Jakob von Uexküll, 'A stroll through the worlds of animals and men', in C. H. Schiller (ed.), *Instinctive behavior: The development of a modern concept*, New York, International Universities Press, 1957, pp. 5-80.

³² Cárdenas-García, Jaime F., 'Distributed Cognition: An Ectoderm-Centric Perspective'.

³³ Cardenas-Garcia, Jaime F. and Timothy Ireland, 'Human Distributed Cognition from an Organism-in-its-Environment Perspective'.

³⁴ Maturana and Varela, *The Tree of Knowledge: The Biological Roots of Human Understanding*.

regarded as the potential for IOA-I to further develop. For example, the realization that a sharp object has the ability to hurt us in most circumstances may be expanded to include all sharp objects as having that ability, since it might not be in our best interest to experiment with all sharp objects. The interactive nature of the human-organism-in-its-environment promotes the development of a PSR-I/IOA-I interactivity. PSR-I cannot but influence IOA-I. In turn, IOA-I cannot but influence PSR-I. It points to the origins of the scientific method, where PSR-I influences our beliefs about our world, which are tested by IOA-I. Further interactivity leads to new beliefs that again get tested and enhanced by IOA-I. This might lead to losing track of which is primary, PSR-I or IOA-I, as the overlapping arrows imply.

SHANNON OR DISTILLED INFORMATION (SD-I)

One characteristic of individual PSR-I and IOA-I is its inaccessibility. Individual PSR-I and IOA-I can only be accessed if an individual is willing to share its contents. PSR-I and IOA-I can only be shared by external expressions that an individual can muster using gestures, pictographs, orality, music instruments, sculptures, writing, etc. This has the effect of externalizing the PSR-I and IOA-I content that an individual has accumulated. While individual PSR-I and IOA-I may be surmised to be extensive in its content, it is limited when it comes to it being externalized by a willing individual. We are mostly unable to externalize all of our complex emotions, feelings and learnings, whether our intent is to make them intelligible to those around us or not.

The practical use of communication, which requires defining precisely the message that is to be communicated, coding it, transmitting it, decoding it and, finally, interpreting the message, is the process of *distillation* of individual PSR-I and IOA-I, by *externalizing* the contents relevant to precisely coding said message. More generally, any act that permits the *distillation* or *externalization* of PSR-I and IOA-I is said to transform said PSR-I and IOA-I into Shannon/Distilled Information (SD-I) or Externalized (Exogenous) Information. This implies that SD-I is secondary to PSR-I and IOA-I, implying that SD-I cannot exist independent of PSR-I and IOA-I. The interlacing of the PSR-I, IOA-I and SD-I circles is to express their dependent connection: IOA-I is dependent on PSR-I, and SD-I is dependent on PSR-I and IOA-I. Note the sets of overlapping arrows point away from and back PSR-I, IOA-I and SD-I, respectively. Or, PSR-I is primary, IOA-I is secondary to PSR-I, and SD-I is secondary to PSR-I and IOA-I. Also, not all PSR-I is capable of becoming IOA-I. But IOA-I has the potential to further develop and encompass other learnings. In a similar way SD-I may encompass only PSR-I, only IOA-I and a combination of PSR-I and IOA-I, as represented by the interlaced circles. Also, SD-I has the potential to grow based on the

interactivity with the environment that a human organism can muster. PSR-I, IOA-I and SD-I are so intertwined in the way that we live and act out our lives that it becomes difficult to give precedence to any of them.

INTERACTING AUTOPOIETIC HOMEOSTATIC ORGANISMS-IN-THEIR-ENVIRONMENT

Figure 2 represents the more realistic situation in which there are other similar human organisms co-existing in the environment, which may be considered just part of the environment to the corresponding organism.

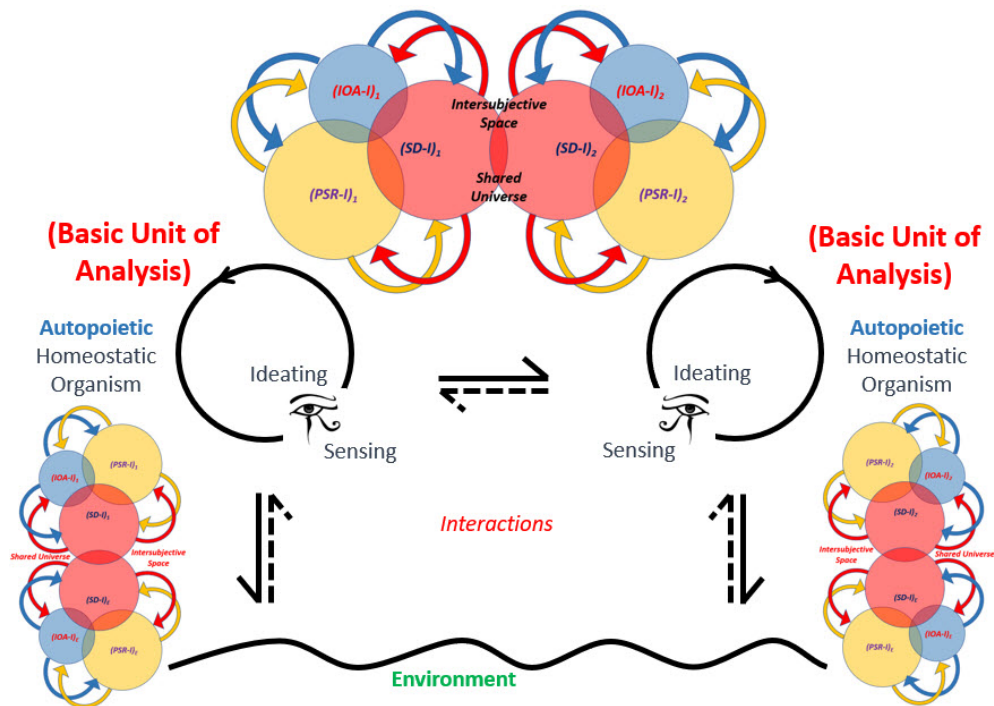


Figure 2 – Interacting autopoietic homeostatic organisms-in-their-environment

We can then surmise that these two organisms-in-their-environment, each having access to (PSR-I), in the case of the leftmost organism, represented by the circle to the upper right of the left-most organism or organism 1, which is in all probability different from that of the other organism-in-its-environment with access to (PSR-I)₂, shown by the circle to the upper left of the right-most organism or organism 2. Though Figure 2 shows two circles of equal dimensions, this would, in general, not likely be case. Organisms that are genetically and experientially dissimilar would most possibly need

to be represented by correspondingly different size circles. Also shown in Figure 2 are corresponding access to $(IOA-I)_1$ and $(IOA-I)_2$ on the part of each human organism. Similarly, each organism has the ability to distil $(SD-I)_1$ and $(SD-I)_2$, respectively. The asymmetrical recursive interactions between the organisms results in an exchange of $(SD-I)$ which occurs in an intersubjective social space, shown in Figure 2 by the designated intersection between the two circles designated as $(SD-I)_1$ and $(SD-I)_2$, respectively, and labelled as *Shared Universe* and further identified as *Intersubjective Space*. This has at least three implications for this *Shared Universe* or *Intersubjective Space* which may consist of: a) Only $(PSR-I)$ which comprises a shared first-person perspective; b) Only $(IOA-I)$ comprising a shared third-person perspective; and, c) Both $(PSR-I)$ and $(IOA-I)$, i.e., a combined first-person/third-person perspective.

Each individual may have her own $(SD-I)$ universe that has the potential to be shared but the need for communication and the forming of communities requires the building of a *Shared Universe*. This sharing results in the forming of bonds between individuals which may be widely shared by the community. In this process of sharing, the $(SD-I)$ universe of each individual requires its reduction by the amount of the *Shared Universe*. This shared space may be complementary, collaborative, harmonizing and/or conflicting, contradictory, counterpart, inverse, contrasting.

It is worthwhile noting that a generic $(SD-I)_i$ and $(SD-I)_{i+1}$ that interact to create a $(\text{shared } SD-I)_j$ does not necessarily have to agree with a $(\text{shared } SD-I)_{j+1}$ which is the result from the interaction of a $(SD-I)_{i+2}$ and $(SD-I)_{i+3}$. Indeed $(\text{shared } SD-I)_j$ in all probability is nothing like $(\text{shared } SD-I)_{j+1}$, e.g., $(\text{shared } SD-I)_j$ might be the result of interactions between two scientists, and $(\text{shared } SD-I)_{j+1}$ might correspond to the interactions between two people in love. There is no secret formula that determines that $(\text{shared } SD-I)_j$ is more relevant or in some way better than $(\text{shared } SD-I)_{j+1}$. Societal dynamics specific to the individuals involved, in a specified time and space frame, sorts that out.

SOME IMPLICATIONS

The mature human organism out of the womb is dependent on its five senses to register differences/information in a process of distributed cognition. Human distributed cognition is defined as “the ability of a self-referencing human organism-in-its-environment to interact with its environment to satisfy its physiological (internal and external) and social needs to survive and sustain itself.”³⁵ ³⁶ One of the most ignored

³⁵ Cárdenas-García, Jaime F., ‘Distributed Cognition: An Ectoderm-Centric Perspective’.

aspects of dealing with information is that human beings are at the centre of all information recognition, extraction, creation, transmission, preservation, storage and utilization. The development of Internalized Information results from an interactive process between PSR-I and IOA-I, as the human organism explores its reality. Key to this exploration are the sensory organs which also correspond to the motility capabilities that the human organism develops, as it sharpens its capacity for effective recursive interaction with its environment, in pursuit of satisfaction of its physiological and social needs. Leading to Externalized Information in the form of SD-I.

As an example of the application of this unique Internalized (Endogenous) Information and Externalized (Exogenous) Information framework let us examine the scientific enterprise. Science is thought to be mainly objective: in order for something to be scientific it has to be obtained by following the scientific method, based on observation and theorizing; posing a hypothesis which is then tested using a repeatable protocol to yield results that are scrutinised by a community of scientists to verify the validity of the hypothesis; thus, yielding additional experience leading to a new cycle of creative hypothesizing in a never ending recurring cycle. This defines a process that is repeatable by anyone with the required skills, and which allows greater and greater approximation to reality by the never-ending and continuous application of the scientific method. This makes the scientific enterprise historical in nature, i.e., what came earlier has the possibility of impacting what comes after. The scientific results that are currently accepted may be superseded by newly generated results and insights that are further corroborated in this endless process. A historical process that is methodical may be said to yield results that change over time, i.e., at any point in time these results may be measured on an absolute temporal basis but realizing that they in all probability will lead to new insights, changes and challenges. So, any particular scientific result is always in the process of changing or becoming something new and better. So, from a complementary perspective, the scientific enterprise is always evolving toward greater SD-I. So, it can be argued that scientific advancement has relative and absolute aspects.

Scientists have to undergo a process of socialization into science. No one is born a scientist, but rather human beings engage in an educational process, theoretical and empirical, that results in human beings that graduate into being scientists. In this regard, a question that requires an answer is: How does a subjective being become an objective being? Thus, science and the scientific method may be examined as a process that encompasses the Shared Universe or Intersubjective Space perspective that

³⁶ Cardenas-Garcia, Jaime F. and Timothy Ireland, 'Human Distributed Cognition from an Organism-in-its-Environment Perspective'.

requires inclusion of PSR-I, IOA-I and SD-I elements. No scientist makes discoveries without being motivated subjectively by PSR-I to make those discoveries, yet no scientist makes discoveries that he can defend and gain recognition without IOA-I. Yet these PSR-I and IOA-I developments can only be expressed in the SD-I Intersubjective Space. In other words, the use of the scientific method starts as an individual endeavour, in which individual participants engage in scientific inquiries and learning. Those individual inquiries and learning only acquire currency when confronted with the collective efforts of countless individuals that constitute the scientific enterprise in the SD-I Intersubjective Space. Reality involves, for an individual, a constant interaction between PSR-I and IOA-I in the never ending short-term, and reality also simultaneously involves SD-I in the never ending long-term. In short, PSR-I and IOA-I are primary but incomplete without SD-I, and the centrality of human beings in scientific discourse is fundamental.

In summary, the social, sensing and ideating autopoietic homeostatic organism-in-its-environment is the basic unit to explain how differences/information/ideas evolve in the Intersubjective process of interacting Internalized Information (PSR-I and IOA-I) and Externalized Information (SD-I). This intersubjective process emphasises the social nature of and recognises the centrality of the human organism-in-its-environment in distinguishing differences/information/ideas. Differences/information/ideas that are internalised and then externalised in the social and intersubjective process of human society.

INTERNALIZED (ENDOGENOUS) INFORMATION AND EXTERNALIZED (EXOGENOUS) INFORMATION

In the ontogenetic process of human development differences/information/ideas generated by human beings exist as Internalised (Endogenous) Information and also as Externalised (Exogenous) Information.

Endogenous information is information that is internal to the human body. It exists in our brain in the form of preferred pathways where sensorial information is embedded and ideation are represented as synaptic changes in organization as a result of conditioning, brought about by our sensory and activity experiences, impacting neural network dynamics. This capacity for acquiring endogenous information allows the manipulation of differences/information/ideas in the human brain and the development of a rich internal life. Endogenous information involves developing PSR-I and IOA-I.

Exogenous information begins when the human organism is able to interact with its environment initially by way of reflex actions that can be interpreted by caretakers.

Evolving, in the process of distributed cognition with caretakers, to more complex exchanges with other human beings. These actions are essential to the survival of the human species that lead to basic human communication in the process of learning and language development to deal with our environment. It is at this stage where most of our creative life takes place, as we externalise our inner life and reach an understanding of the separation of the human organism from the subsuming environment. The distributed cognition process accelerates and refines the life-long process of acquisition of PSR-I and IOA-I furthering the development of the intersubjective spaces between humans and the rest of the environment. The exogenous information process is expressed in the form of wall paintings, ancient stone artefacts, sculptures and musical instruments. The culmination of this process in antiquity is the origination of human speech and language. Human speech and language are the ultimate tools tied directly to exogenous information. Orality can be used as a storehouse of cultural traditions that can be passed down from generation to generation.

The next significant step in exogenous information production is the invention of writing and writing tools. The development of writing begins with the practical need for more permanent accounting practices in Mesopotamia in the fourth millennium BC, evolving from simple pictographs towards more structured signs representing word sounds. Followed by the invention of the printing press in the 15th century, which leads to the proliferation of manuscripts at reduced cost. The quasi-permanence of print media limits the manipulation of its content.

The discovery of electromagnetism and the electromagnetic spectrum in the 19th century brought about the next revolution in exogenous information creation. The reproduction of the human voice and its transmission through the airwaves by analogic means was made possible. But it is only with the advent of the need to improve the efficiency, precision and reach of oral and written communication that digital ICTs gained impetus. Shannon was a key player in the field who promoted the connection between Boolean algebra and electronic circuits³⁷. This development and others were the key to the digital revolution and bringing about the information age³⁸ (Castells 2009). Eventually leading to the ultimate transformation of exogenous information into binary digits, or bits, that are capable of being processed in electronic digital machines. Enabling the storage, processing and transformation of exogenous information from the heads of its creators into machines; machines that have become our companions in

³⁷ Claude E. Shannon, 'A Symbolic Analysis of Relay and Switching Circuits', *Transactions American Institute of Electrical Engineers*, vol. 57, 1938, pp. 713–23.

³⁸ Manuel Castells, *Communication Power*, New York, NY, Oxford University Press Inc., 2009.

their different embodiments. Digital information is akin to any other physical object which can be manipulated and transformed using machines designed by human beings.

In summary, human beings are at the centre of all information recognition, extraction, creation, transmission, preservation, storage and utilisation. What began as PSR-I evolved to IOA-I and SD-I, in a transformation process from endogenous information to exogenous information. A process that led to language, pictographs, sculptures, music, writing and digitization as expressions of exogenous information. In this technological progression in the process of generation of exogenous information the centrality of human beings has been obscured. The process of transformation of endogenous information into exogenous information is mystified.

THE FUNDAMENTAL PROBLEM OF THE SCIENCE OF INFORMATION

In an attempt at demystifying the generation of exogenous information it is useful to pose the *Fundamental Problem of the Science of Information*, i.e.,

How do human beings, in a self-referential process, develop from a state in which the information of the organism-in-its-environment system is almost non-existent to a state in which they not only recognise the existence of the environment but also see themselves as part of the organism-in-its-environment system, and are able not only to self-referentially engage it and navigate through it, but to even transform it in their own image and likeness.

This statement serves to unequivocally recognise the centrality of the human organism in the informational process. This is important not only from the perspective that human beings are at the centre of information, but also to emphasise the social nature of human relationships and the role that they play in making us what we have become with a necessary ethical dimension. The fundamental problem of the science of information is an essential marker for a solid ethical foundation in the Science of Information.

EXOGENOUS INFORMATION AND INFORMATION ETHICS

One key feature emphasised by Wiener³⁹ was the “process of receiving and using information” and the impact on human beings. Apart from the impact that cybernetics had on human beings and the developing machines that are becoming more common

³⁹ Norbert Wiener, *The Human Use of Human Beings: Cybernetics and Society*, 2nd edition, Doubleday Anchor, 1954.

for human use.

In a similar fashion, Moor states,

Computers are special technology and they raise some special ethical issues. In this essay I will discuss what makes computers different from other technology and how this difference makes a difference in ethical considerations (emphasis added). In particular, I want to characterize computer ethics and show why this emerging field is both intellectually interesting and enormously important.⁴⁰

It is interesting to note Moor's "difference that makes a difference in ethical considerations", which seems to parallel Bateson. Further, Moor identified "logical malleability" and the implicit "invisibility factor" as key features that made relevant ethical concerns with computer technology.

What is common to both Wiener and Moor is the fact that Shannon information⁴¹ or exogenous digital information uses digital machines and, more generally, digital information and communication technologies (ICTs) to process differences/information/ideas. In short, humanlike differences/information/ideas are processed by machines and the processing is beyond the control of human beings. This new situation is unlike any in the recent past where the objects of human manipulation are visible to the eye of the humans and are assumed to be in the control of humans. This is the main point regarding exogenous digital information manipulated by machines, which is the currency of digital ICTs, and requires a different approach to IE because of the many-sided impacts of digital ICTs.

A modest proposal for IE that this paper would like to advance is based on three key notions:

1. A UTI based on Bateson's difference that makes a difference;
2. Human distributed cognition, defined as the ability of a self-referencing human organism-in-its-environment to interact with its environment to satisfy its physiological (internal and external) and social needs to survive and sustain itself; and
3. The fundamental problem of the science of information.

The goal is to develop IE so that it fully considers the central role that human beings play in generating differences/information/ideas and exogenous information. A role which demands a conscious effort to bring forth an intersubjective consensual approach, which requires that all manner of exogenous information be included, in all developments in IE. This is sure to promote that "... the overall focus of ethics can and

⁴⁰ James H. Moor, 'What is Computer Ethics?', *Metaphilosophy*, vol. 16, no. 4, 1985, pp. 266-75. p. 266

⁴¹ Claude E. Shannon, 'A Mathematical Theory of Communication', *The Bell System Technical Journal*, vol. 27, 1948, pp. 379-423, 623-56.

should be shifted away from the narrow anthropocentric goal of only human flourishing to the broader, and more reasonable, goal of the flourishing of life, ecosystems and just civilizations, even well-behaved cybernetic machines that participate in the very fabric of those civilizations.”⁴² IE should avoid the burden of the narrow intent of self-interest and promote the broad inclusion that an intersubjective consensual approach brings to bear. Not only in bringing all manner of living beings to the table but allowing them to share exogenous information for the benefit of all.

SUMMARY AND CONCLUSIONS

This paper argues for the clarity that the definition of information by Bateson brings to the discussion of IE. First, it makes possible the recognition that information is not something other than matter or energy. Next, it makes clear that information is a qualifiable and quantifiable entity. Qualitatively human beings are at the centre of information creation, and quantitatively information is easily recognised as an essential element that living beings bring forth motivated by physiological and social needs. It also allows us to understand why the concept of information in this digital age is much more important than it was before, in the industrial age. Digital information is something physical, which we are able to manipulate just like any other physical object in our environment. Even our neural circuits in our brain can be manipulated so as to forget existing informational elements⁴³. This is the new normal that we need to envision for the “logical malleability” and “invisibility factor” of computer use identified by Moor⁴⁴ for all existing and emerging ICTs. But now with a clearly defined notion of information, a UTI, which needs to be developed and applied to all fields of human interest and inquiry, within the goals of an inclusive notion of intersubjective consensual IE.

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⁴² Bynum, ‘Flourishing Ethics’. p. 170

⁴³ Jiangyuan Hu, *et al.*, ‘Selective Erasure of Distinct Forms of Long-Term Synaptic Plasticity Underlying Different Forms of Memory in the Same Postsynaptic Neuron’, *Current Biology*, vol. 27, no. 13, 2017, pp. 1888-99.e4.

⁴⁴ Moor, ‘What is Computer Ethics?’.

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