

## REMARKS ON SCIENTIFIC METAPHORS

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### Summary

Recent contributions by Kuhn, Wartofsky, and Granger, converge in the direction of an extended view of models, one that acknowledges a metaphorical dimension in the language of science. Such a view is in some respects the opposite of the views of both Bachelard and the Logical Empiricists. A number of familiar puzzles of the philosophy of science, such as the problem of reference, the antinomy between realism and instrumentalism, and that between explanation and comprehension, the status of scientific objectivity, may receive a new solution in the light of the Kuhn/Wartofsky/Granger view of scientific metaphors.

A 'discovery' of models was made during the fifties by several proponents of logical empiricism, trying to rescue a number of theses originally put forth by T.D. Campbell and fitting them in the framework of the logical empiricist view of scientific theories (Cremaschi forthcoming). The Campbellian theses on the role of models of supplements to theories were further stressed by Mary Hesse who was able to work out a peculiar moderate post-empiricist alternative to the standard view of science by combination of the Campbellian heritage with the interaction view of metaphor as presented by Black, and with a rediscovery of the Scholastic theory of analogy (Hesse 1965; see also Borutti 1985; Cremaschi forthcoming). One shortcoming of Hesse's view may be the indispensable role given to material analogy, while her definition of material analogy remains uncertain in so far as the logical empiricist opposition of isomorphism to material analogy is not questioned by her (See Hesse 1967:355). Subsequent contributions by Wartofsky have criticized Hesse's idea of material analogy, suggesting conflation of material and formal analogy into the more general idea of "mapping", while criticizing the very idea of a possible isomorphism between theories, and between theories and facts as self-defeating (Wartofsky 1979:1-11,24-39).

Recent contributions by Kuhn, centered on Quine's idea of translation, have tried to work out an account of our way of applying symbolic labels to nature by a metaphorical process of construction of similarity families, thus providing an account of the reference of both theoretical

and observation terms as an alternative to the causal theory of reference (Kuhn 1977:293-319, 240-265; Kuhn 1979; Kuhn 1983; see also Piazza 1985: 106-112; Cremaschi forthcoming).

A somewhat similar development has taken place in French epistemology. Bachelard held an extremely rationalist attitude, acknowledging the role played by metaphors in the history of science but limiting their function to a "prescientific phase". Foucault, a follower of Bachelard, while turning Bachelard's rationalism into a radical relativism, kept his identification of metaphor and analogy with the distinguishing traits of a peculiar phase in the history of the sciences or of savoirs, that is, with the age classique (Foucault 1966; see also Piazza 1985: 87-90). Granger, a fellow-pupil of Bachelard, from his early Bachelardian works to his most recent contributions, has followed a diverging path and, while not renouncing rationalism, has resumed in his epistemology Jakobson's opposition of metaphor and metonymy, giving to metonymy the role that Bachelard used to give to metaphor, and conceiving metaphor as the distinguishing feature of scientific language (Granger 1967; see also Granger 1968; Granger 1969; Granger 1982; Cremaschi 1987).

I shall try in the following to synthesize the common ground of the suggestions by Granger with those by Kuhn and Wartofsky, and to formulate the new view of scientific metaphors in nine theses.

i) An extended view of models should be accepted. A model is, more than the intuitive illustration of a theory which was the object of the discussion between Campbellians and Duhemians in the fifties, an essential feature of every theory of the empirical sciences. A modeling relation holds in so far as something is represented by something different, and in so far as the representing element is provided by transfer (and adaptation) of some previously existing symbolic system.

ii) Models and modeling relations in scientific theories are always endowed with a metaphorical character, in so far as their essence is a tension or a transfer that redescribes (selects, emphasizes, deletes and supplements). Such a metaphorical character may subsist even in the most formalized contexts, in so far as what is peculiar to metaphor is not vagueness, or a concrete or an imaginative character.

The metaphoric dimension in the language of the empirical sciences is however wider than the modeling relation (or rather, it is not useful to try to reduce even these aspects of metaphor in scientific language to the modeling relation). Both theoretical and observation language are introduced and later modified through a metaphoric process, in so far as every step of the process of creation and modification is transfer and adaptation of symbolic labels, to be applied to classes of individual instances in a continuous process of self-correction;

iii) The ubiquity of metaphor in the language of empirical sciences is tantamount to the ubiquity of an interpretive dimension in the language of these sciences. The interpretive dimension exists both for the sciences of man and of society and for the natural sciences.

The necessity to acknowledge the interpretive dimension stems from familiar problems associated with the fixation of reference for theoretical terms, and from the impossibility to maintain the existence of an unchanging observation language through the theoretical and cultural and linguistic changes for the science of nature. Such impossibility for the sciences of man and society has been more widely acknowledged; the recent acknowledgement of the impossibility of an unchanging observation language for the sciences of nature has shaken a shared belief common to both the 'scientific' and the 'humanist' camp.

iv) The language of the empirical sciences has a ubiquitous metaphoric

dimension because no absolute starting-point from which subsequent shifts of meaning may move is available, as well as no ultimate foundation of scientific knowledge, be it sense-data or rational principles. As suggested by Pierce long ago, every time the world is already interpreted.

v) Scientific terms are formed, through procedures that always participate in the metaphoric dimension, starting from lexica shared by language communities which are always practice communities, interacting with the world. It is such lexica that establish natural kinds (like "water" as far as physical reality is concerned, but also like "economy" or "religion" as far as social reality is concerned), but every different lexicon may establish different natural kinds, "cutting the world at different joints". Acknowledging the said possibility is not tantamount to lapsing into relativism or instrumentalism, in so far as the activity of "cutting the world" at some "joints" establishes domains of objectivity, which have their grasp in reality via practice. Acknowledgement of the preliminary dimension/instantiated by the construction of domains of objects or by interpretation enables one to avoid the alternative between objectivism typical of scientific realism and relativism à la Feyerabend.

vi) The opposition between material analogy and formal analogy (identified, in a very rash way, with isomorphism) which has been created by the Logical Empiricists in order to characterize the distinction between immature and mature science, is an opposition vitiated by several dogmas of empiricism. The fact of not having such opposition questioned by a post-empiricist like Mary Hesse, who limits herself to asserting the necessity of "some" material analogy besides isomorphism, has caused great problems to her alternative view of scientific theories.

The similarity relations that are acknowledged/constructed as a first step towards the application of symbolic labels, and as a consequence of every construction and extension of theories are always, obviously, some kind of 'material' analogy (or rather, of "analogy of attribution" in proper Scholastic terminology). But it is useful to give a primary role to metaphor, rather than to analogy, and make the notion of analogy dependent on the notion of metaphor. Everything in reality is similar to everything else; it depends only on the criteria that one chooses. It is the metaphoric transfers made possible by our lexicon and carried out by our contingent intellectual strategies that construct similarity families.

vii) To assert that no ultimate foundation of scientific knowledge exists is tantamount to asserting that scientific language is not an 'absolute' language (in the etymological sense of the word) but that it has rather a pragmatic dimension, besides its syntactic and semantic dimensions. This dimension may be the object of inquiry as for every other kind of language. What makes scientific activities a rather privileged kind of activity lies (as suggested again by Pierce) more in the procedures of the organized activity of scientific communities than in the character of scientific language.

viii) Programs of inquiry into the scientific styles, conceived by several intellectual trends in recent years, arise from the need to examine, within the process of becoming of the sciences, the ways that have been chosen on different occasions, between the many possible ways, of applying symbolic labels to nature, and accordingly of fixing the reference of scientific terms. The traditional dichotomies between the internal and external history of science are modified as a result of the new view of scientific metaphors. The linguistic and cultural dimension turn out to be present intrinsically in the becoming of scientific theories, providing a much firmer bridge between the history of science, the history of ideas, and social history than the one provided by the influence of ideologies in the work of the scientists.

ix) Once the opposition between isomorphism and material analogy has been rejected as a misconceived opposition, and once the realist ideal of an absolute univocity of reference of theoretical terms has been abandoned as untenable, it becomes possible to overcome the prejudice that has been shared by writers as different as Bachelard, Nagel, and Boyd, according to which metaphor or analogy has a role to play in science, but one limited to the "initial phases" of the history of scientific theories.

#### Bibliography

- Silvana Borutti 1985  
 "Le virtù ermeneutiche dei modelli", Materiali Filosofici, n. 15.  
 62-88
- Sergio Cremaschi 1987  
 "Granger and Science as Network of Models", Manuscripto, 11, n. 2
- Sergio Cremaschi forthcoming  
 "Modelli, metafore, linguaggio scientifico. Il dibattito postempirista", in: V. Melchiorre (ed.), Simbolo e conoscenza, Milano: Vita e Pensiero.
- Michel Foucault 1966  
Les mots et les choses, Paris; Gallimard.
- Gilles-Gaston Granger 1967  
 "Science, philosophie, ideologies", Tijdschrift voor Filosofie, 29, n. 4, 771-780
- Gilles-Gaston Granger 1968  
Essai d'une philosophie du style, Paris, Colin.
- Gilles-Gaston Granger 1969  
 "Propositions pour un positivisme", Man and World, 2, n. 1, 386-409
- Mary B. Hesse 1965  
Models and Analogies in Science, Notre Dame (Ill.): University of Notre Dame Press (2nd ed.).
- Mary B. Hesse 1967  
 "Models and Analogy in Science", in: P. Edwards (ed.), The Encyclopedia of Philosophy, New York: Macmillan - The Free Press, 1972 (2nd ed.), vol. V-VI, pp. 354-357.
- Thomas S. Kuhn 1977  
The Essential Tension, Chicago: The University of Chicago Press.
- Thomas S. Kuhn 1979  
 "Metaphor in Science" in: A. Ortony (ed.), Metaphor and Thought, Cambridge: Cambridge University Press, pp. 409-419.
- Thomas S. Kuhn 1983  
 "Commensurability, Comparability, Communicability", in: P.D. Asquith and T. Nickles (eds.), PSA 1982, East Lansing (Mich.): Philosophy of Science Association.
- Gianguido Piazza 1985  
 "Metafore e scoperte nella ricerca scientifica", Fenomenologia e società, 8, 87-119.
- Marx W. Wartofsky 1979  
Models, Dordrecht: Reidel.