

THE THEORY OF LEVELS OF REALITY AND THE DIFFERENCE BETWEEN SIMPLE AND TANGLED HIERARCHIES

ROBERTO POLI

University of Trento and Mitteleuropa Foundation

Abstract: The main features of the theory of level of reality are presented. The conceptual framework according to which levels follow a linear, brick-like order is opposed to a more sophisticated, "tangled" framework.

Key words: Level of reality, stratum, layer, hierarchy, dependence, autonomy

1. INTRODUCTION

Most discussion about levels is focused on levels of interpretation. The topic of the levels of interpretation is obviously important, but I do claim that it should be kept as separate as possible from the problem of the levels of reality. Although confusion between the two planes is not infrequent, their names themselves indicate that they occupy different places in a well structured conceptual framework. The levels of reality have a strictly ontological significance, while those of description have an epistemological one. The presence of intermediate or ambiguous cases does not authorize one to confound categorical specificities. The distance that separates the two themes is therefore the same distance that separates epistemology from ontology. Whatever the relationships between them (of opposition, connection, inclusion, or anything else) may be, they are replicated in the difference between (levels of) description and (levels of) reality.

In what follows I shall restrict my discussion to only certain aspects of the problem of levels of reality. Consequently, I shall be concerned with ontological matters. I shall not address the question of the relationships

between ontology and epistemology. Indeed, I shall take care not to slide from one plane to the other (for an outline of my view on the relationship between epistemology and ontology see Poli, 2001c; for a general presentation of my views on levels see Poli, 1998, 2001a, 2001b; Heller, Herre and Poli, submitted; Gnoli and Poli, submitted).

An intuitive understanding of the basic problem of the theory of levels will facilitate subsequent analyses. The following section contains some excerpts come from my (2001b).

2. HOW MUCH INFORMATION IS THERE?

Let's consider the pen in front of me on my desk. What type of object is this pen? How should I model it? First of all, I may say that the pen is an object made in a certain way, with its own shape, colour and material. In saying this, I am using concepts which describe the physical world of things. The pen must also perform functions: it has been designed to write. This reference to function introduces a different dimension into the analysis: writing, in fact, is not something that I can model using only concepts describing the physical world. Writing is an activity typically performed by humans. By virtue of being constructed to fulfill the function of writing, the pen is in some way connected with this aspect of the world. But when I observe the pen, it tells me many other things. For example, that it has been constructed by somebody, and that this somebody is my contemporary: this pen is not an object from the Roman age or from ancient China. The material it is made, its manufacture, the way it works tell me that there must be somewhere an organization that produces things like pens. If we now shift our focus to this organization, the pen must be an object designed, manufactured and distributed so that it can be sold and end up on someone's desk. In their turn, the points of view of the designer, of the production department and of the distribution department are different, and they describe my pen using different concepts. For the designer the pen is essentially an aesthetic and functional object; for the production department it is the outcome of materials processed in a certain way, etc. For the company producing the pen it is all these things together. For the shopkeeper who displays the pen on his shelves and seeks to sell it to customers, it is again different. To return to myself, the pen is also an object of which I got especially fond because it reminds me of the person who gave it to me.

All these different descriptions are correct: each of them express a facet of the object. Yet they are all descriptions of the same object. Hence, one of the main tasks of information science is to find ways to integrate different descriptions of the same object. Some of these descriptions have an

ontological basis; others have an epistemological basis. We must learn to distinguish among them.

Ontologically, the example of the pen teaches us two important lessons: (1) reality is organized into strata (material, psychological, social); (2) these strata are organized into layers (the physical and chemical layers of the material stratum; the intentional and emotive layers of the psychological stratum; the productive, commercial and legal layers of the social stratum).

3. THEORIES OF LEVELS AND THEIR AUTHORS

Not many thinkers have systematically worked on the theory of levels of reality. We may conveniently distinguish the “English-writing” camp from the “German-writing” one. The former comprises, among many others, thinkers such as Spencer, Alexander, and Lloyd-Morgan (possibly the deepest figure among those quoted). Blitz [1992] provides a reliable synthesis of their main contributions. The “German-writing” camp comprises thinkers as relevant as Husserl, Ingarden, Plessner, and Hartmann. Even if some of them are very well known names, there is no academic work summarizing their contributions to ontology in general and to the theory of levels in particular. A thoroughgoing comparison between the “English” and the “German” camps is nevertheless lacking.

4. WHAT IS A LEVEL OF REALITY?

No general consensus exists about how to define, describe or at least sketch the idea of level of reality. My own choice is to adopt a categorical criterion: the levels of reality are characterized (and therefore distinguished) by their categories. The main subsequent distinction is between universal categories (those that pertain to reality in its entirety – time, whole/part, substance/determination, etc.) and categories that pertain solely to one or some levels of reality.

Most authors prefer instead to adopt an objectual standpoint, rather than a categorical one. Arguing in favor of the objectual standpoint has the undoubted advantage that it yields an elementary definition of level: a level consists of a collection of units (Pattee, 1973, p. 75). From this point of view, the series of levels is a series of objects interacting at different degrees of granularity. A model of this kind is accepted by large part of the scientific community, because it depicts the widely held view of levels based on a reductionist approach. Higher-order groups of items may behave differently, even to the point that it is impossible to calculate (predict) their specific

behaviour, but in the end what matters is that they can all be reduced to their *atoms*.

If this were indeed the way matters stand, then the general neglect shown towards the problem of the levels would be justified.

In order to deal with the real complexity of the problem of the levels, it must be altered so that it becomes possible to study not only 'linear' hierarchies but 'tangled' ones as well. This conclusion bears out the approach which undertakes categorical analysis, compared to the one which studies items in iteration.

An argument in favor of the approach 'by objects' is the ease with which it is possible to pass from a substantialist description to a processualist one: if a level is defined by items in iteration (where the items can be canonically conceived as objects), then a level can be defined by a dynamic. A multiplicity of structurally stable dynamics, at diverse levels of granularity, may define a multiplicity of levels. However, if it turns out that the structuring in levels does not respect a universal principle of linearity, then one is forced to restrict the multidynamic frames to their linear fragments. Which is precisely the situation of current theories of dynamic systems. On careful consideration, in fact, the predominant opinion is that there is only one multi-dynamic (multi-layered) system: the one described by the natural sciences. Other forms of knowledge are scientific to the extent that they can be located in the progressive series of supraformations (groups of groups of groups of items, each with its specific kinds of interaction). Hence the alternative: a discipline is scientific to the extent that it can be located in the series of aggregation levels – if so it can be more or less easily reduced to the base level – or it cannot be thus located and is consequently not a science: it has no citizenship in the realm of knowledge and is scientifically stateless.

5. THE THREE MAIN STRATA OF REALITY

The distinction is widespread among three basic realms or regions (or strata, as I will call them) of reality. Even if the boundaries between them are differently placed, the distinction among the three realms of material, mental and social phenomena is essentially accepted by most thinkers and scientists. A major source of discussion is whether inanimate and animate beings should be placed in two different realms (this meaning that there are in fact four and not three realms) or within the same realm. The latter option defends the thesis that a phase transition or something like that connects inanimate and animate items.

From a categorical point of view, the problem about how many strata there are can be easily solved. Leaving apart universal categories (those that apply everywhere), two main categorical situations can be distinguished: (a) Types (Items) A and B are categorically different because the description / codification / modelling of one of them requires categories that are not needed by the description / codification / modelling of the other; (b) Types (Items) A and B are categorically different because their description / codification / modelling requires two entirely different groups of categories. Following Hartmann, I term the two relations respectively as over-forming and building-above. Strata or realm of reality are connected by building-above relations. That is to say, the main reason for distinguishing as clearly as possible the different strata of reality is that any of them is characterized by the birth of a *new* categorical series. The group of categories that are needed for analyzing the phenomena of the psychological stratum is essentially different from the group of categories needed for analyzing the social one, which in its turn is different from the one needed for analyzing the material stratum of reality.

Over-forming (the type (a) form of categorical dependence) is weaker than building-above and it is used for analyzing the internal structure of strata. Each of the three strata of reality has its specific structure. The case of the material stratum is the best known and the least problematic. Suffice it to consider the series atom-molecule-cell-organism (which can be extended at each of its two extremes to include sub-atomic particles and ecological communities, and also internally, as needed). In this case we have a clear example of a series that proceeds by levels of granularity. The basic distinction of the realm (stratum) into physical, chemical and biological components can be considerably refined (e.g., by distinguishing biology into genetics, cytology, physiology, ethology, ecology – a slightly more articulated picture is provided by Poli, 2001). Compared to the material realm, the psychological and social ones are characterized by an interruption in the material categorical series and by the onset of new ones (relative to the psychological and social items). More complex types of over-forming are instantiated by them. The basic situation is sketched in Poli 2001. However, much work is still required.

A terminological note can be helpful. I use the term ‘level’ to refer in general to the levels of reality, restricting the term ‘layer’ to over-forming relationships, and the term ‘stratum’ to building-above relationships.

6. FORMS OF CONNECTION AMONG STRATA

The question now arises about 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 Figure 1.

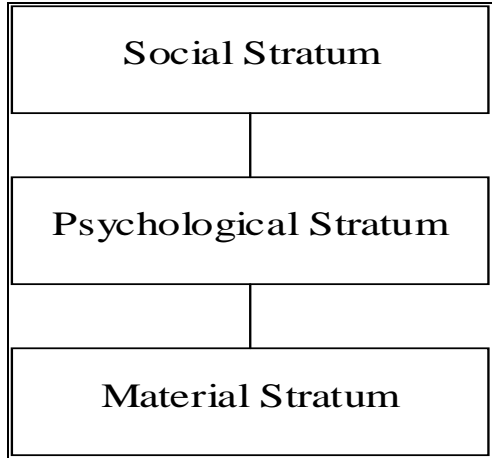


Figure 1. Linearly organized strata

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.

The point of view illustrated by Figure 1 is part of the received wisdom. However, a different opinion is possible. Consider Figure 2.

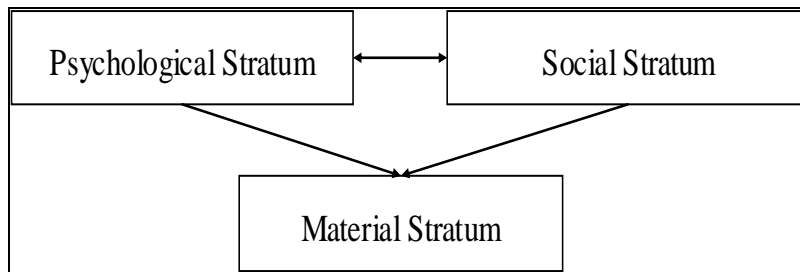


Figure 2. The architecture of strata with bilateral dependence

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, 1984).

7. CAUSATION

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 smoothly 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 could therefore be distinguished (and compared) in a principled way.

The further distinction between causal dependence (between items) and categorical dependence (between levels) provides means for elaborating a stronger antireductionist vision.

Beside 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 advanced 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.

8. VIRTUOUS CIRCULARITY

The connection between the theory of levels and causality entails recognition that every level of reality may trigger its own causal chain. This may even be taken as a definition of level of reality: A level of reality is distinguished by its specific form of causality. As a consequence, we thus have a criterion with which to distinguish among levels of reality and levels of description.

The acknowledgement also enables us to develop a theory able to accommodate different senses of causality (distinguishing at least among material, mental and social causality). However, if the downward option is also available, the direct or elementary forms of causality should have corresponding non-elementary situations.

9. REFERENCES

- Andersen, P. B., Emmeche, C., Finnemann, N.O. and Christiansen, P.V., eds., 2000, *Downward Causation. Minds, Bodies and Matter*, Aarhus University Press, Aarhus.
- Blitz, D. 1992, *Emergent Evolution*, Kluwer, Dordrecht.
- Campbell, D. T. 1974, "Downward Causation in Hierarchically Organised Biological Systems," in F. J. Ayala and T. Dobzhansky, eds., *Studies in the Philosophy of Biology*, Macmillan, London, pp. 179-186.
- Campbell, D. T. 1990, "Levels of Organization, Downward Causation, and the Selection-Theory Approach to Evolutionary Epistemology", in G. Greenberg and E. Tobach, eds., *Theories of the Evolution of Knowing*, Erlbaum, pp. 1-17.
- Gnoli, C. and Poli, R., submitted, "Levels of reality and levels of representation".
- Heller, B., Herre, H. and Poli, R., submitted, "Formal ontology of levels of reality".
- Luhmann, N. 1995, *Social Systems*, Stanford, Stanford University Press.
- Pattee, H. H. 1973, *Hierarchy Theory*, New York, Braziller.
- Poli, R. 1996, "Ontology for Knowledge Organization", in R. Green, ed., *Knowledge Organization and Change*, Indeks, Frankfurt, pp. 313-319.
- Poli, R. 1998, "Levels", *Axiomathes*, **9**, 1-2, pp. 197-211.
- Poli, R. 2001a, "The Basic Problem of the Theory of Levels of Reality", *Axiomathes*, 2001, **12**, 3-4, pp. 261-283.
- Poli, R. 2001b, *ALWIS. Ontology for Knowledge Engineers*. PhD Thesis, Utrecht.
- Poli, R. 2001c, "Foreword", *Axiomathes*, 2001, **12**, 1-2, pp. 5-9.