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Book Review :

Le Tout et les Parties dans les Systèmes Naturels, T. MARTIN (Ed.)
Paris, Vuibert, 2007, 241 pp., ISBN : 978-2-7117-4046-8, 28 euros (paperback).

An assembly of coupled oscillators, like neurons, cardiac cells or fireflies, exhibits patterns of organization with a global dynamics that cannot be anticipated from the oscillatory dynamics of the individual oscillators. The properties of the whole of the assembly are not a mere addition or juxtaposition of the properties of the elements of the assembly. But more generally, if the whole can have properties that its parts do not have, where do these properties come from and under what conditions will certain elements be legitimately recognized as parts, and some not? Or else, if we start from elements, according to which principle will the set of those forming a whole be circumscribed?

Whatever its starting point, organism, neuronal system, coupled oscillators, the unfolding of the debates opposing holist conceptions of systems and reductionist ambitions seem doomed to a common central antagonism. According to the latter, properties of the whole will eventually be completely understood in terms of the properties of the parts, while according to the former, the whole is a distinct level of organization characterized by new, emergent, properties. But asking whether acquiring knowledge of the parts is enough to claim knowledge of the whole, or whether there is more to the whole than there is to the parts, presupposes as given the identification of the whole and of its parts.

The problem, as this collection shows in many ways, is that, in empirical sciences, that much is not given. So if the argument for either position is to prove relevant to the development of scientific knowledge, to illuminate or even provide any normative guidance to scientific investigation, general considerations, even though needed to clarify what the issues and options are, will fall short. The conditions under which a set of things can be seen as forming a whole, under which a property can be reduced to other properties, or can be considered as emergent, the conditions under which the distinction between whole and part is not only possible but fruitful and why that is so, will all have to be newly specified in accordance to each specific object of investigation.

The nineteen French-written papers gathered in this volume were presented to the conference the Société de Philosophie des Sciences organized in 2005 on the theme "Le tout et les parties dans les systèmes naturels" ("The whole and the parts in natural systems"). By addressing specific cases pertaining to different disciplinary domains, this collection gives an interesting overview of the diversity of issues in which whole/parts distinction may arise and of the different forms it can take.

The collection is divided in 5 parts corresponding to these disciplinary domains: ecology, with a special focus on the concept of ecosystem; biology, with particular attention to the concept of function and to the contrast between structural and functional organization regarding for instance the immune or memory systems; medicine, with the tension between individual and statistical approaches; material sciences, with essays discussing the concept of mixture in chemistry, representations of the universe, and

models of the Galaxy; and finally, epistemology, with three essays reformulating in terms of whole and parts three different philosophical views on knowledge.

An introduction by the editor provides a quick overview of the collection with substantial abstracts of the papers, but regrettably hardly any perspective on the essays, the theme, or the collection. The editor's sole attempt to take some distance is to draw a demarcation between the essays according to the level of application of the distinction between whole and parts: the object of knowledge, the method to acquire knowledge, knowledge itself.

Unfortunately the new categorization thereby created is too reductive and even sometimes misleading. Why that is so reveals something important about the formulation of the part/whole distinction. First, among the papers said to apply the distinction to *method* is the paper by Jerome Goffette and Marie Flori, which contrasts statistical and individual approaches in medicine but applies, in fact, the part/whole distinction to statistical population and individuals. Second, it is among the papers most naturally seen as applying the distinction to *objects*, for instance to ecosystems with Patrick Blandin, or chemical mixture with Bernadette Bensaude-Vincent, that we find the most reflective discussions on the tension and inter-play between objective and methodological interpretations of the distinction between whole and parts. The question whether the part/whole distinction is methodological or objective should rather be understood, it seems, as an issue internal to the specific context in which this distinction is elaborated and elucidated.

There are two other important conclusions the reader can draw: to make the distinction between whole and parts philosophically fruitful, and not merely rhetorical, is a real task; it doesn't come for free. And to do that involves putting relations on the front stage.

For the part/whole distinction to have some philosophical work to do, there must be some characteristics that the whole has and not the parts, while at the same time, the characteristics of the parts have to be essentially involved, in one way or the other, in the realization of those characteristics of the whole. It is in the specification of this involvement that the notion of relation comes to the fore and helps resolve the paradoxical situation.

As Blandin's survey of the historical development of the concept of ecosystem clearly illustrates, a major difficulty is to spell out what it is for the parts to be essentially involved and to specify what counts as an emergent property. Like Donati Bergandi, also discussing this concept, Blandin proposes a transactional conception of ecosystem where the existence of emergent properties is grounded in the genetic co-evolution and co-adaptation of individuals. The emphasis on the dynamics of the relations between the parts is equally central to the interpretive proposal by which Bensaude-Vincent concludes her historical exploration of the paradoxes attached since Aristotle to the concept of mixture in chemistry.

The same point applies to Alexis Bienvenu's elucidation of Reichenbach's statement that "each singular prediction is associated to the whole of experience" and Delphine Chapuis-Schmitz's holist interpretation of Schlick's conception of natural laws. Bienvenu explains how Reichenbach not only distinguished between different levels of

inductive procedures, each induction being based on inductions of the previous level, but proposed a method of evaluation of the relation of mutual support between inductions of two successive levels. And Chapuis-Schmitz explains how, for Schlick, law statements describe natural structures but are only meaningful as parts of a theory, through their relations with other statements of the theory.

By contrast, in the discussions devoted to the concept of biological function it is rather the dynamics of the relations between whole and parts that is put forth, as when Philippe Huneman questions the thesis according to which a certain function can be realized in different ways, or when Françoise Longy reveals the conceptual confusions threatening the analysis of the function of a system in terms of functions ascribed to its parts.

But it is not always clear what the philosophical benefit of the part/whole distinction is meant to be regarding the understanding or clarification of the phenomenon discussed. For instance, both types of relations mentioned above (parts-parts and whole-parts) may well be relevant to the size effect phenomena regarding scale models or living bodies that Jean-Marc Drouin describes, but *how* is left to the perspicacity of the reader. Likewise, in his essay "The whole and the parts of memory", Jean-Claude Dupont outlines the different strategies of functional or structural analysis of memory and the difficulties that confront them, but what are the parts and what is the whole and even what to do with the distinction is left to the reader to speculate.

This sort of problem becomes even more acute with essays which, rather than explore the distinction between whole and parts from within a certain concept or

problem, apply this distinction as if afterwards to a particular issue so as to reformulate it in these terms. Not only is the fruitfulness of the distinction then sometimes dubitable but even whether it is appropriately stated. For instance, Goffrette and Flori criticize, regarding a specific case of medical decision, the primacy of statistical considerations at the expense of the experience of the patient and the patient-physician relation. They certainly make an important point and are probably right about it. But their interpretation of this tension as an asymmetric relation of influence between a perspective on the whole and a perspective on the parts is not really convincing. Beside the fact that this construal doesn't add much to their analysis, is it really a statistical population that a patient is part of? Does an abstract statistical population have parts that are flesh-and-blood individuals?

The same sort of flaw threatens the otherwise very interesting paper applying the part/whole distinction to models of the Galaxy. After she explains that there are two models of the Galaxy, both in agreement with the observations even though they postulate different structures, Stephanie Rufy, concludes that the predictive accuracy of the whole of a model is not ground for a realist interpretation of its parts. It is not clear what this reformulation adds to the more common notion of under-determination, but the real problem is elsewhere. What these elements, which cannot be interpreted realistically, are parts of is the whole structure, but is it the structure that accounts correctly for the observations? Isn't rather its mathematical description? The equivocation with 'model', like previously with 'population', invites a confusion of categories. The relation between the equation, which is the predictive instrument, and the elements of the structure it describes is not one of whole and parts.

Incidentally, an alternative interpretation of this under-determination is suggested by the conception of structure proposed by Piaget and mentioned by Blandin in his paper. Conceiving of a structure, as Piaget does, as characterized by some emergent properties may open up an account of the predictive accuracy of the two descriptions in terms of emergence at the level of the two structures of similar properties, in spite of the difference in the properties of their respective parts. But making the part/whole distinction fruitful would still need a real demonstration.

And that holds also when this distinction is used, by Thomas Lepeltier, to reformulate the distinction between Milne's method of construction of a cosmological model, from very general kinematic considerations, and relativistic models. The contrast, as the author himself aptly remarks, is between rationalist and empiricist epistemic strategies. It remains unclear how the part/whole distinction could help better understand this epistemological issue.

In fact, a general explanation of these shortcomings might simply be the surprising, and sometimes frustrating, brevity of most of the essays. But in spite of, or even because of the mixed reactions it prompts, the collection, as a whole, is an exciting and valuable demonstration of the philosophical importance and heuristic potential of the distinction and relation between whole and parts.

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