

## THE CAUSAL NETWORK OF IN-BETWEENNESS

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**ABSTRACT.** *This paper focuses on our in-betweenness status in relation to two interacting realms: one labeled “matter”, the other labeled “information”. By applying the Aristotelian theory of causality to this framework, it identifies causal aspects of interaction among these realms. The emerging image is one of a system in the strong sense, as inspired by David Bohm – a set of elements functioning together in such a way that none of them could be missing without fundamentally altering the nature of the ensemble. This system is spanned by a causal network with nodes located in the two realms and at their interfaces. We discuss the distinct type of access humans have to the nodes from their intermediate positions, as well as the implications of the proposed framework for the analysis of current trends regarding digitization, virtualization and all-pervasive fragmentation.*

**KEYWORDS:** *information space, Aristotle’s causal theory, network, system, virtualization, digitization, fragmentation*

*“...We have made you neither of heavenly nor of earthly stuff, neither mortal nor immortal, so that with free choice and dignity, you may fashion yourself into whatever form you choose...”*

Pico Della Mirandola: Oration on the Dignity Of Man<sup>2</sup>

Some of the main topics of this paper are the human condition, causality, information, and soup. All of them have been subject to ample debate over time, even if they have not always been addressed together, in the same articles or books. If we take them separately, it might turn out that while people have very different opinions regarding these topics, of the four it is mainly the third one, information, which could score the highest measure of agreement. This could seem strange, especially in a context in which we are going to deplore the lack of a commonly recognized definition for this notion. What we mean, however, is that the vagueness of the concept of information would usually not tend to push us towards conflicting positions, as it is often the case for the other three, which have occasionally given rise to strongly opposing views. With this Augustinian approach in mind (“Provided that no one asks me, I know. If I want to explain it to an inquirer, I do not know”<sup>3</sup>), we

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<sup>2</sup> Translated by Richard Hooker; in: Reading About the World, Vol. 1, Paul Briens et al. (eds.), Harcourt Brace 1999.

<sup>3</sup> Saint Augustine, Confessions, XI. xiv.

find that “information” might offer a favourable starting point for the present discussion.

The core idea in this brief essay is the following: humans are characterized by in-betweenness, which is their determining condition – in other words, every other aspect of “being human” depends on it. Most of what will be used to support this statement has probably been uttered before – on many stages, and in many ways. If anything new or different can be spotted in our argument, it might not rely on a change in the story or the characters, but rather on the way the stage is set up, with information being assigned a major function. Moving away from the view that information represents some kind of backdrop, our endeavour is taking into consideration something that has long been recognized but often neglected, such as the air breathed in and out by the characters in the play. The latter thus turns into an interaction among participants moving between two categories of entities: the floor, the furniture, the props, on one hand, and the air on the stage, on the other hand. There is, however, a fundamental difference between the air used in our allegory and the actual role assigned to information; to be more accurate, the story should speak about air that is not only transformed when exhaled, but also capable of changing those who inhale it; it might affect the players on the stage, the personnel, the audience, as well as the floor, the furniture, and the props.

Comprehensively addressing such a goal would require an effort much broader than we can deploy here. The present approach will have to be painfully limited in extent. To start from a common place, as suggested above, let us return to information. You may want to proceed by reflecting upon what you have been doing, not just right now (presumably reading these lines), but also before that. If you review your recent activities, you can be sure to identify the fact that all of them are related to addressing concepts, acting upon categories, etc. – manipulating information. Of course, the very fact that you remember your actions is informational by nature, but even those actions *per se*, considered separately, promptly reveal their informational content. We dwell in the realm of information as much as in what we call the material world. Most of us will probably agree with this statement, even if we lack a widely recognized definition for information – a situation that is as progress-hindering as it is justified by the very nature of this strange entity (Suteanu, 2007). It might be in the nature of fundamental concepts to make the search for sharp definitions ineffective; as Eucken (1879:22) pointed out, even Aristotle tended to be ambiguous with respect to “supreme concepts” (examples include *ousia*, *hyle*, or *dynamis*). There is, however, one thing that should be specified right away to avoid confusion: the meaning we ascribe to the distinction between “information” and the “material world”. The former is not meant to be presented as separate from the world we live in, on the contrary – we subscribe to Landauer’s (1996) position concerning information being “physical”. Indeed, as discussed below, we consider it to be an intrinsic component of the world seen as a system. The intention of this distinction is to keep our awareness awake to the fact that, in spite of its ubiquitous and unavoidable presence in the world, information has properties that are radically

different from those of its “material” counterparts. The present article is not the place to have an appropriately ample discussion on this issue: let us just add here that the special characteristics of information seem to originate in its relation to copying and uniqueness. Fortunately, an exciting (and hopefully relevant) exploration can be undertaken even in absence of a crisp and complete description of what makes information different from anything else.

The good news is that we have figured it all out. First, we know how to get it all now: we can capture, store, and transfer information – *all* of it: digitization allows us to make identical – undistinguishably identical – copies, in an unlimited number, and preserve them in perpetuity; with the current rate at which our “reality” is shifting to the virtual realm (Suteanu, 2010), more and more of it will be captured and thus, in some way, “owned”. Second, we know how to interfere with time: the material support for information in digital form allows us to play and replay previously recorded images and sounds, anytime, anywhere: we can thus have time chopped and re-run. Third, we also know how to handle space – distances are like play-dough in our hands: our networks span the planet and more, and interactions among their nodes often depend now mostly on non-spatial factors. Do these transformations involve an inevitable shift from material values towards those of the spirit, from “to have” towards “to be”, in the sense of Erich Fromm (1979)? One may claim that something different and somewhat surprising is

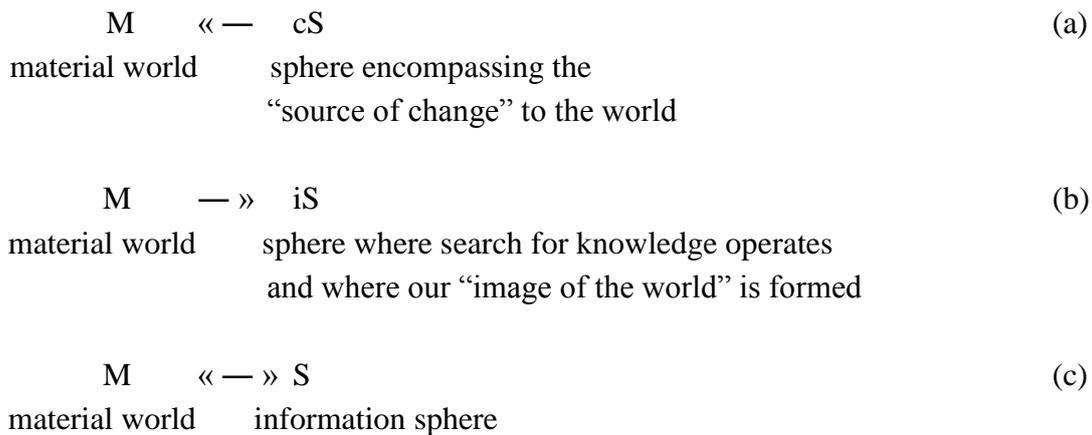


Figure 1

actually happening. We are experiencing a deepening materialism – but materialism has never been so dematerialized. The accelerating transfer of goods and values from the material world to the information world, accompanied by an over-abundant production of absolutely identical copies, which blurs the distinction between originals and replicas, is drawing us vigorously into the whirl of incessant search for more and ever newer possessions. Guaranteed identicalness, the power of virtuality, and the metamorphosis of geographical distances according to economic and technological criteria effectively support cultural uniformization, not just in a

limited region, but on the planet as a whole. Ironically, large-scale virtualization does not make us more detached from material goods; it does not turn us into more “spiritual” beings. We can see – probably for the first time in history, or at least for the first time so clearly – that a departure from the preoccupation for material objects, for “things”, does not contradict or undermine a materialistic approach to life: on the contrary, virtualization and digitization address materialistic desires. Illusions of matter and the pleasures relying on them are not necessarily less “matter-bound” and more “spiritual” in nature.

All these achievements are not mere theoretical scenarios, they are not confined to laboratory experiments: they have already become part of our lives and have changed our lives – significantly. Scientific progress is occurring faster than ever, so, technologically speaking, we are a happy species on a happy planet. As with all stages of major technological progress though, multiple forms of change occur, with either positive or negative implications – or both – being distinguishable now; we will probably become aware of many other, even major ones, in the future.

Beyond these incontestable manifestations of change, there are, however, reasons for deep concern. Among the most important ones are those related to our interaction with information, which lie at the basis of most aspects of our life. David Bohm (1980) has convincingly shown that our worldview is subject to fragmentation to such an extent, that fragmentation might be, ironically, the only all-encompassing feature pervading all fields of thought – and, implicitly, all fields of action. Our fragmented perception of reality and our fragmented approach to addressing problems have increasingly led to almost insurmountably hard challenges related to confusion and conflict on many levels. He finds that only a colossal concentration of our best efforts – made possible by the realization of the dire perspectives awaiting us should we not succeed – would make a real change possible. The challenges that Bohm carefully analyzes, as well as the origin of these challenges, concern our relation with information. We have important reasons to try to enhance our understanding of the way information works.

Like other thinkers, but earlier than many of them, Noica (1944) chooses to discuss information starting from etymological considerations. He insists on the early, active meaning of the verb “to inform”, which used to suggest conferring shape, removing homogeneous matter from its anonymous state, bringing something into existence: it is this, Aristotelian sense, that Noica considers to point to the deep significance of informing and information. In fact, *Logos* itself is seen by Aristotle as having a dynamic character and should be analyzed, according to him, as a process (Randall, 1960:297). In contrast, the present meaning of informing has mainly passive connotations, such as making oneself available for information by simply tapping into information sources, with most activities being oriented especially towards finding the best sources to tap into, rather than breathing new form into existing material in a creative process. The meaning changed from “giving” to “receiving”. Today, informing oneself would hardly be considered a creative process. In contrast, the powerful Aristotelian roots of “information” evoke the encounter of

two key concepts: *form* and *matter*. The latter is continuous, virtual – nothing precise, unless form provides it with actuality, specifying its configuration, its shape, its change.

This dichotomy allows us to talk about two realms. One of matter, which we will label “M”, the other of information, a realm or “sphere” seen as a source of conferring shape, a source of change, which we will denote by “cS”. The latter is considered to be acting upon “M” (Fig. 1a). One of the most comprehensive and intricate models regarding such an information realm and its interactions with the material world was proposed by Mihai Draganescu in a series of monographs (see, for instance, his synthesis work entitled “The depths of existence” – Draganescu, 1979). Many other scholars have approached this subject in original ways, and it would not be possible to list them all here (insightful overviews have been provided, for instance, by von Beyer, 2003 and Wright, 1990); we would only like to mention in this context the extensive but less-known work of Paul Constantinescu (1990).

One can assume that any change in the material realm is associated with information specifying the change: there is specific information encompassed in “information flux” or “i-flux”, which accompanies all processes occurring in the material world (Suteanu, 2007). In contrast to other models regarding the role of information in the physical world, the i-flux view includes interactions on all scales between information and matter, with scale representing a key factor in this framework (Suteanu, 2011).

From a somewhat different perspective, one may consider the distinction between “world” and “spirit” (Eco, 2011). On one hand, one may refer to “strong thinking”, a worldview according to which the “Absolute” is knowable and reason is always capable of grasping “the order of the world” (*veritas est adaequatio rei et intellectus*); on the other hand, one may consider “weak thinking”, a position that emphasizes the essential role and the unavoidable multitude of (possibly conflicting) interpretations (Zabala, 2006): regardless, says Eco (2011), there are always “facts” of the world to be interpreted, and not interpretations alone. “Flow lines” exist in the world, which have been there prior to any interpretation, and which guide the “thinkable”, the “utterable”, guarding them against aberrant moves. Such “lines of resistance” carry sense, direction (indicating at least the “wrong” directions), and it is through them that the world – even if arising from our interpretations and language – is presenting us with something that has already been there, has already been given, and is not constructed by us. It is thus difficult to argue against the existence of a material world, “M”, apart from another realm or “sphere” we denote by “iS”, in which our explorations and interpretations are operating (Fig. 1b). While living in a material environment, humans are constantly exploring non-material environments. We can see ourselves dwelling indeed between the materiality of the physical world and the space of information, when considering not just these, but also other different perspectives, such as those involving mathematical or artistic universes (Eliade, 1956; Berlinski, 2000).

In this context, we propose here the conjecture according to which cS and iS are part of one and the same sphere, which we will denote by “S” (Fig. 1c). S will thus stand for a sphere that interacts with matter, being always associated with its change. At the same time, S interacts with thought, hosting the realm of interpretations and knowledge. S is established as a domain in its own right, different and complementary to the “material” realm. In this framework, humans occupy an important position, one with access to both realms and characterized by in-betweenness. Most importantly, this is a world inevitably seen in its oneness: fragmentation is not intrinsic to its nature. It is in this sense that we can state that M and S form a system, by using a strong meaning of system, inspired by David Bohm (1994), i.e. a set of elements functioning together in such a way that none of them could be missing without altering the nature of the ensemble in a fundamental way.

Let us review in this framework the Aristotelian theory of causality (Physics II 3 and Metaphysics V 5). While completely absent from these pages until now, soup will finally come to the forefront of our discussion. We will start our model with the material realm, and move then to the information sphere, step by step. Clearly, the material cause would consist in this case of the soup ingredients. As a person with limited access to the world of soup-making, I would not venture to provide a list of such ingredients (which hopefully also saves us from disagreements that would distract our attention from the main theme of this discussion): let us assume that safe examples of ingredients would include water, salt, and certain vegetables such as carrots, potatoes, or onions.

Any collection of ingredients would be useless, however, without a procedure that would put them to work. We need a method. An algorithm. In this case, we call it a recipe. Now let us assume that we have it (for the writer of this article, this is actually the easiest part of the complex process of making soup). The recipe corresponds to the Aristotle’s “formal cause”.

It is at this point where the need for a more sophisticated causal theory, like the one of Aristotle, can be easily identified. We wish that a set of ingredients and a recipe were enough to make soup. I am fully aware of the fact that for those among the readers who have not tried it before, this will come as bad news: as strange as this may sound, those conditions are actually not enough. Reproducible experiments have consistently shown that no amount of waiting time seems to turn a recipe, water, salt, and vegetables (or other ingredients, or more ingredients, or fewer) – into soup. To make this issue palpable to those who are more familiar with abstract domains, we may compare this situation with one in which we are in possession of a function. Any function. Let us say  $y = 5x$ . Our function is capable of transforming any number of values of  $x$  according to the recipe provided in the formal cause. However, no matter how long we are ready to wait, nothing happens. It takes something else to turn any and all possible values of  $x$  into values of  $y$ . Somebody – or something – has to actually apply the available function, and this should happen for every value of  $x$  we want to be transformed. No matter how similar the formal cause may seem to be to an “activity” (Bohm, 1980:53) – and the program or algorithm should indeed be similar

to the series of actions to be performed – it cannot replace the actual activity. From this point of view, a function is like a soup recipe. And this is when Aristotle comes to rescue by providing another, completely different component of the causal framework: the efficient cause. It is only when this cause intervenes that things actually happen.

If we consider soup ingredients to be part of the material world, and the recipe (its content, that is, regardless of its material support) to come from the information sphere – in other words, the material cause to be located in M and the formal cause in S – then the efficient cause addresses the essential process of information being coupled to material components. The efficient cause acts at the interface between M and S. As is often the case, it is at the system interface where the most interesting things seem to happen. Following his “causally-oriented reading” of Aristotle’s *Rhetoric*, Rosenfield (1971) underlines a somewhat unexpected yet important feature of the process of causal interaction: the fact that “change requires generic cooperation between powers of acting and of suffering action”. Sure, the material components must be present. The algorithm must be prepared. However, everything may be given and ready, awaiting the transformative act, but nothing can occur unless – and to the extent to which – and in the manner in which – the coupling between S and M takes place. The efficient cause acts like a dynamic key. It brings the recipe to life and puts the soup ingredients in motion. It churns the numbers called x-values and produces the faces of y. Can anything be more important than that?

According to Aristotle, the answer is yes. His answer can be more easily understood in the case of soup, than, say, of spring rain. His idea that there might be something beyond the mentioned three causes is bold and, admittedly, difficult to support in certain cases<sup>1</sup>. However, we may keep applying his causal framework in this exploratory endeavor, examining the possibility that it would help us to shed light on the relations among informational and material components of the world. Adapted to our example, Aristotle’s daring question becomes “why would you make soup?”. To be honest, I have asked myself the same question as a child, and probably so did many other children who would have very much appreciated it to be allowed to skip soup, when there were so many other good things to eat (dessert being one example). I must also confess that neither this, nor the other three categories of causes came to my mind while I was asking myself this question, which illustrates the fact that asking questions, as useful as this exercise might be, does not always lead to powerful insights. Nevertheless, in his causal framework, Aristotle’s is a powerful question. It indicates that there is something beyond the presence of the right ingredients, of the recipe, and of the efficient cause enabling their coupling. There is a “plan” to make soup (and to have kids eat it, I might add). Now, that is something different from the other three causes. We will refrain from discussing here the issues

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<sup>1</sup> The debate regarding the way in which Aristotle admits that not all cases would allow one to identify each of the four causes, as well as the ideas that distinguish his different approaches to the causal theory – pursued not only in *Physics* and *Metaphysics*, but in *Parts of Animals* as well – are beyond the scope of this paper.

related to the “plan” behind spring rain, or the nature of its planner. Our interest is focusing on the interdependency between the key components of the world, whether material or informational or anything else – if anything else should prove to have to be included.

Even if at first sight this fourth, “final” cause, shares the nature of the formal cause, by being “informational” rather than “material”, one can sense the distinction. It is one thing to write down a recipe (or a number of recipes), and another to decide to cook, and what to cook. It is one thing to apply an equation to every desired value of  $x$  to get  $y$ , and another to get the equation in the first place. It is one thing to apply nature’s laws (“formal cause”) associated with the changes occurring in the physical world (“material cause”) through mechanisms constituting an “efficient cause”, and another thing to produce the laws. One may wonder if Aristotle’s “final cause” could not be associated with the actual source of such laws: a cause operating at a totally different interface, one between the information sphere  $S$  and another realm, to which we have not assigned a letter yet.

These four types of causes can be thought of as acting in a multitude of situations, in which different physical entities are involved. While various instances of the material causes are expected to be interrelated, so are the other three causes, whether considered to be operating in the information sphere or at the interface. The image of a network arises, a causal network consisting of nodes located in the different types of realms. Humans find themselves in a situation that makes them capable of accessing both the material and the informational domains. They are not confined to any of them. From their intermediate position, they have access to nodes of the causal network. With their in-betweenness status, they can use the nodes to navigate the different types of space, without expecting that their exploration will leave those spaces unchanged. And without giving up their confidence that, no matter how complex the networks and how intricate the spanned spaces, they will keep learning about themselves and about navigation, which might turn out to be one and the same thing.

The picture of the world that emerges from the application of the Aristotelian causal framework to the material and informational realms proves to be closer to some kind of “Unity”, to a “Cosmos” that is intrinsically un-fragmented and by principle un-fragmentable. Admittedly, it is quite different from the image that dominates today’s science. There is a huge chasm between what is generally considered to represent the scientific vision and the one discussed, for instance, in the framework of Biocosmology (Khroutski 2008, 2010a, 2010b). In fact, in spite of the significant changes towards inter- and trans-disciplinarity that have been occurring lately, in spite of the accumulating arguments arising from the science of complexity as well as from individual disciplines, notwithstanding concrete proof concerning the effectiveness of integrative approaches, and regardless of the “unifying” discourse arising in various fields (such as the study of the environment), our scientific framework does not provide a unified approach to nature. Most of the time, we act in science as if no steps towards an organic picture of nature had been made. We usually

teach as if fragmentary approaches were the only legitimate paths in knowledge space. The very fact that there is so much talk about our results becoming more integrated shows how remote a “Cosmos” image is from our daily life space. This is not just a matter of bad choices or of intellectual or emotional idleness (although this might be the case to some extent): the reasons for our fragmented view seem to have completely different dimensions from those for which we feel personally responsible. One should not hasten to make a particular type of human endeavour (such as science) responsible for this situation: our thinking has been moving along in this direction, of deepening and gradually all-encompassing fragmentation, for a long time and on many fronts (Bohm, 1980, 1994). Not having an obvious culprit to blame, however, is not a reason to believe that the situation is less serious and less alarming. The interconnectedness suggested by the causal framework discussed here offers reasons for more and deeper worries. If the sphere S makes interactions between iS and cS possible (or even includes them as part of its functioning), our fragmented worldview may have an impact beyond our mere thoughts and our ways of approaching the world. It hardly seems appropriate to further contemplate possible interactions in a realm working according to mechanisms we do not know, and the very existence of which is marked by major uncertainties.

The causal framework of in-betweenness offers an image of a tightly bound whole, characterized by unavoidable interdependencies that are not limited to the type of causal thinking that dominates our current worldview. Some of its links – and probably the most important ones – have not been supported by any proof. The whole framework can thus be seen as a speculative model – at best. It is the author’s hope that it might contribute to the seeds and the stimulus for the emergence of better anchored models.

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