

Three obstructions: forms of causation, chronotopoids, and levels of reality

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Abstract The thesis is defended that the theories of causation, time and space, and levels of reality are mutually interrelated in such a way that the difficulties internal to theories of causation and to theories of space and time can be understood better, and perhaps dealt with, in the categorial context furnished by the theory of the levels of reality. The structural condition for this development to be possible is that the first two theories be opportunely generalized.

Keywords Ontology · Causation · Interaction · Levels of Reality · Space · Time · Spacetime · Chronotopoids · Hartmann · Dynamics

1 Introduction

Three of the principal theories which can be used to understand, categorize and organize the many aspects of reality *prima facie* have unexpected interdependencies. The theories to which I refer are those concerned with the causal connections among the items that make up the real world, the space and the time in which they grow, and the levels of reality. All things considered, it is not the fact that these theories are reciprocally connected that matters most, but the discovery that the difficulties internal to theories of causation and to theories of space and time can be understood better, and perhaps dealt with, in the categorial context furnished by the theory of the levels of reality. The structural condition for this development to be possible is that the first two theories be opportunely generalized. In other words, the thesis outlined in this position paper has two aspects. The first is the hypothesis that the theory of levels can function as a general categorial framework within which to recast our understanding of causal and spatio-temporal phenomena. The second aspect is that the best-known and most usual categorizations of causal, spatial and temporal dependencies are not sufficiently generic and are structurally

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constrained to express only some of the relevant phenomena. Explicit consideration of the theory of the levels of reality furnishes the keystone for generalization of both the theory of causes and the theory of times and spaces. To assert that a theory is not sufficiently generic is to say that the manner in which it is configured may hamper rather than help full understanding of the relevant phenomena. From this assertion follow two of the three obstructions mentioned in the title to this paper.

The third obstruction is easier to specify. Whilst the theories of causality and space-time are robust and well-structured—whatever criticisms one might wish to make of them—the situation of the theory of the levels of reality is entirely different, in that it is not at all widely endorsed or thoroughly developed. On the contrary, it is a decidedly minority proposal, and it still has many obscure, or simply underdeveloped, aspects. The theory of levels is the third obstruction cited in the title. Nonetheless, the approach outlined in what follows seems to be the most promising route to follow.

Though I may be mistaken, as matters stand it seems that the theory of levels provides the best categorial framework in which both to undertake the indispensable generalization of the theories of causal connections and of space-time, and to examine their interactions.

2 Causal connections

I include in the concept of causal connection all the linkages which constitute the particular dependency relationship whereby the actions and development of an item are influenced by the presence, actions and development of another item.

Three specifications are necessary. By ‘item’ I mean the class of types (genera) of substances (‘objects’, ‘processes’, ‘stuffs’, perhaps ‘groups’, and ‘states of affairs’) and their accidents, attributes, properties or determinations. I shall use the usual terminology to denominate the two classes as respectively ‘class of substances’ and ‘class of accidents’. I shall not discuss whether the various categorially distinguishable types of substance are ontically reducible to a smaller set of genera; but were I to do so, the most natural hypothesis would be that substances *qua* processes are the ontic bearers of the other types of substances.

Secondly, by ‘influence’ I mean every form of interaction between the source of the causal connection and its target. I do not assume, however, that the source and target of the causal connection must be individuals; for they may very well be collections (multiplicities) of various kinds.

Thirdly, and equally importantly, I use the expression ‘causal connection’ to denote the idea that causal nexuses may occur systematically in non-relational form. They may sometimes be relations, but they are not necessarily such. The forms of causal dependence are often richer and more sophisticated than transpires from their relational codification.

In light of these preliminary distinctions, the terms of the problem that I shall address can be summed up in two statements.

The first is that there are innumerable forms of causal connection among many different types of items. Whatever the realities of concern to us, the items that make up those realities are interrelated by many different forms of causal dependency

operating in many different directions. We often find that the usual forms of unilateral dependency (from A to B) are flanked by bi- and multilateral dependency (as in the case of a network whose elements arrange themselves in parallel with each other).

The second statement is that, despite the boundless multiplicity of the items which make up the world and the apparently equally boundless multiplicity of their causal connections, we can and must say that we live in *one* world (and not in 12 or 47 different worlds). Although at first sight banal, this observation relates to a problem which is anything but trivial: if the world is *one*, this means that the multiplicity of items and the multiplicity of their connections are structured so as to converge on a synthesis, on a whole.

There are two different ways to understand this whole. The first is to interpret the unity of the world as the unity of the matrix which remains when all items and all their causal dependencies have been *reduced* to a base canonical form, which is usually the one propounded by some theory of physics. Obviously, this reduction can only be performed at the cost of forfeiting a great deal of information (and it is for this reason that the canonical reference structure is obtained by *reduction* and not by *transformation*). Those who for some reason find this strategy unacceptable are forced to adopt a different one based on defence of the various types of information of which items are the bearers. The problem now is that the majority of the scholars who defend the idea of a multiplicity of different types of information (biological, psychological, linguistic, economic, aesthetic, ethical, etc.) have no difficulty in acknowledging the presence of connections internal to *individual* domains, but they usually find it extremely hard to *coordinate them* systematically in some appropriate general categorial framework. Put otherwise, the majority of the scholars who reject reductionism find themselves forced to defend the idea of the (irreducible) multiplicity of worlds. It therefore seems that the fundamental choice is between accepting that there is only one reduced world (i.e. a single reality-bearing structure) and accepting that there are many mutually irreducible worlds.

I believe that both these positions are mistaken. Each of the two options is based on a correct assumption (the *unity* of the world on the one hand, the multiplicity of *realities* on the other), so that—by complement—each of the two options is forced by the absence of an adequate categorial framework to rigidify and dogmatize its underlying assumption.

Perhaps the best way to escape from this impasse is to develop a broader categorial framework in which the various cases find appropriate collocation and configuration. This is the problem to which the expression ‘generalized theory of causal connections’ refers. The main difficulty which arises when we endeavour to produce such a theory is that we have almost no inkling of the direction in which we should proceed. Fortunately, however, the theory of causes is not the only fundamental theory to find itself in this embarrassing situation.

3 Chronotopoids

In the course of the twentieth century, numerous scholars sought to defend and elaborate the idea that there are different kinds of time and different kinds of space. The problem is not just the difference between time as the external order of phenomena (clock or calendar time, understood not only informally but specified up

to the desired level of precision) and the inner, subjective time of psychological phenomena (qualitative or phenomenological time). The difference between ‘time’ and ‘timing’ has been described particularly efficaciously by van Gelder and Port (1995), and their work may be consulted for a modern version of the difference between the two types of time. I shall not reiterate their arguments here, because the thesis that I wish to discuss is more demanding than that implicit in the difference between the two families of time just mentioned. Stated simply, I shall argue that that there are *numerous* families of times, each with its own structure. The same applies to space: I shall argue that there are numerous types of real spaces endowed with structures that may differ greatly from each other. The qualifier ‘real’ is obligatory. I shall not be concerned with the fact—which I consider entirely obvious and not at all disconcerting—that many different abstract (usually mathematical) theories of space and time can be constructed. We shall later need all our mathematical imagination to comprehend the richness of the real; for the time being the point in discussion is that there are many *real* times and spaces.

I have said that during the twentieth century various thinkers sought to defend and elaborate the idea that it is proper to distinguish diverse spaces and times—for example in psychological, social, anthropological, historical, and cultural terms. Unfortunately, it seems correct to say that many of these authors substantially failed in their attempts because they were unable to go beyond allusive and metaphorical renditions of their ideas. The thesis that I propose here is that, as in the previous case of causal connections, these failures were due mainly to the lack of a theory of the levels of reality. In the case of the time and space problem as well, we can only hope to move forward by devising an adequately generalized version of the corresponding categories.

Drawing on Brentano, I shall treat the general problem of space and time as a problem of chrono-topoids (understood jointly, or separated into chronoids and topoids).¹

Development of the theory will require solution to three main problems. The first of them is establishing which families of chrono-topoids are continuous and which are discrete.

The second problem concerns the cohesion of their structure—the forces, that is, which hold them together. The solution to this aspect of the question relates to the problem of causal connections discussed in the previous section. Here we find a first interaction between the theory of causes and the theory of chronotopoids.

The third problem—which, note, is very similar to a corresponding problem pointed out in the case of causal connections—centers on the synthesis among different chronotopoids. However many the differences may be among the multiple chronotopoids required by the items which constitute reality, chronotopoids do not operate independently of each other; they must merge into a synthetic configuration. As in the previous case of causal connections, also the theory of chronotopoids is seemingly obliged to rely on a theory of the levels of reality.

¹ See Poli 2004 and Albertazzi 2006. Bell 2000 and 2005 provide an intuitionistically-based reconstruction of Brentano’s theory. A different interpretation is under elaboration by H. Herre (in preparation) and A. Scheidler (in preparation).

4 Some details

Some further information may aid the reader in navigating through the complex terrain described. I shall furnish only some basic details. The point to be made most forcefully is that the study of psychological and social phenomena requires a variety of geometric structures (spaces) only some of which are sufficiently known (see e.g. Koenderink and van Doorn 2001). Needed for this purpose are spaces with hierarchical structures (atlases of maps on different scales), spaces with locally unordered structures, point-less continua (whose minimal parts are therefore ‘infinitesimal’), spaces based on forms of exclusively local organization, and so on. Study will have to be made of multiple relations among these spaces (as well as other types not mentioned). Spaces can be varyingly understood as containers or as structures in which geometric entities are viewed as operators of various kinds. The latter may have inputs, states to be modeled, and corresponding results.

An exemplification which is less abstract and more explicitly tied to the natural articulation of space might comprise the space in which we move, visual space, the visual field, the space of colour, various types of parametric space (shapes, phases of movement), and the spaces of meaningful objects (e.g. physiognomies). Large part of the contemporary literature concentrates on structures based on and guided by data, while processual approaches (e.g. of microgenetic type) are very rare (for an exception see Rosenthal 2004).

Some of these spaces can be viewed as abstractions of corresponding parametric spaces of physical type (consider the space of colours understood as a three-dimensional subspace of the space of physical radiation), while others have no obvious physical correlate and are apparently authentically mental (hot and cold colours).

Of particular interest is the case of pictorial space: that is, the space obtained when an observer looks ‘into’ a painting. Because a painting consists of a surface covered by patches of colour in a certain pattern, the pictorial space is a psychic object hallucinated by the observer. Nonetheless, pictorial objects have spatial attitudes, shapes, intrinsic colours and material properties which form a spatial scene. The studies by Koenderink show that pictorial space is a homogeneous space with one isotropic dimension (and is therefore not Euclidean), locally unordered, with a self-similar topological structure.

5 Levels of reality

The topic of the levels of reality is certainly not a new one. What would perhaps be new is a theory of levels able to resist criticism. Among the many versions of the theory now largely discarded are those developed by Spencer, Lloyd Morgan and Alexander (for a survey see Blitz 1992). Less clear is judgement on what is still today the most sophisticated version of an ontological theory of the levels of reality: the one developed by Nicolai Hartmann (Hartmann 1935; Poli 2001a).

Although my theory is closely influenced by Hartmann’s work, it introduces an architectonic change with which he would presumably not agree (Poli 2001b and subsequent works cited in the bibliography): the replacement of the linear order followed by Hartmann—the ordered sequence of physical, biological, psychological

and spiritual strata—with a triangular organization where the psychological and social strata co-evolve out of the material stratum understood as comprising both the animate and inanimate worlds.

Referring the reader to my other publications for the many details necessary for full understanding of the theory, here I outline only its main components.

The crucial point of departure is the adoption of a categorial approach to the levels of reality. Put simply, a level of reality is represented by a group of categories. The levels of reality are characterized (and are therefore distinguished) by their (ontological) categories.

The next step is to distinguish *universal* categories, those that pertain to the whole of reality, from *level* categories, which pertain to one or more levels but not to all of them.

As far as universal categories are concerned, the old Aristotelian list of categories is still helpful. Whatever the items under analysis, they may present qualitative and quantitative determinations, temporal and spatial locations, relations with other items, and they may exert influence on other items and be influenced by other items. Obviously, each of these categories requires developments that go well beyond Aristotle. However, his main intuitions as far as accidents are concerned are still worth considering.

Substance and accident are the first two universal categories. The analysis of substance requires the development of a number of new theories. One of them is the theory of particulars, i.e. the systematic analysis of categories like thing, process, stuff, and state of affairs. A second theory required is that of wholes and their parts (structures). Furthermore, account should also be taken of causation and chronotopoids. These basic references show that ‘substance’ is the heading for a complex net of topics. Accidents also have a troublesome complexity centered on the difference between extensive and intensive accidents, whose further distinctions require chronotopoids, i.e. by distinguishing accidents extensive in both space and time, extensive in space and intensive in time, intensive in space and extensive in time, or intensive in both space and time, for *appropriate* spaces and times (therefore called chronotopoids). Note that I am using the theory of chronotopoids to classify accidents (for some initial steps in this direction see Poli and Mazzola 2000; Poli 2001c, ch. 6).

In its turn, the theory of levels of reality articulates the dichotomy between substance and accident. This distinction requires further specification: certain families of accidents may inhere in specific families of substances. On the other hand, families of substances admit only corresponding families of accidents. Having a given length is an accident that can only inhere in a material substance;² the accident of an irrepressible joy can only inhere in a psychological substance; the accident of fulfillment of some legal requirement through revocation can only inhere in a social substance. The theory of the levels of reality provides the categorial framework within which all these differences can be systematically articulated.

The distinction operates across three basic realms or regions (or strata, as I shall call them) of reality. Even if the boundaries between them are differently placed, the distinction among the three realms of material, psychological and social phenomena is largely accepted by most thinkers and scientists. A major source of discussion is

² *Material* as used in this sentence should be taken as opposed, not to formal but to psychological and social, according to a distinction I will shortly provide.

whether inanimate and animate beings should be placed in two different realms (which means that there would be four, not three, realms) or within the same realm. The latter option defends the thesis that a phase transition or something similar connects inanimate and animate items.

6 Hierarchies

However, the notion of the hierarchical organization of reality is not enough on its own, for there are many types of differently structured hierarchies. The ontological hierarchy assumed by the theory of levels has wholly innovative features with respect to conventional hierarchical theories (Poli 2006c). Inadequate understanding of the entirely original nature of the hierarchies required by a theory of the levels of reality has been the main factor responsible for the failure of previous attempts to develop a stratified ontology. Put briefly, the problem is that the hierarchy of levels in general is not a linear hierarchy but a complex one which I call ‘tangled’. In other words, the levels are organized as in a network, but this is a network composed of nodes connected on different planes, and some of these nodes display complex forms of *existential* dependence on other nodes in the network.

7 Two main relations

Various types of relations link the various levels of reality together. Two main situations can be distinguished.

Consider for instance the relationships between chemistry and physics. Let us assume that we possess a categorially adequate analysis of physics³ expressed as $\varphi = \{C_{\varphi 1}, \dots, C_{\varphi m}\}$. Let us further suppose that we possess a categorially adequate analysis of chemistry, say $\chi = \{C_{\chi 1}, \dots, C_{\chi n}\}$. The following question can now be asked: what type of relation connects physical and chemical reality? The answer is straightforward: Chemistry is based on physics, but it says something more. Chemical phenomena go beyond (purely) physical phenomena, i.e. chemistry is a creative extension of physics. Trying to categorize chemical phenomena by resorting to physical categories alone does not produce false results, but it proves useless because it dissolves what is characteristic of chemical phenomena. Categorially speaking, the situation just sketched can be summarized by saying that the set of chemical categories extends the set of physical categories. Passing from the physical to the chemical level means adding *new* categories.⁴ This is the situation called *over-forming*.

Let us now discuss a different case, for instance the connections between physics and psychology. As in the previous example, we assume that adequate categorizations are available in the form of, say, $\varphi = \{C_{\varphi 1}, \dots, C_{\varphi m}\}$ and $\psi = \{C_{\psi 1}, \dots, C_{\psi n}\}$. However, it is evident that the new situation is substantially different from the

³ Obviously this categorial analysis must be produced by physicists, not by philosophers.

⁴ This is only the simplest feature. A less cursory description would require discussion of a number of other features, notably the possibility that not all the lower level categories should be lifted to the higher order level, and that in the two contexts the same category may perform a different role because it interacts with different groups of level categories.

previous one. We cannot claim—as we did in the previous case—that the categories of psychology *extend* the categories of physics, and that the group of psychological categories is obtained by adding new categories to the categories of physics. All that we can claim is that psychological categories are orthogonal to physical categories. However, something more is needed, namely the claim that psychical phenomena require physical bearers.⁵ Psychological phenomena are difficult to categorize because they are *categorially independent* from and *existentially dependent* on their bearers. Relations between levels characterized by both categorial independence and existential dependence will be termed *building-above* relations.

Some terminological conventions will help the further development of the theory of levels. In what follows, levels connected by building-above relations will be called *strata*, levels connected by over-forming relations will be called *layers*. I shall eventually use the expressions ‘sub-layer’ and ‘sub-stratum’ when analysis requires them. The term *level* will be used as generic between strata and layers.

8 The three strata of reality

I previously distinguished the three broad realms of material, psychological and social phenomena. According to my terminological conventions, these are strata of reality, or categorially orthogonal domains. Both Husserl and Hartmann, for example, have distinguished the realms (or strata in my terminology) of nature, psychological phenomena, and social phenomena. And both maintain that the distinction among natural, psychological and social phenomena is a strictly categorial distinction.

The question now arises as to how the material, psychological and social strata are connected together. The most obvious answer is that they have a linear structure like the one illustrated by the left side of Fig. 1.

On this view, the social realm is founded on the psychological stratum, which in its turn is founded on the material one. Likewise, the material stratum is the bearer of the psychological stratum, which in its turn is the bearer of the social one. This point of view is part of the received wisdom. However, a different opinion is possible. Consider the right side of Fig. 1. In this case, material phenomena act as bearers of *both* psychological *and* social phenomena. In their turn, psychological and social phenomena reciprocally determine each other. Psychological and social systems are formed through co-evolution: the one is the environmental prerequisite for the other (Luhmann 1995).

Before continuing, I should point out that the reference to Luhmann’s phenomenology or systemic sociology is restrictive, in that these are theories concerned with human reality *in particular*. But the thesis set out by the scheme on right-hand side of Fig. 1 is much more general because it states that the mental and social dimensions of *any living entity* interact with each other in the forms which are typical of the individual species. This position resembles the twofold characterization—‘reproductive’ and ‘economic’—of living species devised by Eldredge and Greene (1992).

⁵ It would be more accurate to say *biological*. However, we will shortly see that, from a categorial viewpoint, the connection holds between the psychological and the material strata of reality, biology being included in the latter.

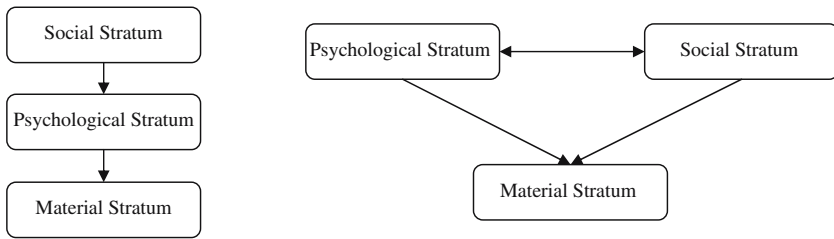


Fig. 1 Left: Linearly organized strata. Right: Strata with bilateral dependence

In dynamic terms, the evolutionary interaction may be viewed as proceeding from proto-mental systems to early proto-social ones, whose operations retroact on the proto-mental systems to trigger further development. Note that strictly speaking one can neither affirm nor deny some priority of mental components over social ones.

The triangular scheme has a more complex structure than the linear scheme, because it requires specification of the horizontal relation between the psychological and social realms—the one that embodies their interactions. Although I am not yet able to demonstrate it, my intuition is that the interaction between these two strata is one of *bilateral building-above*. And the fact that this is a building-above relation tells us that the two strata are characterized by two different, reciprocally orthogonal, categorial series. It also tells us that they stand in a relation of existential dependency. The bilaterality adds a further condition whereby the existential dependence is reciprocal: the one does not exist without the other.

In light of these specifications we may now state that the psychological stratum and the social stratum are characterized by the presence of a twofold form of existential dependency: on the one hand, both depend on appropriate material bearers; on the other, the psychological stratum depends on the social one, and the social stratum on the psychological one.

9 The material stratum

Each of the three strata of reality has its specific form of organization. The case of the material stratum is the most obvious. Suffice it to consider the atom-molecule-cell-organ-organism series (extendable at each extreme to sub-atomic particles on the one hand, and to ecological communities on the other). In this case we have a clear example of a series that proceeds by levels of granularity. The segmentation of the material stratum into physical, chemical and biological planes can be considered a first approximation to its inner organization. The biological plane, for example, can be distinguished into the sub-planes of genetics, cytology, physiology, ethology and ecology. Each of these sub-planes is characterized by the presence of a specific reference item (respectively: gene, cell, organism, population and ecosystem) each of which instantiates a specific causal network. The distinction among these various planes is relatively clear-cut provided one does not too closely approach the critical zones of transition from one plane to the next. Seen from close up, in fact, the differences among the planes merge into a sort of indistinct phenomenal continuum (e.g. supramolecular chemistry). These are the cases in which the lack of a general theory of causes makes itself most sharply felt.

The material realm has a largely linear internal organization (in the sense of a structure analogous to that depicted on the left-hand side of Fig. 1). Biology raises some resistance against the linear characterization of the material realm with its division of eukaryotes (i.e. organisms whose genomes are enclosed in nuclei) into animals, plants, fungi and protists (Margulis and Schwartz 1998). Thorough analysis, however, would take us beyond the scope of these introductory remarks, and I merely note the presence of a possible problem.

10 The psychological stratum

The psychological and social strata differ from the material realm in that they are characterized by the onset of new categorical series (relative to psychological and social items).

Analytical description of the psychological stratum is less straightforward than in the case of the material stratum, not only because of its intrinsic complexity but also because our scientific imagination has been unable to furnish an elementary schematization like that provided by the physics-chemistry-biology series (Poli 2006a).

The first requirement when addressing the problem of the structure of the psychological stratum is to realize that the psyche has a twofold nature: as far as mental activities are concerned, it is a process; on the other hand, mental processes are structured so that they present correlated contents. The traditional way to present the thesis of the processualistic nature of the psyche is to claim that psychological phenomena are temporal phenomena. I shall consider the thesis of the processual nature of the psyche in the version of it developed by Brentano (Albertazzi et al. 1996; Poli 1998; Albertazzi 1999; Poli 2004, Albertazzi 2006):

Main ontological thesis on psychological phenomena (Brentano's thesis): Psychological phenomena have two sides, one independent, the other dependent. The independent side is a process, termed 'act'; the dependent side is an object, termed 'correlate' of the act.

The easiest way to show the connection between act and correlate is by examples, as follows: for every seeing there is something that is seen, for every thinking there is something that is thought, for every feeling there is something that is felt, etc. Correlates depend on their acts as their ontological bearers. But something more is at stake, because the dependence connection between correlate and act is of a more intimate nature than the usual bearer-borne relation. In fact, borne correlates are dependent on their bearer acts not only existentially but *materially* as well. *Material* here should be taken in the Husserlian sense, where it is opposed to *formal*.

We shall distinguish two main families of acts, which Stein baptized 'egological' and 'non-egological'. The latter family is further subdivided into 'perceptive presentations' and 'mental presentations'.⁶

Presentations form what is usually called stream of consciousness, specious present, moment now or working memory. This concerns the basic temporal structure of our conscious life. Mental presentations in particular involve what is nowadays usually ascribed to propositional knowledge. However, we shall see that the difference between non-propositional and propositional knowledge does not fit well

⁶ The two last terms are not Stein's.

with the difference between perceptive and mental presentations. Egological acts concern the so-called emotional components of the psyche (Poli 2006a, b).

Three major problems characterize the theory of psychological acts: (1) the structure of the act, (2) the interaction among different acts, and (3) the production of an act on the basis of previous acts. A number of connected but different problems concern the act's correlates. The latter can be simple or complex (or higher-order), and complex correlates are grounded on simple (or less complex) correlates. Furthermore, correlates are partially dependent on their acts, in the sense that *modifications* of the acts result in *corresponding modifications* of the correlates. Distinguishing the aspects of the correlate that depend on the corresponding act from those that are independent of it is not always straightforward.

Leaving apart the problem of the correlate, the main task is understanding the nature of the acts of presentations. Some experimental data may help in construing at least some of its features:

- Presentations last from 200 ms to 3000 ms ca. On average, they last approximately 700 ms.
- The duration of presentations depends on a variety of factors, ranging from the subject's mood feelings (they are shorter when the subject is excited and longer when s/he is relaxed) to the cognitive state of the subject (attention shortens presentation), to the content of what is presented, etc.
- Presentations come with an inner organization, on various dimensions. Of these the most important are (a) the distinction between focus and periphery, (b) the presence of internal laws of organization, and (c) the elaboration of their content in subsequent stages. Point (a) entails that there are upper limits to the complexity of the correlate in the focus. Point (b) yields possibly the most surprising results, namely the laws of temporal and spatial inversion (Benussi 1913). Point (c) claims that presentations themselves have a temporal structure. This last point is highly significant in that it marks the difference between the Berlin and Graz schools of Gestalt psychology.
- Presentations come in a (temporal) series, often called stream of consciousness. (Albertazzi 2001, 2003, Poli 2006a).

Presentations provide the *stuff* to be further elaborated by subsequent higher-order cognitive acts (e.g., reasoning). This second level is termed the level of *representations*. These are produced syntheses based on series of presentations. Most of recent research on the mind has taken into account representations alone, without giving proper acknowledgment to the underlying layer of presentations. If I am right and presentations do play the role I am ascribing to them, focusing on representations only amounts to weaving in the air, with no solid ground beneath.

At this point the question arises as to the relationships that hold between the complex of egological acts and that of non-egological acts.

In the context of theory of levels, is the relation that connects the two complexes together one of over-formation or of building-above?⁷ In the former case we interpret the two levels as layers of reality, in the latter as strata of reality (or better, substrata of the psychological stratum).

However, it requires only a moment's reflection to realize that the problem is more apparent than real. For it is evident that neither of the two levels derives from

⁷ Or some third type of relation not yet identified.

the other by over-formation. Hence it follows that the level of egological acts and that of non-egological acts are connected by a building-above relation.

The psychological stratum is therefore distinguished from the material stratum by the presence internally to it of building-above relations.

11 The Social stratum

The structure of the social stratum is yet again different (in the specific case of human societies). Here I shall restrict my discussion to just one consideration. Put very briefly, the social world is characterized by the presence of a series of tendentially universal domains in reciprocal interaction. The dimension of (tendential) universality alludes to the fact that each of these domains seeks to see the entire universe *juxta propria principia*. The world of legal norms, values, institutions, art, etc. proceeds according to specific interpretative principles with which it seeks to view reality from a particular standpoint. Each domain has its distinctive categorial perspective. In the terms of the theory of the levels of reality, this means that the various maximal domains are connected by building-above relations. In other words, each of them is a substrate of the social stratum.

12 Levels of complexity

Analysis has shown that the internal organization of the three strata follows different patterns: the material stratum has a basically linear structure; the psychological stratum has at least two substrata, each of them with a distinctive structure in layers; the social stratum has multiple substrata. Whether these require further levels of stratification or whether they are exclusively composed of layers of reality has not yet been determined.

The absence or presence of substrata, and perhaps of further substrata, furnishes a straightforward criterion with which to organize the strata of reality according to their levels of ontological complexity. On this basis, the material stratum should be termed *simple*, while the psychological stratum and the social stratum are *complex*—with the latter possibly being characterized by a greater level of complexity than the former.⁸

13 Forms of causal dependence

The theory of levels of reality is the natural setting for elaboration of an articulated theory of the forms of causal dependence. In fact, it readily grounds the hypothesis that any ontologically different level has its own form of causality (or family of forms of causality). Material, psychological and social forms of causality can therefore be distinguished (and compared) in a principled way.

The further distinction between causal dependence (between items) and categorical dependence (between levels) provides the means with which to develop a stronger antireductionist vision.

⁸ For a more analytical definition of ontological complexity see Poli (2006b).

Besides the usual kinds of basic causality between phenomena of the same nature, the theory of levels enables us to single out upward forms of causality (from the lower level to the upper one). But this is not all. A theory of levels also enables us to address the problem of *downward* forms of causality (from the upper to the lower level). The point was first made by Donald Campbell some years ago (see e.g. his 1974 and 1990). The recent Andersen et al. (2000) collects a series of recent studies on the theme.

Study of the psychological and social strata also raises the problem of the theory of action and the projects that the latter expresses. In categorial terms this means addressing the problem of the future. Whatever the other aspects of anticipation may be (Rosen 1985, Baianu 2006), from the point of view of a theory of causes ‘anticipating’ means activation of some sort of backward causation. Without a theory of the levels of reality, one fails to see how one can even begin to address these problems.

It is thus evident that the strength of the theory of levels resides in its ability to furnish the categorial setting in which to generalize the fundamental theories jointly constituting ontology: the theory of relations, the theory of causes, and the theory of space-time. These generalizations induced by the theory of the levels of reality display sophisticated forms of connection and they are not analytically separable. The general theory of relations cannot restrict itself to external relations, but must be able to reactivate the apparently obsolete concept of internal relations. The generalized form of the theory of causes becomes the theory of *tendencies*, some minimal aspects of which have been adumbrated by this paper. The prime distinction with regard to the latter theory is between intra-level and inter-level tendencies. In not dissimilar terms, the generalized theory of space-times becomes the theory of chronotopoids, where the main idea is that each level of reality is matched by a specific family of chronotopoids with its own laws of organization. The first consequence of the theory of chronotopoids is that the relationships among levels of reality can be translated into relationships among their corresponding chronotopoids. From a formal point of view, this may furnish the basis for development of appropriate formal models.

14 Presuppositions of the theory of levels

The ontological theory of levels runs counter to a number of deeply entrenched presuppositions of mainstream science and philosophy. It is therefore advisable to state its main claims openly. Three aspects are relevant. Let us consider them in the form of dichotomies, as follows:

- Levels of reality vs. levels of interpretation;
- Descriptive vs. genetic;
- Categorial vs. individual.

For each dichotomy, the first option is the reference one. Although confusion between *levels of reality* and *levels of interpretation*⁹ is not infrequent, trading one for

⁹ Often termed *levels of description*. In order to avoid overlaps with the concept of *description* occurring in the second dichotomy, the expression *levels of interpretation* will be used to refer to the epistemological interpretation of levels, as opposed to their ontological interpretation.

the other is to blur or confound ontological dimensions with epistemological ones. In short, only some of the many possible levels of interpretation can be properly taken as levels of reality, namely those that are grounded on ontological categories. Further information will shortly be provided.

As far as levels of interpretation are concerned, the choice concerning the granularity of the scene under description—the *windowing of attention* (Talmy 2003)—depends only on the observer and his/her purpose. On the other hand, levels of reality are grounded on real items, on their intrinsic nature. Although it is not the purpose of this paper to argue in favour of this apparently old-fashioned view, two basic remarks are appropriate. Firstly, what is at stake here is one of the guiding ideas of the phenomenological attitude, namely the assumption that what appears—the phenomenon—is always the appearance of some underlying reality. Otherwise stated, phenomena display in their own way aspects, sides, and components of what they are phenomena of. This means that—through phenomena—we access the nature of reality. Secondly, the concept of *essence* or *nature* of something is again one of the basic features of the phenomenological attitude. As a first and only partial approximation, the nature of an object is given by the object's structure as shown by the web of internal and external causes that make the object's behaviour explicit.

Atoms, molecules, organisms distinguish levels of reality because of the causal links that govern their behaviour, both horizontally (atom–atom, molecule–molecule, organism–organism) and vertically (atom–molecule–organism). This is the first intuition of the theory of levels. Even if the further development of the theory requires a number of qualifications to this initial intuition, the idea of a series of entities organized on different levels of complexity proves correct. The difference between levels of reality and levels of interpretation entails acknowledgement that the *items* composing the levels of reality are endowed with their own form of *agency*.¹⁰ From the point of view of the theory of levels of reality the two requirements of agency and the presence of a causal web are equivalent. The former goes from above, the latter from below. A fully-developed theory of levels requires both a properly generalized concept of causation, able to consider not only material causes but psychological and social causes as well, and a correspondingly generalized idea of *agency*, able to explain not only psychological and social dynamics but material dynamics as well.

Broadly speaking, the difference between levels of reality and levels of interpretation amounts to the thesis that the former constrains the items of the universe as to which types of causation and agency are admissible. A level of reality can therefore be taken to be a level of interpretation endowed with an appropriate web of causes or an appropriate type of agency.

Developing the theory of causation (or the theory of agency, for that matter) requires passing to a new framework. This is where the opposition between description and genesis enters the scene. The distinction between a descriptive framework and a genetic one goes back to Brentano, where it was presented as the difference between descriptive and genetic psychology. The idea is that before studying the causes that structure and connect the phenomena under observation one should know them. Otherwise stated, the first step in any scientific effort concerns accurate *description* of the relevant data. If we are able enough, we may

¹⁰ Providing that *agency* is properly neutralized.

succeed in connecting data within an appropriate web of causal dependences. Such a web is termed *genetic* in the sense that it explains why some items derive from other items. In this sense, *genetic* therefore means *dynamical*. It may well be—and more often than not it is—the case that only a fraction of the relevant phenomena are so explicable. Different sciences have been developed in order to efficaciously segment the whole of reality into classes of more or less uniformly connected phenomena. The guiding idea has been that phenomena occurring within each class are more causally homogeneous than phenomena pertaining to other classes, so that the task of explaining their behaviour should be more easily accomplished.

This *dividi et impera* (divide and rule) strategy has proved immensely successful, at least for some regions of reality. Other regions have proved more refractory, for a number of serious reasons. The first is that different regions may require different types of causation, some of which are still unknown, or only partially known. A second reason is that for some regions of reality the analytic strategy of breaking items into pieces does not work properly. A third and somewhat connected reason is the lack of a synthetic methodology.

The complexity of reality requires the analytic strategy of segmentation into *categorially* homogeneous regions. This first move is not questioned. However, some regions contain only items that can be further analytically segmented into pieces. These items are entirely governed by their parts (from below, so to speak). Other regions contain items following different patterns: they depend on both their parts and the whole that results from them. Our understanding of these more complex items is still deficient. Unfortunately, this is not the end of the story. Something more is required: sooner or later the products arising from the segmentation into categorially homogeneous regions should be synthesised. For we all live in *one* world (Smith, 1996). This second synthetic move has proved much more troublesome than the original analytic move.

The ontology of the world cannot rest on analytic decomposition into different scientific frameworks. Sooner or later we shall have to reunify them. Reductionism is the despairing answer provided by those who believe that a synthetic picture will never be achieved.¹¹

There is no denying that we still lack many answers. However, the theory of levels of reality is a necessary step toward the elaboration of a fully developed synthetic strategy.

Most details of the links connecting together the various levels of reality are still unknown. This should not come as a surprise. The various sciences had mainly been concerned with causal links *internal* to their regional phenomena. The nature of inter-regional links is still largely unknown. The lack of a theory of levels of reality has been the main obstacle against development of the theories needed. For this reason, the first and most indispensable task is to develop the *descriptive* framework of the theory of levels. Proposals concerning the architecture of levels and their basic connections will improve our understanding of the world and its many types of dependence.¹² In this way, the theory of levels helps answer a number of new scientific questions.

¹¹ The belief is usually buried under the apparently neutral move of taking synthesis as the inverse of analysis, the idea being that $ASx = SAx$. See Rosen, 1985.

¹² It may be worth noting that the theory of levels may provide guidance for the teaching of sciences and their interrelationships.

The last opposition concerns the difference between the individual and the categorical. Let us assume that the differences have been accepted between levels of reality and levels of interpretation on the one hand, and between descriptive and genetic frameworks on the other. Suppose also that a descriptive acceptance of the theory of levels has been accepted.

The remaining problem, therefore, is how to describe levels. Apparently, the choice is between descriptions based on individuals and descriptions based on categories. However, it is obvious that descriptions based on individuals do not work. The easiest way to see this is as follows. Assume that the distinction among the physical, the biological and the social levels is accepted.¹³ The decision now to be taken is whether each level contains its own group of individuals. If this were true, we should hypothesize three different groups of individuals, one for each level. However, it may well be that the physical individuum, the biological individuum and the social individuum are the only one individuum existing in the real world. Any of us is a good exemplification of this situation. The given exemplification can be made as sophisticated as one wishes by distinguishing theory-based (or model-based) individuals from real, transcendent, individuals. Be that as it may, what interests us is the world. It is always the same individuum that may be subjected to physical, biological and social scrutiny. If we decide that each level of reality is composed of its own group of individuals, a number of demanding and possibly unsolvable problems immediately arise. My claim is that there is no principled reason for going this way. Even if this strategy may occasionally prove helpful, in the long run it systematically reifies categorical distinctions. The opposite strategy is based on categories, not on individuals. According to a categorially-based strategy, levels of reality are defined by their categories.

Some brief specifications will be helpful.

- *Apparently, the choice between (transcendent) individuals and categories does not rule out theory-based individuals.* A moment's reflection shows that the latter are fictions, because the strategy based on theory-based individuals is isomorphous to the category-based strategy.
- *Nobody denies that the same phenomenon (or group of phenomena) can be categorized in many different ways.* Correct. However, it should not be forget that we are doing ontology. Only ontological categories are relevant to our task.
- *Even in this case, there can be different ontologies.* I am inclined to deny this possibility, however. Furthermore, none of the great ontologists was an ontological relativist.
- Suppose that we are willing to accept the *via difficilior* (more difficult road) of a unique ontology. Even so, the ontology can be presented in different ways, based on different groups of categories, mutually isomorphs but not identical with each another. I accept this claim. However, it is ontologically immaterial because it concerns the formal architecture of the theory more than its ontological content. For our present purposes, we may select any of those categorial groups and deem its categories canonical.¹⁴

¹³ The psychological level raises special problems. The difference between the three strata discussed above and the three actual levels is immaterial to the point under discussion.

¹⁴ Different choices may result more or less suitable from a modelling perspective.

15 Conclusion

I conclude by pointing out that each of the three obstacles discussed requires the other two. It seems highly unlikely that any of the three could be removed without dealing with the problems raised by the other two. Nevertheless there is an order of importance or priority among them whereby the theory of levels provides the general framework within which the other two theories can be addressed.

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