

LOGIC, EPISTEMOLOGY AND THE UNITY OF SCIENCE: AN ENCYCLOPEDIA PROJECT IN THE SPIRIT OF DIDEROT AND NEURATH

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[...] on devra cependant se garder de dissimuler l'ambiguïté de certains énoncés, et de vouloir esquisser un système unitaire [...] Pour nous au contraire, nous voudrions déclarer d'emblée que la forme de l'encyclopédie est la plus parfaite que nous puissions jamais atteindre pour exposer l'ensemble de la science, opposant ainsi expressément au pseudo-rationalisme de toutes les philosophies "centralistes", notre travail scientifique concret; Qui se garde soigneusement d'anticiper la systématisation générale de la science. (Otto Neurath ([1935], p. II.3)

It is against the principle of encyclopedism to imagine one "could" eliminate all such difficulties. To believe this is to entertain a variation of Laplace's famous demon who was supposed to have a complete knowledge of present facts sufficient for making complete predictions of the future. Such is the idea of "the system" in contrast to the idea of "an encyclopaedia": the anticipated completeness of the system is opposed to the stressed incompleteness of an encyclopedia. (Otto Neurath ([1938], pp. 20-21)

The Encyclopedia presents a contemporary version of the ancient encyclopedic ideal of Aristotle; the Scholastics; Leibniz, The Encyclopedists and Comte. It wishes to give satisfaction to the pervasive human interest in intellectual unity, but its common point of view permits divergences and differences in emphasis and does not blur the fact that an inseparable feature of the institution of science is constant growth. It aims to provide a basis for co-operative activity and not a panacea. (Charles W. Morris [1938], p. 75)

1. Unity: An Unfashionable Notion

The idea that the unity of science can be achieved by means of logical analysis, an idea widely associated with the Vienna Circle, has fallen into disrepute. Today, logic plays a relatively minimal role in mainstream philosophy of science and no single approach to logic or semantics can claim to dominate the field. Logic, according to popular wisdom, has done more harm than good, abstracting us from the important subtleties of scientific investigation and mistakenly forcing a frozen universal structure on the dynamic process of knowledge-seeking. While many philosophers of science have shied away from logic there have, in the meantime, been many important new developments in logic, some of which may have extremely significant applications to questions in epistemology and general philosophy of science. These developments have gone virtually unnoticed in the broader

philosophical community. One of the purposes of this volume is to encourage philosophers to recognize the potential riches to be found in recent work in logic, for instance in the plethora of non-classical logics, including, prominently, game theoretical semantics and independence-friendly logic. The rhetoric of systematicity and formalism continues to characterize analytic philosophy of science and it is likely that the gradual withering of logic as a significant part of the philosophy of science is due more to neglect than to any serious argument.

By contrast, there has been no shortage of arguments against the notion of unity. It has been subject to ceaseless attack in recent history and philosophy of science. Evidence of the disunity of the sciences has been easy for critics to muster and arguments against specific attempts to achieve the unity of science are often quite devastating. However, while some of these criticisms are sound and will give pause to any prospective unifier, it is a mistake to ignore the preponderance of unified theories in science.¹ Much of the development of physics in the second half of the twentieth century was motivated by the desire to unify quantum mechanics and general relativity. It would be difficult to understand the conceptual framework or the historical development of quantum field theory or string theory without recognizing the important role of unification in science. One can find many other important examples that show the abiding interest in, and heuristic function of, unification in scientific practice.

It is likely that many arguments for the disunity of science are directed towards a strawman. In particular, we would suggest that there is a widespread misreading of all talk of unity in science as an insistence on the unity of scientific method. On the contrary, as we show below, one can find prominent examples of unification projects that emphasize instead the danger of forcing scientific practice into conformity with favored a priori conceptions of rationality. This aspect of Neurath's vision of the unity of science, is clearly articulated in the short article translated below. In this introduction we will show a less familiar face of the unity of science movement by highlighting the encyclopedic spirit of philosophers like Neurath and Morris, along with those earlier great Encyclopedists Diderot and D'Alembert. This is the encyclopedic spirit that, we hope, informs the present volume. On our view, to consider the knowledge-seeking enterprise as a single human endeavor does not involve rigidly adhering or enforcing a simplified model of science.

To understand the kind of methodological and even ontological diversity that a particular unification project might encompass, consider, for instance, the relationship between genetics and evolutionary theory. It is likely that any attempted unification of these fields would preserve their methodologically distinct features while allowing communication and cooperation between them. The great evolutionary synthesis in biology in the 1930s and 1940s can, perhaps, be understood along these lines.

Similarly, unification is not necessarily a matter of subsuming distinct fields under a single set of laws. Rather, such unification may involve the discovery of a third set of phenomena or regularities or even the development of a third discip-

line. By way of illustration, consider for instance the emergence in the 1980's and 1990's of Cognitive Neuroscience. Such unifying developments will often leave the original sciences essentially intact while permitting an exchange of contributions between them.

This rough discussion of two possible responses to anti-unity arguments is meant merely as a sketch of possible lines of argument. At this stage it would be a mistake to prescribe the possible outcome of unification projects in detail. To do so would be tantamount to prematurely adopting the dogmatism of what Neurath called 'centralist philosophies'. As we shall show below, allowing for the co-operation across scientific specializations was one of the original goals of the Vienna Circle's Encyclopedia project, at least as articulated by Neurath.

The current emphasis on disunity in science studies and the philosophy of science is also due to the belief that an attempt to unify automatically entails an absence of historical or practical understanding of the sciences. This is simply false. One of the goals of the unifiers, exemplified by some of our best historians and philosophers of science, is to satisfy an abiding human need to understand connections and similarities in contexts of great diversity and apparent disunity. Again, it is not necessary to prejudge in detail what unity will look like or what functions it will serve in order to make the case for its intellectual significance. While unification projects will vary from science to science, there is a set of important and interesting general lines of philosophical inquiry that are opened up once one takes the possibility of unity seriously. Consider two recent and widely acclaimed works in the history of science: Jean Gayon's *Darwinism's Struggle for Survival* and TianYu Cao's *The Conceptual Development of 20th Century Field Theories*. Both are exquisitely researched works by acknowledged masters of the history of their respective fields of study. Both are also intent on providing readers with an understanding of the continuity that characterizes the history of those fields. Specifically, Cao's approach explicitly involves looking to the details of scientific change in order to find continuity in the preserved mathematical structures employed by field theorists. Similarly, Gayon traces the central conceptual core of Darwinism through a variety of historical mutations, from Darwin to Kimura. So, while the devil may be in the details, those same details may also be the best place to look for unity.

2. The Collapse of the Second Wave

As discussed above, in epistemology and general philosophy of science, many philosophers clearly seem to regard the present situation as a reaction to, and rejection of logical positivism. Thus, it might seem a very inauspicious time to launch a project dedicated to the relationship between logical investigations and the unity of science. Indeed, our interest in the application of insights from logic to problems in philosophy of science will undoubtedly strike some critics as