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NEW CONCEPTS AND METHODOLOGIES IN PUBLIC HEALTH RESEARCH

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Figure 1
NEW CONCEPTS AND METHODOLOGIES IN PUBLIC HEALTH RESEARCH

INTRODUCTION

The field of Collective Health is passing through a profound epistemological, theoretical, and methodological crisis — a paradigmatic crisis, as Thomas Kuhn would say. At the present juncture we need to be, with Rorty (1991), post-Kuhnians.

Of course, Kuhn (1970) made an enormous contribution to the understanding of the historical dynamism of the fields of science but confined his notion of a paradigm to the field of theoretical production alone. An important limitation to his idea is that a paradigmatic crisis in this sense is recognized by the presence of anomalies. In health, for example, the relationship between health and the environment, or the problem of psychosomatic stress, would clearly be a Kuhnian anomaly. This is insufficient, however. A propaedeutic to the paradigmatic crisis much more complex than a mere historical inventory of anomalies has to be developed,¹ for there are other, more copious signs of the insufficiency or crisis of a paradigm that point toward its supersession, yet cannot be regarded as anomalies.

One of those signs of paradigmatic crisis is the scientific enigma (or paradox). An example is the enigma of health planning — that is, the fact that where there is planning no important changes take place, or else do not occur as they were expected to, while examples abound of intense transformation without any planning. This is a paradox that has to be added to the constellation of signs of paradigmatic crisis in the field of health. A third sign is limitation — that is, what is not covered by the sphere of application of a given paradigm. As an example of this kind of sign in the field of collective health we could cite social class as one of the dimensions to account for health-disease-care processes, since present-day epidemiology undeniably faces difficulties in incorporating into its dominant paradigm the discussion of social classes and other basic aspects of society (Breilh, 1989; Laurel, 1994).

¹ Gaston Bachelard, a pre-Kuhnian, was probably more subtle with his notion of an epistemological obstacle (except that he, too, did not advance toward a correct propaedeutic to the epistemological crisis).
In addition to anomalies, paradoxes and limitations, we submit that another sign of crisis in a paradigm is the presence of blind spots: paradigms (made consubstantial with institutional practice by historical agents) that cannot be seen. Applying this argument to our subject and field, we assert that Collective Health, at its present stage of conceptual development, does not refer concretely to health as such. Hence, the argument that justifies it as scientifically grounded practice is circuitous and incomplete; those who espouse that argument hesitate, invent metaphors, and discover indirect ways of talking about health, but they are still thinking in terms of disease. Not even the collectivization of disease through the concept of morbidity denotes "a thing called health." In short, the object "health" has been a blind spot in present-day research in the field of Collective Health.

As we will show further on, the ontological object that is Collective Health has been constructed by a pseudoprobabilistic, monotonic set logic that does not do justice to the wealth and complexity of health-disease-care phenomena. The heuristic object of collective Health, its determinate model-object, has been structured with a fixed hermeneutics subject to notions like the doctrine of causality that have already been superseded in other scientific fields of greater epistemological maturity. The result is an object called "health", which actually refers to "collective disease," and even so is given partial and residual treatment as "risk and risk factors." It is no wonder, then, that there is no "scientific theory of health" in the field of Collective Health.

Hence, the most crucial challenge at this point in the discussion of the epistemological basis of Public Health is the question of the object "health". This, as we have seen above, is an important (and ironic) blind spot in the dominant paradigm of the field of health. The purpose of this brief essay is to contribute to a kind of semeiotics of this intriguing blind spot—the potential model-object of a new definition of health in

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According to Bunge (1972,1983), objects of knowledge are used to produce knowledge as model-objects, that is, ways of understanding, images of something, nonspecular images, figures that can mediate thought about things, processes, phenomena, and events. Bunge (1972) also proposes that model-objects are of two types: ontological and heuristic. Ontological models are forms, figures or images that refer to a thing in itself, that is, that seek to concentrate the designation of the thing. For example, risk, health, disease, and body are ontological model-objects. However, an ontological model-object is not the only way to organize knowledge of a thing or to describe its properties. Priority must be given to the genetic property of that object, and precedence to its determination. Incorporating a set of propositions that determine an object and its genesis and origin converts the model into a heuristic one, that is, a model for understanding. It may be said that the ontological model is descriptive and the heuristic one analytical, but this would certainly be another way to reduce the categories of descriptive and analytic.
specific societies—in order to amass indications of epistemo-methodological trends in research in the field of health. Accordingly, we will first summarize some points that may characterize what has been referred to as the new scientific paradigm, which questions what is happening in science generally. Secondly, starting from the questions raised by the assessment of the paradigmatic crisis in the collective field of health, we will attempt to present a series of more specific epistemological challenges and trends. Thirdly, using an admittedly descriptive strategy to address the theoretical challenges involved, we will attempt to present a kind of map, as synthesized as possible, of the model-object of health-disease-care processes. Finally, we will attempt to conclude with a preliminary analysis of the pragmatic movements that research practice identifies as current possibilities and trends in this field.

II. THE "NEW SCIENCE" (or, WHAT IS GOING ON IN SCIENCE IN GENERAL?)

Several epistemological and methodological elements, grouped under the generic heading of "new paradigm," have been proposed as an alternative trend for present-day science. This approach is sometimes erroneously called "chaos theory," which is much more a marketing term than anything else, since it is concerned with neither theory nor chaos, as will be seen in what follows. We think a much more fitting name for the principal partial unifier of the various contributions to an alternative scientific paradigm is "Theory of Complexity".

The Theory of Complexity was developed most systematically by Edgar Morin (1988, 1989). It is a general application of the premise that scientific research, unlike the conventional positivist approach, whose aim is to simplify reality in order to arrive at its essence, must respect the complexity inherent in the processes of nature, society, and history. There are several possible definitions of complexity based on a more rigorous epistemological approach (Lewin 1992). First, we may define complexity as a plurality of levels or diversity of relations between the components of a given model-object. Second, the complexity of a model may be understood as its nonfinal nature, which in conventional system language corresponds to the feedback property of a heuristic model. Incidentally, in its most widely applied versions, the theory of complexity is seen almost as a "neosystem," updating and expanding some propositions of general systems theory that had attained some influence in the science of the 1950s and 1960s (Buckley, 1976). Because of this, the term "theory of dynamic systems" has been used with some frequency to designate complex models generated in the context of proposals of an alternative scientific paradigm.
In this section we will endeavor to present briefly the principal themes and problems which, often insufficiently articulated among themselves, appear to point to a paradigmatic shift in present-day science.

First, the most visible feature of the so-called "new paradigm" may perhaps be the notion of nonlinearity in the sense of rejection of the doctrine of simple causality that is also part of the conventional approach of science. The use of the Greek term "chaos" (meaning "disorder," the antonym of "cosmos," also from the Greek, meaning "order") in the sense of the description of systems of nonlinear relations, connotes that this approach is open to the consideration of paradoxes, which are intolerable in the conventional epistemology; an example of this is the concept of "order out of chaos" (Atlan, 1981), which we could call Paradox I in the new paradigm. In any case, this usage as a term in a jargon established by practice (Gleick, 1986) includes the expectation of alternative ways of determination that spring from seemingly disorderly, that is, "chaotic," phase transitions. This particular reference, therefore, embodies a special determinism, in which chaos is clearly distinguished from indeterminacy or randomness, both of them corollary to the famous uncertainty principle that ushered in the criticism of present-day relativistic physics.

Second, a fundamental theoretical problem of alternative paradigmatic perspectives lies in that concrete reality can be thought of as discontinuously structured. This is another way to address the question of determinacy in general, in which science opens itself to the possibility of "emergence," that is, of the engendering of the "radically new" in the sense of something not potentially present in the synthesis of determinants. Paradox is recently being tolerated as an integral part of scientific logic; this may be designated as Paradox 2 of the new paradigm: "the new out of the existing." By the way, the question of discontinuity has been given fairly sophisticated mathematical treatment through the so-called theory of catastrophes worked out and propounded chiefly by René Thom in the 1980s (Thom, 1989). This issue is closely linked to the "irreversibility problem," in which the concreteness of time as a dimension is called into question. Thus, the Newtonian notion of real time is opposed to the concept of time relative to processes and the observer, which is represented as a kind of constructed time. The treatment of this problem in relation to physical chemistry and modern biology, particularly in the quest for a definition of life in terms of the organization-entropy dialectic as "dissipative structures" (Prigogine and Stengers, 1986) has opened a debate about a systemic biology based on entirely new foundations.
In strictly analytical terms, such proposals frequently include basic notions that purport to be innovative in science: “nonlinear models,” “strange attractors,” and “weak” effects. Predictive models based on theoretical models of the distribution of events based on nonlinear, discontinuous, or critical (catastrophic) functions have been put forward as useful for the description of complex determinant relationships. Two senses have, in general, been added to the notion of nonlinearity: On the one hand, nonlinear can mean nonfinal, recursive, or iterative, in the sense of an effect of nonconvergent dynamic systems. On the other, nonlinearity can be associated with the property of relationships between series of events that do not conform to the logic of the specific dose-response effect. The other notions mentioned correlate immediately with the definition of nonlinearity. First, “strange attractors” constitute a graphic expression of the association of elements of iterative systems and hence appropriate for representing nonlinear relationships in so-called “phase-space.” Second, the notion of “sensitivity to initial conditions” as an essential property of dynamic systems opens the door to explanatory models based on “weak” effects or sensitive effects (interactions)—that is, models with less precision or predictive stability, based on known configurations of factors or determinants. The consideration of “weak” effects or interaction factors makes it possible to operate models of dynamic systems in the form of networks of sensitive points, which we regard as having high potential for the question of the object "health".

Third, the notion of “fractals” is seen as most fascinating and of greatest utility for the development of alternative ways of producing scientific knowledge. This is a new geometry based on reduction of the forms and properties of objects to the “internal infinite,” as for example the possibility of dividing a line into two equal parts, which in turn may be divided, and so on, always preserving the original form of a line divided in halves. In this way one may represent in a highly synthetic way the observation of the permanence of certain properties throughout the different levels of a system. A variant of this notion may be found, with the appropriate specific features, in the famous local x global question, which has fueled a discussion of utmost current interest in the social sciences of today (Hannerz, 1994). In the health area, Nancy Krieger’s (1994) “ecosocial models” are based essentially on the application of a fractal approach to construction the object of collective health.

Fourth, one of the least popularized of the new paradigmatic approaches is fuzzy set theory, proposed by Zadeh at the beginning of the 1960s. This approach is critical of the notions of limit and precision essential to set theory on which formal analysis in modern science is based (McNeill and Freiberger, 1993). The old Aristotelian formalism
defines the logical foundations of certainty on the basis of identity and noncontradiction. As a corollary, there are three modes of uncertainty: contradiction, confusion, and ambiguity, which do not lend themselves to logical or mathematical formalization, and hence lie outside the bounds of scientific rationality. To these is added fuzziness, a particular property of complex systems relating to the arbitrary nature of infrasystemic limits imposed on events (units of the system) and on the system itself in its relations with supersystems (contexts) and different observers.

Initially, fuzzy set theory implies a radical critique of the notion of an event as an arbitrary fragmentation of processes and of the transformation of the elements of dynamic systems, and imposes a precise boundary wherever the limits are fluid, which we will call Fuzziness 1. Second, consideration of fuzzy logic could restore contextualization as a stage in the process of knowledge production. In this case the outer limit of the system—that is, the interface between the system and the context—is blurred, forming what could be referred to as Fuzziness 2. Finally, the critique of the notion of a limit also implicitly questions the epistemological category of objectivity, reviving the classical problem of the observer as an effect of a Fuzziness 3, in this case referring to the fluid, ambiguous, contradictory, and confused delimitation between subject and object.

These principles, methods and logics, which sometimes appear to be mutually incompatible, have been referred to, particularly in the Anglo-Saxon countries, as "postmodern" science. Proponents of the new paradigms often suggest that a "new science" is in full spate of development and requires epistemological categories of its own (such as, apparently, the category of complexity), new theoretical models (such as "chaos theory"), and new forms of logical analysis (such as fractal geometry and nonlinear mathematical models). The basic premise of this perspective is that the theories of irreversible processes and entropy of thermodynamics, indeterminacy, the probabilistic causality of quantum physics, the dynamic systems of biology and, in short, the approaches of complexity in general, are capable of producing the new metaphors needed to understand and bridge the gap between the natural world and the historical world. These metaphors describe complex, self-regulated, changing, unpredictable systems that produce emergent levels of organization (Lewin, 1992). Even though no generally accepted pattern of theoretical modeling is yet in sight, the proposals put forward highlight fractal fragmentation, partiality or relativity, dynamism, indeterminacy and contingency as characteristics of the desired alternative formulation.
Despite their evident potential for renewal, a critical review of these approaches brings out a degree of "epistemological risk," particularly for the sociohistorical sciences, in the supposed possibility of quantifying all relations that are the objects of scientific inquiry by putting forward nonlinear models as an analytical alternative in cases that do not lend themselves to conventional explanations. What will the consequences of these alternative approaches of science be for scientific practice in general? While, on the one hand, they propose an updating of the critical and innovating nature of scientific production, which would reopen the gap—which had been thought closed—between science and technology, on the other they retain scientific quality as a fundamental sociohistorical value through movements that destabilize the originally positivistic design of totalized knowledge, and which paradoxically reinforce the authority of science. In any case, these new paradigms being proposed have nothing to do with a supposed movement back to irrationalism in present-day science (according to the Habermasian critique), despite the opportunistic claims of the various "mysticisms" emerging from post-modern disinformation.

Epistemologically, such proposals of paradigmatic renewal generate discussion of the very process of construction of scientific objects—that is, of how this process may be taken as a way to produce conceptual objects for use in the practice of science for the rethinking or reconstruction of its objects. Bunge (1972, 1983) proposes a schematic but efficient way to illustrate what is new in this present-day epistemology. This is a philosophy of science that may be viewed ironically as "nonepistemological," an epistemology seen as much more propositive than normative in nature. Contrary to what has been established by the epistemology handed down, the object of knowledge is not a representation of a "thing," an abstract equivalent of a concrete object, and hence not a determination of the object of knowledge exclusively through the concrete object, but rather a referential relationship (Bunge, 1983). Scientific objects are proposed, constructed, and created by reference to things in the concrete world.

A methodological reading of these new paradigmatic perspectives uncovers no determination of the empirical by the conceptual. Concepts are constructed, created in day-to-day research, as we are shown by Juan Samaja in his masterly work *Epistemología y Metodología* (Samaja, 1994), but they survive only by reference to the concrete object. The mere existence of a concrete object does not guarantee or even generate an object of knowledge, but the production of objects of knowledge may generate concrete objects. The history of science presents ever-growing numbers of generated concrete objects, as in modern physics (Powers, 1982) and all the objects
in the world of information processing, the famous cyberspace, which is nothing more than a created world that is now becoming a reality, albeit a virtual one.

We must now examine these questions in the sphere of our specific interest: how the construction of a new science on the foundations described above will affect the object that is collective health. Put differently, what epistemological, theoretical, and methodological patterns must be activated by the heralded paradigmatic shifts?

III. AN EPISTEMOLOGICAL CHALLENGE: THE RESOLUTION OF FALSE CONTRADICTIONS

To reconstruct Collective Health at the epistemological level the false contradictions that dominate the problem of knowledge in this field must first be resolved. In this section we will first present a critical analysis of some of these fundamental methodological polarities that have validated (sometimes without much consistency, as will now be seen) conventional research in Collective Health, and have even constituted a kind of “implicit epistemology” of the field, equivalent to what Althusser (1974) called the “spontaneous philosophy” of scientists.

Foremost among the polarities of greatest interest for the proposed analytical matrix is the one of theory and practice. When knowledge begins to be produced at a certain level of abstraction, those engaged in the day-to-day work of services and research have a strong tendency to reject any epistemological critique. This rejection is often manifested in a differentiation between research and services, as though the former were concerned solely with theory and the latter purely with practice. Some who assume the superiority of practice wonder about the relevance of theory to problems that are eminently practical, such as the health of the population. The gulf between theory and practice is devoid from the outset of any logical or philosophical justification (Althusser, 1978). The distinction is drawn perhaps for ideological reasons, but much more to strike at and disrupt the continuity and complementarity that exists between the two dimensions (Morin, 1990). So much has already been written on this subject, proposing semantic exercises as theoretical practice or practical theory, that there is no need to rake over this issue yet again, for the simple reason that there is no such contradiction.

The polarity between the object and subject of research is based on the notion that knowledge is produced by a subject that controls and dominates an object and who is always faithful to and respectful of that object because it is external to him, the
subject, who in this situation is the hub of the research process. Here, too, there is a 
false contradiction, which has already been transcended in every science that has 
atained any degree of philosophical maturity. When the problem is considered with 
epistemological awareness, the subject is seen to exert effects on the object and the 
object on the subject in a process that Samaja (1987) has called “the dialectic of 
scientific research.” When the object of research is defined not as a representation but 
as a reference, what is proposed is an interaction (in the precise etymological sense of 
interaction between”) between the subject and object of research to the point that the two 
become relative to each other. At one point the subject is differentiated from the object, 
and at another point they trade places, and what was the object becomes the subject 
of the research process. It is understood, then, that the distinction is merely a working 
one, that is, entirely provisional, and of use only to set the research process in motion. 
This is the only utility (though not the least important) of this polarity.

The other disjunction is between the object and the context (the “natural" milieu), 
context being what is not produced by the research. We may grant that the tracing of 
limits is part of our logic: this is how we naturally think, but it is still no more than an 
ordering of the world so that we may think about it. In fact, there is no ontological or 
...gical guarantee that those limits exist or lie where they do, because it is we who have 
put them there (Castoriadis, 1978). The strongest example in the field of Collective 
Health is the line between the normal and the pathological, and hence between health 
and disease. Much has been written about this as well, but we would like to emphasize 
that in nature, in culture, in society, discontinuities arise in how the world is seen by 
subjects. It is “we” (modern, ethnocentric westerners) who think of objects always as 
discrete, as isolated entities. And science defines itself as a particular process for the 
drawing of boundaries within the realm of the continuous.

There are other, related polarities that may be considered more quickly if grouped 
together, such as the individual and the collective, the individual and the population, the 
biological and the social. These are all opposites that contain no contradictions in the 
strict sense of the word. In relation to the object of Collective Health, for example, there 
can be no contradiction between the individual and the collective when considering the 
wealth of possibilities for integrating the knowledge generated by research at the 
individual level into the structuring of a collective perspective. These are different, but 
hierarchically organized levels. The search for a “collective design" for health, though 
fully justified in face of the political demands of our time, has unfortunately blocked the 
capacity for conceptual criticism and resulted in mythification of the collective setting as 
a whole, which prevents its being viewed in terms of levels of organization. Taking the
example of epidemiology as an illustration, our definition of population is more a
definition more in the field of law and political science than one based on “natural”
heterogeneities or homogeneities among the members of a group, in this case a given
society (Samaja, 1994). We could even say that a population is an abstraction in the
sense that the definition of a population is based on homogeneities, and individuals are
never homogeneous. How do people as pragmatic as public health officials make them
homogeneous? Can it be that they do so only for the convenience of working with
denominators that can refer solely to aggregates? And finally, are these historical
agents aware, in their intraparadigmatic practice, that the category of “aggregate”
operates at different heuristic levels: the logical, the theoretical, and the empirical?

All of this leads us to another pair of false opposites, which has chiefly impeded
the development of the social sciences applied to health: quantity and quality. Quantity,
in a still current Aristotelian sense, is one of the topoi, precategories that are essential
to thought in that they make it possible to insert categories into discourse. There is no
utility in thinking about quantity in itself: quantity is always of something. Since the
mathematical philosophy of Bertrand Russell (1924) it no longer makes any sense to
speak of logic except with reference to symbolic logic, in which everything, including
the topoi, has meaning. Thus, quantitation is always and nothing more than the
quantitation of qualities (or properties), as we have already been told by Cecilia Minayo
(1992). However, the quantification of qualities is not only not all there is to the process
of knowing, but is actually secondary in it, for an object cannot be known without
describing it, that is, recognizing its qualities (Granger, 1980). It can even be said that
measurement is a structured, standardized form of description, the description of
dimensions, of qualities that the investigator, in constructing his hypothesis, takes to
refer to some dimension and, hence, to be calculable or measurable—that is, reducible
to the formal language of mathematics. Obviously, this assumption has no basis in the
concrete object or its properties, but refers to the properties of the object of knowledge,
which may be addressed by descriptive operations that include, as we already know,
quantitation.

Critical examination of the false dichotomy between the qualitative and the
quantitative also allows us to move on to deconstruction of the opposition between
description and analysis, so popular in the manuals of epidemiology, the premier basic
science of Collective Health. In principle, there is no science without description. In
other words, there is no science without setting the limits and establishing the properties
(which includes determining them), forms, and contents of objects of knowledge
(Bunge, 1974; Samaja, 1994), all of which is accomplished by description. Of the many
misunderstandings about description, I would like to cite the following: description as superficiality, as paralysis, and as a preanalytical operation (generator of hypotheses).

In the first case, we have no need of Cortázar, Proust, or Dostoyevsky to confirm the potentialities of intensifying the descriptive approach. Second, thinking of description as paralysis or crystallization, incapable of accounting for flows of determination (or causality) makes no sense either, for what is to be described is necessarily processes, be they the linear and mechanical processes of causality or the more dynamic and complex processes of the systemic approach. As for the third misunderstanding, suffice it to say that the logical opposite of analysis is synthesis, and never description.  

As a backdrop, the opposition between the concrete and the abstract is of utmost importance, for it cuts across all the contradictions analyzed (or deconstructed) above. This is a cardinal methodological problem for the epistemology based on the premise that science is a social, cultural and historical practice and, as such, is wordplay (Wittgenstein, 1922). In this epistemology, a discussion of the sense of terms becomes fundamental to promote thought about what is formal or conventional and hence in need of criticism. Here the opposition normally drawn between the concrete and the abstract is also a paralyzing convention. Here we can, for example, think up terms that are semantically less absolute. To refer to the concrete there are highly interesting propositions such as that of Bhaskar's transitive and intransitive dimensions (1989), or Samaja's (1994) validating standards, but we have to admit that all objects of knowledge are by definition abstract. Objects are operators of knowledge, and we use them because they are usable for the purpose. Knowledge cannot be produced without mediation, or rather, without the mediation of objects, which are abstractions from the concrete (Samaja, 1994). Thus, this false polarity is perhaps even more primordial and more important in the sense of more basic than the first of our polarities, the one between theory and practice. Hence, an inquiry into thought (which is, to an extent, what we intend) is always regressive and radical, that is, is always archeological in its

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3 The question remains, however: where did the texts of epidemiology come upon so indefensible a formulation? It is possible that in its earliest stages epidemiology took as a model statistics, in an impoverished version of the application of the mathematics of probability, because it proposed in its manuals that measurements of scatter and of the occurrence of events are descriptive and tests of significance analytical. We may try to understand the intention of the first ideologues of epidemiology in proposing this opposition as an attempt at analogy (Macmahon, Pugh and Ipsen, 1960). What may have happened, however, is that many texts (with the lack of creativity from which they generally suffer) began to repeat this distinction to the point that epidemiology ended up divided, as it were, into two versions, one a second-class, low-quality, supposedly descriptive epidemiology and, in opposition, a superior, analytical epidemiology.
quest for roots (Foucault, 1966). The best approach, in the sense of the direction that the critique should take, will be to extract the myths embedded in the practice of Collective Health so as to demystify each of those polarities by digging down to the fundamental disjunction between the concrete and the abstract which, in the final analysis, governs the construction of its preferred objects.

All this leads to the need for a pragmatic approach to the object not in the common-sense notion of immediacy, but in the sense that the object must contribute to a practice instead of becoming the mere production of technology. Much of what appears to be a paradox in a given paradigm stems from the fact that we are not dealing with an object obedient to the determinations of prediction, that of limited and limiting, rigorous and precise anticipations. The object of Collective Health is actually much more tolerant of approximate ways of anticipating how it will proceed. So it is quite legitimate to attempt to move beyond this predictive preventive practice so familiar to us in its application to the individual and to the mass, toward a provident or, if we may be allowed, a pre-visional collective health--that is, a collective health that can propose visions, forms, diagrams, and scenarios instead of predicting a few measures and their effects.

IV. RE-CON-FI-GURING THE OBJECT OF HEALTH

At the theoretical level many writers are already noting the strategic importance of constructing an object of Collective Health. We would add that this is one of a new family of scientific objects and is constructed as a complex, totalized object (Morin, 1990). To clarify this idea we propose an analogy (which we regard as a referential device as powerful as it is little used). The analogy is drawn from a field of science in which prediction is relative by definition: meteorology, in which no one believes in prediction but much is said in forecast. What defines a hurricane? Not barometric pressure, or wind speed, or temperature change (all of which may be estimated with some degree of precision), but all of them combined in an integral totality that is recognized as a hurricane, but cannot be reduced to its measurements. By analogy, it may be said that the prospective object of health-disease-care is, like a hurricane, a much more complex object that is definable only in its broader configuration, for it has different facets or angles, and that none of those angles by itself gives access to the object in its entirety. We will call it the health-disease-care integral. A health-disease-care integral may be referenced both as a network of sensitive points or as a metaphor for the social representation of diseases as epidemiological structures, chains of
causation, or relationships of risk generation. The logic that can predominate in these prospective objects is a multiple and plural logic that cannot be expressed in coded form and can only be recognized by its effects.

There is in the philosophy of contemporary science an important trend toward the possibility and necessity of constructing an epistemology of the map as a device for the construction of scientific objects. Epistemological research would become a kind of “cartography” of systems for the representation of a given model-object. If this basic perspective is adopted and we apply “in the abstract” some of the indications of the trends of paradigmatic shift present in the current scientific landscape, discussed above, we can move toward the mapping of a kind of ontological model-object by reference to the phenomena of health-disease-care as shown in Figure 1.

To understand this figure, we must first lay down a few basic rules of syntax for it in terms of principles and dimensions. The basic principle of this proposition is a search for the integrality of the proposed map, which entails referencing the phenomena of health-disease using a totalized model object. Thus, the object must take the form of a “health-disease-care integral.” The resulting referential map can then incorporate the various facets as it acquires them, in accordance with the perspective of the knowledge-producing social subject (the investigator who participates in social networks of institutionalized knowledge). This perspective is configured in a space of three dimensions: validation standards, domains, and levels of complexity. First, the dimension of standards is that of basic heuristic models incorporating four validation standards: the explanatory standard, the structural standard, the systemic standard, and the synthetic standard. The dimension of domains is that of the classical vectors of philosophical inquiry, from the particular to the general. Finally, the dimension of levels of complexity expresses the different levels of organization of objects of knowledge, from the micro to the macro level. In the specific case of health-related processes, this last dimension can be simplified to three levels: molecular, clinical, and social.

At any level of complexity the health-disease-care integral can be examined from any of the various combinations of standard and domain. A determinant-based explanatory approach in the domain of the particular which produces highly structured causal metaphors is capable of producing a facet of the model object considered: the pathological process as manifested in the “case” or “case of disease.” Establishment of the clinical discipline around this facet of the totalized object of health-disease-care has been considered in historical terms (Foucault, 1966), epistemological terms (Clavreul, 1982), and praxeological terms (Almeida Filho, 1992). The preferred logic for
the production of this segment of the model object has been abductive logic, in accordance with Samaja (1994), which we may here regard as a type I analogical logic. Even in the explanatory standard, though originating in the opposite epistemological domain, we can find the conventional epidemiological perspective (the epidemiology of risk factors), grounded in an inductive logic based on probabilities. In this perspective the facet of the health-disease-care integral reproduced there constitutes a specific concept designated for our purposes as Risk I, that is, the notion of risk that starts from an underlying frequency-based reasoning. The heuristic models that derive from this approach most commonly apply a quasiprobabilistic determination (as developed by the writer - Almeida - in *A Clínica e a Epidemiologia*) with risk-production models based on the direct action or the interaction of risk factors.

In the structural standard, initially in the domain of the particular, we find the conditional heuristic models. These are topologically-based metaphors for the action of invariant structures in the form of “conditioners” of processes in general that can be explained by causal models. Large numbers of examples of these partial model-objects have been constructed in the biological and the social sciences in a perspective that has generally been referred to as “structuralism.” In what is of most immediate interest to us, this approach acts in the basic model-object by configuring “structures” that result from “change,” which in turn results from “secondary structural processes.” In practice, these stratified topological models have been dominated by deductive logic.

In the domain of generalization, the explanatory models of this standard are configured around matrices of possibilities and produce true logical forms. Their effect on one of the facets of the object of health-disease-care integrals may be expressed as Risk 2, in which the notion of risk is much closer to the common-sense concept of risk as a potential threat-danger. The potentiality (or virtuality) of this risk derives from the operation of a logic we would call “quasi-deductive,” which generates possibilities for the occurrence of events “deduced” from the compilation of knowledge produced by application of the related models of determinant explanation. In the field of health, the different disciplinary approaches taken--for example, that of occupational health--ground their theoretical practice, even if unwittingly, in models of this kind.

In the standard of dynamic systems, in the domain of the particular, where heuristic models defined by sensitivity to their own movement are configured, the products of those models are networks of processes that produce processes. The predominant logic in these model-objects, especially the one concerned with the general laws of movement and transformation, we will call Dialectic 1. The facet of the
integral-object that corresponds to this standard/domain takes the general form of "health-disease-care systems," which are generated by systemic models that are essentially iterative, interconnected, and fractal (in the sense that each element includes a network of lower-order processes). The models of this standard are equivalent to the domain of generalization, and great difficulties are encountered in their treatment, which have only recently been addressed through a conceptualization that is still provisional but of great potential. These are "alinear systems" or, more properly, metaphorical objects, figures in which blurred boundaries between elements and intercontexts hinder any attempt at formalization. The heuristic devices developed for the purpose that are of greatest potential are Lakoff's (1986) "prototypes," which initially resulted from a theorization directed at linguistics. "Prototypes" are types that have some relevance to categories that by definition are subject to fuzzy logic. More definite criteria for the treatment of these new objects in logic have not yet been established; "paraconsistent logic" (Da Costa, 1989) is cited as a possible source of them, and is brought into the schema as Dialectic 2, incorporating the possibilities for the treatment of ambiguities and inconsistencies. In another area the possibility is emerging of devising an approach to the construction of this facet of complex objects, or rather of integral model-objects, which approach, being more openly metaphorical, dispenses with formal expressions.

Finally, we come to the standard of hermeneutic processes, which produce synthetic model-objects, images, and maps (in the strict Wittgensteinian sense). In the domain of the particular there is the possibility of "emergence" in the sense of engendering of the new, which actually results from synthesis beyond determinations (even of multiple determinations). In the domain of generalization there are the praxeological processes of construction of everyday life (at a somewhat partial level). In both cases we propose the consideration of a new elementary form of determination, hitherto best known in esthetics, called "anamorphosis," which can express even cipiently the transition of conventional practice and of the emergence of maps-images. It is needless to say how inadequately this facet of the object of "health-disease-care objects" has been dealt with in present-day scientific practice. In any case, an "imaginary" definition of health can be proposed in this perspective: Synthetic forms, the merging of standards, domains, levels, logics, models, products and objects. Thus health-disease-care will be a composite, one of those synthetic forms which, since they refer to the concrete world, only make sense as integrals.

Lastly, "health-disease-care integrals" constitute model-objects that are polysemous, multifaceted, plural, simultaneously ontological and heuristic models that can cut (and be taken) across different standards and domains referring to different
levels of complexity, constructed for (and by) reference to the facts produced by the sciences of Collective Health. In this sense integrals are “metasyntetic” objects of knowledge, that is, they express more than a “synthesis of multiple determinations” and incorporate in one model-object different reference classes: a) propositional models, which assume logical forms that specify elements, properties and relationships; b) iconic models—schemata and graphic and visual forms; c) metaphorical models, which result from the ability of a propositional or iconic model to pass from one domain to another; d) metonymic models, which result from dislocations and substitutions, also from one domain to another. A partial and provisional example is AIDS, which is more than a “disease” in the clinical sense, more than a “lesion” in the sense of a histopathological structure, more than a “risk 1” in the epidemiological sense, more than a “risk 2” in the sense of environmental health, more than a “complex process” in the socioecological sense, more than a “prototype” in the “semiotic” sense, and is not reducible to a “form” as a component of the social imagery. AIDS is all that plus the transformation (the historicity, we may not forget) of each of those facets of a totalized model-object.

V. CHALLENGES AND TRENDS IN METHODOLOGY

In the methodological sphere the architecture of the complexity of the integrals of health (units of area-cum-population) has to be considered in the architecture of research strategies and in the selection of data-production techniques. This entails a redefinition of the typology of forms of research design in Collective Health. There are interesting possibilities for the insemination of extensive research strategies with “qualitative” techniques, in processes that could be described as methodological hybridization. In addition, we may expect a reassessment of research designs that have had little standing to date, for example, ethnographic strategies, case studies, and “ecological” epidemiological studies.

Let us consider case studies first. Redefinition (in light of the levels of increasing complexity) and reappraisal of the case study (the specimen). To move forward here we need to understand that the definition of a case depends on the level of analysis and interpretation, in which what is a case for the level of complexity of a given study can be the universe for the next level of complexity. For example, what is an individual case for our epidemiological investigation will be the universe for the application of knowledge for a clinical approach, which in turn is the continent of metabolic subsystems, which will be cases at yet another level. Conversely, a complex epidemiological study of a population can be a case to consider in a broader analysis
of the health-disease-care process in society. In short, the definition of what constitutes a case depends on the degree of stratification of the architecture of complexity of the methodology employed.

The other methodological avenue is what could be called the "re-engineering" of aggregate studies (also referred to as ecological studies). There is a very recent movement to reinstate the aggregate study, which includes a discussion of the validity, or rather of the very existence of the ecological fallacy (Susser, 1994; Schwartz, 1994). Finally, even within the methodological avenues already being opened we see a downgrading of statistical inference as a source of analytical legitimation for epidemiology, that is, a proposal to include differential analyses in which the role of statistics is reduced and the importance of mathematical calculation enhanced (Miettinen, 1985).


And now, to close, for the sphere of application. We began to speak above of pre-visual models, themselves applications of alternative logics. These models are attempts to move beyond the current paradigm in health planning, in which epidemiology becomes more than a spectator of strategic planning and from its virtual laboratories starts to contribute to the planning of practice. It can then be said that at that stage of the process of superseding the dominant paradigm it is possible and desirable to propose a kind of virtual planning. Economists are already starting to do this. In collective health it is even more feasible to construct hypersimulations, that is, simulations that are general, integral, and complex and, hence, not only quantitative but also simulations of scenarios, using forecasts instead of predictions.

Present-day theories of planning/management in the field of health are increasingly based on practice, though they are being applied without the available methodological tools, as though epidemiology or the sociocultural sciences had nothing to say to planners of the school of Carlos Matus or Mario Testa. Here we agree that unimaginative epidemiology and the rapid assessments actually being done have very little to contribute. If, for example, an ethnoepidemiology were developed that was superior in any of the senses referred to in this article, it could contribute very greatly to remedying what is seen as one of the main weaknesses of the historicist
contributions of planning in the field of health: its inability to evaluate change with any objectivity.

1. Areas of complex (integral, aggregate) intervention at different levels of organization [in epidemiology, for example, a distinction, as in economics, between a micro(clinical)epidemiology and a macro(populational)epidemiology].

2. Dynamic singular and plural heuristic models (of, for example, AIDS). Culturally sensitive ethnoepidemiological models (to forecast instead of merely to predict). Multilevel fractal models.

3. Figurative (virtual, for scenarios, for objects) planning

4. Practical (pragmatic, interactive) management of health systems.

A concept of evaluation must be put forward that goes beyond the familiar (and superseded) impact evaluation or risk analysis but stays within the triad of success rate of operations and effectiveness and efficiency in the use of resources, and develops the concept of evaluation by analogy. This is yet another important contribution made by Samaja (1994a) in his efforts to apply Peirce’s abductive logic to the philosophy of science in the health area, and justifies epistemologically the logical foundations of what are known as “sentinel sites.” This concept involves monitoring by selection, which implies the development and application of a logic of what may be called "special representativity" in the following sense: The rules for the selection of samples for statistical inference aim at representativity, that is, a sample is thought of as a representation of the population at large. This representativity may be regarded as "partial" in the sense that what that representativity provides (and results from its dependence on assumptions such as that of homogeneity\textsuperscript{4}) is not useful for our

\textsuperscript{4} We have here a historical curiosity worth exploring. As we are told by Desrosiers (1988), in a series of world statistical conferences from 1913 to 1916 a very strong discussion took place between theoretical statisticians for whom representativity had to synthesize the attributes (and heterogeneity) of a population and those who thought that the sampling process had to produce a median distribution, that is, had to represent the homogeneity of the population. The proheterogeneity school lost this intraparadigmatic contest to the defenders of homogeneity, and we can now understand why since then the logic of partial representativity has governed evaluation theory in general, and why there is silence on the very existence of an alternative representativity. Perhaps it is now time to change this outcome, too, and to demonstrate that there is no logical or scientific justification whatever for it, that it is simply the course taken by a historical process in the paradigmatic struggle to build statistical knowledge which, as we find, has become one of the principal sources for the legitimation of epidemiology (Rothman, 1986).
The representativity that seems most representative of the complexity of health-disease-care integrals is the "representativity of the selected types," equivalent to the idea of the "representativity of finalistic samples" referred to by Samaja (1994a).

VI. EPILOGUE: AVENUES

To summarize, there are four key terms for the recognition of avenues toward a new paradigm in collective health: The first is transdisciplinarity. Only those who are transdisciplinary—that is, amphibious, capable of operating in different disciplines—have the freedom needed to do this, which requires the building of bridges:

a. To critical epistemology, to find a particular praxeology of the sciences of Collective Health. To evaluate the methodological laws of the disciplines in this field and the perspectives of their practice along the lines already proposed by Samaja. Scientific research capable of contributing to practice, not just of producing techniques. This would actually mean integrating it increasingly into a new epistemology: an epistemology of complexity, reflexivity and deconstruction (Santos, 1989; Samaja, 1993), a critical epistemology (Bhaskar, 1989) decisively marked by "ecosensitivity," and thus reaffirming the historical character of the objects of health-disease in society.

b. To the new systemic biology. To integrate it into models for the understanding of health-disease-care integrals based on complex systems in light of the new paradigms, as put forward by Varela.

c. To the social sciences in the field of health. For an ethnography of practice in Collective Health. To review models used in the study of the Human Genome Project as developed by Rabinow.

The second term is complexity, the demonstration that complication has given way to complexity. As we saw above, the definition of this distinction has been the object of many very profound essays, Morin's (1990) for example. Among the departures toward a renewal of Collective Health we must include the new strategies recently proposed to address the phenomena of complexity in the context of a change of paradigm. At the heart of the theoretical-methodological problems of such a conceptual program lies the dilemma between (a) the adoption of rigorous, systematic and
detailed determination by means of abstraction to simplify quantitation, and (b) the challenge of acquiring real knowledge of complex totalities in their concrete manifestation as problems of collective health. To resolve this dilemma, new strategies in logic and methodology may be of use by producing "more analytical descriptions" capable of stratifying the totalized structures at the different levels of integration (Samaja, 1994). In the specific sphere of epidemiological science, for example, these approaches will have other methodological consequences, such as: elimination of the method of advance hypotheses; downgrading of the notion of statistical significance; implosion of the idea of representativity and, finally, a break with inductive logic. In the more specifically methodological sphere it would certainly be fruitful to review the notion of the experimental and trace the boundaries of the virtual sphere of population databases as the "laboratory for analysis of the health situation" par excellence.

The third term is plurality. The global changes cited at the beginning indicate more than ever that we must insist on an attitude of openness to plurality (Santos, 1989). No more monolithic contributions, monopolies of thought, or controlled approximations, but the possibility of knowing whatever comes. This is not eclecticism, but something else related much more to the recognition that there is a concrete gap between the concrete object and the object of knowledge, and that processes at one level must be referenced by the knowledge built at the other so that it may be recognized.

The last term is praxis. By which I mean that actions, to be recognized as such, must be carried out in practice. That is, the actions of collective health are actions like all actions of human science. They, too, must be carried out, and that is praxis. This effort must result in the construction of new conceptual models in which health is an expression of the conditions of life and must restore to this field the dynamic of social interactions as a foundation for better and more effective strategies for intervention.

This renewal in the field of Collective Health will favor new ways of conceptualizing and measuring health and contribute to the construction of explanatory models, with a view to the identification of "sensitive points" at which intervention on the health situation is potentiated. This requires a transcending of the conceptual, methodological, and technical limitations of epidemiology and the social sciences and the restoration of their symbolic and concrete effectiveness as basic disciplines of collective health. This renewal of the practice of Collective Health will strengthen its participation in the redefinition of organizational models and in strategies for the transformation of public health in the hemisphere. I have no doubt that Latin America
has already attained a high degree of theoretical sophistication and has acquired the methodological potential for participation in this crucial effort. Indeed, we are no strangers to chaos, and so have no prejudice against nonlinear or alternative modes of reasoning or the practices of the unforeseen in response to the imprecise. Thus, our business is solely to master, boldly and vigorously, the instruments of technology and build up our analytical intelligence to address the important historical commitment of carrying Collective Health beyond the old paradigms of cause and risk.
Bibliographic References


Samaja J. Vigilancia Epidemiológica dos ambientes em que se desarrollan os processos da reprodução social. Ponencia presentada al 6to. Congreso Latinoamericano de Medicina Social, Guadalajara, Mexico, Marzo 1994a.


