

Complexity and Sociology

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Abstract

This study focuses on the correlation between sociology and complexity and it operates a reflection on the deep epistemological and ontological meaning of complexity, revealing how complexity goes beyond the analysis of the global society and is linked to sociology itself and to the issue of its scientific trait. The study shows how complexity, rediscovered following the globalization processes, reconnects sociology with its own origins and concerns the issue of the relation of sociological science with its own object, that is to say, society and social order. In a more radical manner, the challenge of complexity is intertwined with the road of revisiting modern science and epistemological identifying among “order”, “intelligibility”, and “science”. In such a vision, complexity, not only reconnects sociology to its object, but highlights how those traits considered as non-scientific residue of human and social sciences belong to the fundamental issue of scientific knowledge. The challenge of complexity is outlined, as questioning the idea according to which the “modern” science depletes the “scientific vision of the world”.

Keywords

Sociology, global society, complexity, unitas multiplex, sociology beyond societies

This paper aims at theming the relation between sociology and complexity and at developing the idea according to which complexity goes beyond the referral of the analysis of contemporary society and operates a reflection on the deep meaning in ontological and epistemological terms of complexity, revealing how complexity is “ingrained” to sociology itself and to the issue of its scientificity. In a more radical way, complexity refers to the issue of how the identification of knowledge was identified with the type of disciplinary formation invented for the so-called “hard sciences” during the nineteenth century and to the development of physical, biological, systemic, and social sciences, that have doubted the legitimacy of such identification.

The concept of “complexity”—insofar as suitable to describe some dynamics of the current global society, like the network of interdependence and of connectivity that cuts transversally every collective

entity—is not a result of the most recent sociological study, but it possesses an almost century-old history in which many intersections with sociological sciences have been produced. The history of complexity, as stated by Stengers (1985), refers to the history of our scientific and epistemological tradition. The development of sciences during the nineteenth century outlines an itinerary that, the rifts of the alleged necessity of “Cartesian” borders of science have imposed a reconsideration about problems, concepts, questions, objects, and dimensions of science and knowledge. The history of complexity is defined, as Ceruti (2014) underlined, through the intertwining of

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many itineraries that produce an epistemological shift of key notions of the science, like the notions of law, necessity, or order.

In line with Introini's (2017) considerations, this paper aims at showing that complexity, rediscovered following the globalization processes, reconnects sociology with its origins and it concerns the issue of the relation of sociological science with its own object, that is to say, society and social order. The global becoming of the contemporary society can be read as "ruin" of the modern prerequisites of order (Boudon 1985; Giddens 1994; Introini 2017). This path has been analyzed by Beck (2003) with the elaboration of the concept of "methodological nationalism", that sums up the result of all those processes that have led to the end of sovereignty of "state-nations", that is to say, of phenomena expressed as "individualization" (Bauman 2001; 2002), "narcissism" (Cesareo 1985; Cesareo and Vaccarini 2009; 2012), "space-temporal compression" (Harvey 2015), "fragmentation", "deinstitutionalization" (Touraine 2000), "connection, interdependence and networked" (Wellman 2001; Castells 2000), "mobility" (Urry 2003; 2005b; Urry and Elliot 2010), and "cosmopolitanism" (Beck 2003).

These processes develop into two tendencies: firstly, the explosion of "differences" at the expense of collective subjects and of the concept of society as *ens sui generis* elaborated by Durkheim; secondly, the problematization of the notion of border, whose delimitability depends on the existence of macro-actors like institutions, that constitute a kind of social and territorial "container" (Beck 1999) able to compress the difference. The collective subjects were the requirements of an "ordered" world with respect to which the notion of border ended up playing a fundamentally strategic role. Globalization does not limit itself to making more intense transits "inside" and "outside" the membranes constituted by borders, but it disgregates the requirements to give oneself borders, designing a world that is no longer apprehensible according to distinctions/disjunctions of

the model of modern science (Introini 2017; Contini 2012). Globalization marks the passage from a comprehensible world according to the logic of national and international relations and of their separability to that of transnationalization, or else a world in which phenomena produce themselves escaping the order of the national-state collective. Beck (2003) speaking about the end of the "methodological nationalism" underlined the deep co-belonging between a social ontology based on the primacy of the collective and of the state-nation, a conception of social order assimilated to the natural one, an "essentialist" idea of science and the concept of *societas* (national) *sive natura*.

Globalization and its processes of "cropping" of the world have manifested strongly the trait is not at all natural of the idea of society (Introini 2017). Society is not "a given", and it is not "a priori" given once and for all. The concept of society reveals all its historical trait, unchecking itself from that naturalistic definition that allowed Durkheim to consider society as the object of sociology. Sociology, Urry (2000) underlined, can emancipate itself totally from the Durkheimian instances that have forged its concept and grasp the sense of transformation in act only progressing towards a "sociology beyond societies". The emergence of complexity, that is to say, disorder, leads sociology to re-confront itself with its origins to redefine itself together with its own object.

COMPLEXITY: A DISCOURSE "ON" SCIENCE

According to Stengers (1985), the notion of complexity has not got an epistemological status assimilable to the one of the proper scientific notions, and it does not refer to a theory nor to a specialized discipline, but it belongs to a discourse "on" science. The complexity paradigm leads to a transformation not only to questions and answers of science, but also to the kind of questions and answers through which the scientific investigation is defined. Complexity

cannot be defined in a univocal way. Morin (1984a; 1985) specified that it is not possible to approach complexity through a preliminary definition, but it is necessary to follow different leads that conduct to the issue of complexity.

The history of complexity refers to the scientific and epistemological itinerary. The development of sciences in the nineteenth century leads to doubting the alleged necessity of the “Cartesian borders” of science and imposes to reconsider problems, questions, objects, and dimensions of science and knowledge. Throughout history of great philosophers and scientists—such as Wiener (1948), Von Neumann and Morgenstern (1947), Von Neumann (1951; 1966), Ashby (1952; 1957; 1962), McCulloch (1965), Bateson (1972; 1979), Piaget (1967; 1974; 1975), Simon (1962; 1982), Waddington (1977), Maturana and Varela (1972; 1980; 1985), Von Foerster (1960; 1982; 1985), and Luhman (1990)—the themes, investigations, and more in general, the philosophical and anthropological discoveries define the horizon of complexity. The history of complexity refers back to the issue of how the identification of knowledge has been determined with the epistemological statute of the so-called “hard sciences” in the nineteenth century and to the following developments of the physical, biological, systemic, and social sciences, that have questioned the legitimacy of such identification (Emery 1985; Rapoport 1968; Contini 2006; 2013; Contini and Maturano 2009). The history of complexity is defined, as stated by Ceruti (2014), through the intertwining of many itineraries that produce an epistemological sliding of key notions of science—like the notions of law, necessity, or order—therefore the classic relations of subordination are substituted by complementarity, competition, and antagonism relations. Prigogine’s (1968) thermodynamics suggests the idea that “organizing phenomenon” can originate from a thermal dynamic imbalance. Alternatively, Von Neumann (1966) in his study on the self-reproducing automata discovered

that the uniqueness of the “natural automata” is how it works in conjunction with disorder. Atlan (1972) drew from Von Neumann’s studies the idea that permanent disorganization/reorganization is a fundamental characteristic of the living auto-production and suggests the idea of “organizer chance”.

Furthermore, this reinterpretation of the concepts of law, necessity, and order forms a part of a wider reintegration process of the observer in the phenomenon description. Von Foerster (1984) stated that the proprieties that were thought to be characteristics of the phenomenon were revealed to be characteristics of the observer. For example, chance and necessity, semantically connected respectively to disorder and order, were considered proprieties of the nature. However from a constructive point of view, necessity derives from the capacity to make infallible deductions, namely: Necessity and chance reflect some of our own abilities and inabilities and not those of the nature. The observer’s reintegration marked the most important developments of the contemporary physical and biological sciences, while the social and human sciences encountered this issue from the start.

Prigogine writes:

A few years ago my friend Isabelle Stengers and I wrote a book entitled *La Nouvelle Alliance* (Prigogine and Stengers 1979). This title—the new alliance—could have been read in different ways. One was the alliance between two cultures, the reason being that time did no longer oppose physical sciences against the biological and human sciences. But I think that today we can overcome this statement, and we can conceive a project that allows us to proceed towards a prospective of a tighter bond between the two cultures. (...) And in this way we reach an image of the universe that starts to have a complexity comparable to the one we live within us. I often wonder if this convergence between the world around us and the world within us is not one of the most significant happenings of our century. (Prigogine 1985: 191-193)

According to Morin’s considerations, there are different itineraries that converge towards complexity. The first route of complexity is given by the

ascertainment that chance and disorder have an active role in the evolution of the universe. Disorder and chance became part of the physical sciences firstly through heat—which is the movement-collision-dispersion of atoms—secondly through the big bang and then through the continuing dispersion of the universe. The second route towards complexity was opened with the introduction, in natural science, of the notions of singularity, locality, and temporality. Such notions can no longer be eliminated from the scientific discourse through the universalist abstraction. The third route, the complication one, is given by the assumption that the biological and social phenomena present an incalculable number of interactions and of inter-retroactions. The fourth route towards complexity was opened when the works of Von Foerster and the ones of Prigogine showed that it is necessary to consider a logical relation at the same time of complementarity and antagonism among the notions of order, disorder, and organization. The fifth is the route of the logical complexity of the “unitas multiplex”, that requires to consider the organization as what constitutes a system from different elements and that forms a unity at the same time that it constitutes a multiplicity. The sixth route of complexity is given from the crisis of clarity and of separation in the scientific explanation. The seventh route of complexity is the one where there is the return of the observer. The observer’s issue interests both the social sciences—as the sociologist is in the society that hologrammatically is within him—and the physical sciences, in which, only to mention some scholars, Heisenberg has shown that the observer disturbs the microphysical observation and Brillouin has highlighted how every observation that implies an acquisition of information is paid through an expenditure of energy.

The different routes towards complexity—disorder, contradiction, complication, logical difficulties, the observer’s issue, etc.—are intertwined and woven

together to form complexity. When you proceed along the complexity road, you reach the “complexus” of the “complexus”, that is to say, the core of complexity where different complexities meet, and we understand how two linked nuclei exist, an empirical and a logical one. The empirical nucleus includes disorder, the aleatory phenomena, the complications, the intricacies, and the multiplications; the logical nucleus instead refers to both the contradictions and to non-describable problems within the logical one.

“Unitas Multiplex”

Morin ties the concept of complexity to the one of system and associates the idea of complex unity to the one of organization that has remained at embryonic stage in the *General Systems Theory* (Von Bertalanffy 1968; Wienberg 1975). In this way, Morin conserves systemic and cybernetic ideas (*General Systems Theory*) in their fecundity, but at the same time, he criticises, transforms them and refers them to a paradigm of complexity. In the elaboration of the concept of “unitas multiplex”, Morin draws from the principle of “order from noise” of Von Foerster, from the principle of “organizer chance” of Atlan (1974; 1979), and from the “automa” theory by Von Neumann and the works of Prigogine. Besides, the research of Gunter, Maturana, and Varela introduces Morin to the notion of “self-organization”. Finally, Morin assimilates and overcomes Jacob’s (1970) and Monod’s (1970) positions. In contrast to Monod, who researches the principle of intelligibility of the living in the dialectic between invariance and perturbation, Morin suggests a complex dialogic of organization and self-organization.

The organization of the “self-eco-organizing system” assumes the intervention in depth of disorder. Disorder becomes a necessary ingredient in the self-eco-organizing system, that is to say, of every living system and a social system *a fortiori*. The complex organizing vision conceives the tetralogic ring “order-disorder-interactions-organization”. Such

a ring of reciprocal co-operation means that order, organization, disorder, and interaction develop reciprocally the ones with the others, in a relation that does not allow to separate the terms. The more complex the order and the organization are, the more they need disorder. Order and disorder that in the reductive vision were considered respectively sovereign the former and a discharge of the real the latter, in the complex conception, become relative and relational to each other. Thus it introduces logic complexity in the heart of these issues, in the sense that the fundamental link of notions is of dialogic nature, where dialogic stands for a symbiotic unity of two logics, that at the same time feed each other.

In other words, for Morin, it is not about turning the hierarchy between order and disorder upside down—like Serres (1974), according to whom it is disorder that foregoes order and that is real—it is instead about eliminating the hierarchy and to set the issue in terms of complex and dialogic relations among order/disorder/organization. This is the way followed by the principle of the “order from noise”, formulated by Von Foerster (1960), that shows that from a disordered turmoil or unrest, ordered phenomena can originate and Morin prefers to call it “organization from noise”, or organizing principle through disorder. Such a principle objects to both the classical principle of the “order from order”—or of the natural order that obeys the laws of nature—and to the statistical principle of the “order from disorder”, according to which a statistical order at a population’s level is produced starting from disordered and aleatory phenomena at individuals’ level. Finally, according to Morin, the idea of organization must refer itself necessarily to a complex unity.

According to Morin, the “*unitas multiplex*”, or complex organized unity, is formed by organized interrelations between elements/individuals, actions or other complex unities and should be conceived in function of the trinity macro concept system/interrelation/organization. This macro concept

is indissociable. Organization is the crucial notion and links ideas of interrelation to the one of system: Every interrelation endowed with a certain stability or regularity assumes an organizing trait and produces a system. Consequently, the organization keeps, links, forms, and transforms the system and originates its own rules, limits, and specific effects. Morin, re-elaborating the principle of Von Foerster (Von Foerster 1960; Von Foerster and Zopf 1962), according to whom the rule of composition of its components in interaction in the coalition is superadditive (superadditive composition rule), conceives the system as something more than its components considered in an isolated way or juxtaposed. Morin calls “emergence” (Morin 1977), the quality or property of a system that presents a novelty trait compared to the qualities or properties of the components considered in isolation. The emergence is a product of the organization that not only appears at a global level as a “macro-emergence”, but can also be exhibited at a component level under the shape of “micro-emergence”.

Therefore, in the “*unitas multiplex*”, not only the whole is more than the addition of the parts but also the part is in the whole more than the part. The emergence—because it is a new quality that cannot be decomposed and that cannot be deduced from the elements of the system—has the statute of an event: It is irreducible physically and logically non-deductible and it presents itself as a “fact”. This means that in the “*unitas multiplex*”, the whole and the parts are in a dialogical relation, that is at a time complementary, concurrent, and antagonistic. At the same time, every organizing relation carries out some restrictions or obligations on the elements/individuals/parts, that make the parts lose determined qualities or properties or they inhibit them. In particular, on the level of human societies—in which the individuals have the possibility to choose, decide and to complex development—the issue of obligations is set in an ambivalent manner, as they can result repressive and

destructive of freedom. Therefore, in every system, not only the earning in emergence must be valued but also the loss because of the obligations (Morin 1985).

Organization, therefore, is at one stage of transformation and formation, and anti-organization is both necessary and antagonistical to the organization. Consequently, the self-organizing system is also self-eco-organizing, because its environment participates in its organization, and self-eco-organization assumes the permanent reorganization and the intervention in depth and multiformly of disorder. The originality of the social organizing structure is, according to Morin, at the same time in its complexity, heterogeneity, negentropy, and singularity. The social system is negentropic, because it is able to reduce and “negate” the growth of entropy within the system. Human societies, in their permanent processes of disorganization/reorganization, integrate, recuperate, and “socialize” disorder.

COMPLEX SOCIOLOGY

The complexity of the real demands a paradigm and a method of complexity (Morin 1973; 1977; 1980; 1991). The method of complexity intends to go beyond the Cartesian method and requires thinking without ever closing the concepts, re-establishing the articulations between what is separated, understanding the multidimensionality, and considering singularity, locality, and also the integrating totality. The principle and method of complexity conceive—overcoming the big caesura between natural sciences and human ones—the reciprocal implication among physics, biology, and anthropo-sociology, according to a circular relation. According to such relation, human sciences postulate natural sciences and natural sciences in turn postulate human ones; at the same time, the anthropo-social reality depends on physical reality, which depends on the anthropo-social one. Consequently, these realities, even if they must be

dealt with as separate, cannot be isolated and made incommunicable. Multidimensionality of the anthropo-social reality implies an individual, a social, and a biological dimension. The economic, psychological, and demographic one are aspects of the same reality, aspects that must be separated, but not isolated. Therefore, complexity requires, according to Morin (2012), both the dialogical, and the organizing thinking that is able to comprehend the self-eco-organizing relation—that is the deep relation between system and environment—the hologrammatic relation between the parts and the whole and the principle of recursion.

Morin roots the anthropo-sociology in the biological and physical in complexity, that shows the originality of one compared to the other (Morin 1977; 1984b). This can be interpreted in terms of a complex sociology and of a multidimensional approach in sociology. Morin’s complex sociology (Morin 1984a; 1984b) links what is generally separated in the theory of sociology: the notions of “global unity”, of “construction”, of “complementarity”, of “antagonism”, and of “self-eco-organization”. The latter concept, in turn, places the accent, binding them together, on key social traits generally ignored by sociological theory, that is to say, the problem of organizing autonomy (auto-organization), the problem of the relation around it (ecologic relation), the permanent problem of internal disorganization (entropy growth), and the problem of internal reorganization (self-generating principle). It is all about recognizing multiform disorder in the social organization. The key notion of self-organization supposes, together with self-eco-organisation, the notion of negentropy and information, that co-presuppose one another (Morin 1984a; 1986).

This means that complex sociology considers the complexity of the relation society/culture/individual, the complexity of autonomy/dependence, and therefore, the possibilities of individual autonomy and of autonomy of thought. Such sociology goes beyond

sociologies that are based on a deterministic and reductive paradigm and that resort to the unilineal cause-effect scheme.

The anthropo/socio/cultural complexity can be considered, according to Morin, only by a complex sociology which implies a dialogical and recursive complex method. A method, that is to say, associates in a complex manner—that means complementary/concurrent/antagonistic—the instances necessary to the existence and functioning of an organized phenomenon. The recursive and dialogical method considers the relation between different elements of the system according to circularity, in which every element conditions every other element and it is by this in turn conditioned. This means that the products and the effects of a process are considered at the same time as co-generators and co-causing of the process. The recursive sociological method considers society circularly as a product of interaction between individuals and as retroactive on individuals. At the same time, the complex method considers knowledge not as a simple product, but as active in permanent self-production of society, which makes a start from “inter-cogitations” between individuals, and in turn, it retroacts in a mega-computing way on individuals. The social process is considered as a uninterrupted productive ring in which the products are necessary to produce what produces them. “Complexity is not only an empirical phenomenon (chance, risk, disorders, complications, tangles in the field of phenomena), but it is also a conceptual and logical issue that confuses the demarcation and the frontiers so clear between concepts like ‘producer’ and ‘product’, ‘cause’ and ‘effect’, ‘one’ and ‘many’” (Morin 1985: 52).

The second methodological principle is the hologrammatic principle. Morin defines the hologrammatic methodological principle referring to the physical hologram.

The hologram is a physical image whose qualities (of

perspective, of colour, etc.) depend on the fact that every point contains almost all the information of the whole that the image represents. And in our biological organisms we possess an organization of that kind: each of our cells (...) contains the genetic information of all our being in its totality. Naturally only a small part of this information is expressed in that cell, while the rest is inhibited. In this way, we can affirm not only that the part is in the whole, but also that the whole is in the part. The same goes for our societies too, even if in a completely different manner. Since birth, family teaches us language, the first rituals and the first social necessities, (...). And this inclusion of culture continues through school, and through education. (...) And therefore, in a certain way, society in its entirety is present in the part—in the individual. (Morin 1985: 52)

This means that we need to abandon the linear kind of explanation to adopt another kind of explanation in movement, circular, an explanation in which to understand a phenomenon you go from the parts to the whole and from the whole to the parts. On the basis of the hologrammatic principle, in complex organizations, like in an hologram, the whole must be conceived as included in the part that is included in the whole. Organizational complexity of the whole implies the organizational complexity of the parts, which expects recursively the organizational complexity of the whole. The mind/brain “produces” that world that “has produced” the mind/brain; we produce the society from which we are “produced”. It follows that the hologrammatic principle is joined to the recursive principle.

In third instance, the method of complex sociology considers society as a macro-system that contains within itself sub-systems relatively autonomous, and one of these is constituted of ideas and knowledge—noosphere. At the same time, the complex sociological method analyzes society as a co-organizing system of the incorporated systems, which carry within them hologrammatically the presence of the incorporated.

The complex method conceives the relation between individual minds and culture as hologrammatic and recursive: hologrammatic in the

sense that culture is in the minds of individuals, which individual minds are in turn in culture; recursive in the sense that individuals can form and develop their cognitive activities only within a culture, that comes to life only with cognitive inter-retro-actions between individuals. That is the same as saying that cognitive interactions of individuals regenerate culture, that in turn regenerates such cognitive interactions.

Therefore on the basis of the complexity method, the instances that produce cognitive activity must be considered as reciprocal co-producers. It needs to be conceived, that is to say, a complex recursive unity between the producers and the product of knowledge and, at the same time, a hologrammatic relation between each one of these producer and produced instances. Each instance, producer and produced, contains the others and in this sense each one contains the whole as whole. In other words, the method of complexity considers every cognitive activity as inclusive of biological, cerebral, cultural, social, and historical components, and conceives the bio-anthropologic complexity and the socio-cultural hyper-complexity. To conceive complexity means to conceive a relation at the same time dialogical (complementary, concurrent, and antagonistic), recursive, and hologrammatic between these instances co-generating of cognitive activity. Morin's complex sociology considers, therefore, society as an eco-system co-organizer of the systems that it contains, one of which is the "noosphere" or "sphere of mental things". To conceive the world of the noosphere according to the self-eco-organizing principle, means to be able to place the central notion of autonomy/dependence of the noosphere at the top of the anthropo-socio-noological ring. This means that the noosphere, produced by the set of anthropo-social activities is an emergence. So, the complex method articulates the noosphere in the anthropo-social world according to a circular psychosphere/sociosphere/noosphere relation. Such a method conceives among the anthropological instance,

the socio-cultural one, and the noological one, a complex game, complementary and antagonistic. Besides, the complex method considers the noosphere as self-eco-organizing and according to an uninterrupted dialogic of order/disorder/organization.

In the perspective of complex sociology and of the multidimensional approach in sociology, elements such as "the phenomenon", "the event", and "the crisis" assume a new cognitive statute (Morin 1984b). On the level of the empiric methodology, the complex sociology privileges observation and intervention. The importance given to the phenomenon means to adapt the theoretical approach to reality and not the opposite, that is to say, to adapt the real to the discipline. The phenomenon, which is at the same time geographical, historical, economical, sociological, psychological, etc., is what emerges in the social reality as a relatively isolable datum starting from an empirical emergence or a number of concatenated events. The multidisciplinary approach does not disintegrate the phenomenon but tries to individuate polycentrisms. From a sociological point of view, the event is what goes beyond statistical regularity. The event represents novelty, that is to say, the information that brakes at the same time into the social system and into the sociological one. The event-information is destructuring and perturbs rational systems. The methodologically healthy aspect of the event consists in the fact that the event tears the rationalizing structure. Morin's complex sociology is in opposition to the sociological methodology that is faced at eliminating the event to reach the formalization and the mathematization of regularity and of structures. The complex sociology goes along the path of a clinical sociology. The clinical sociology is centered on direct observation of what is accidental, casual, and therefore also on the observation of the crisis, that is to say, that—in the field of mechanistic sociology—it was considered irrelevant or statistically minor. Crisis is revealing for a sociology that does not only base itself on statistical data and on representative samples.

The contraposition between Morin's complex sociology and a mechanistic sociological method, finalized at normalizing and eliminating the perturbation and the unbalance, includes the technics and research methods. Complex sociology focuses on the issue of the observer in relation to the observed phenomenon and on the problematic of indissoluble and reciprocal contamination of the couple subject-object. In this way, it privileges the investigation "from live", observation, and participation-intervention.

CONCLUSIONS

The paper considers the relation between complexity and sociology and highlights how the strength and the attractive capacity of the "systemic" or "neosystemic" reading of complexity—that constitutes the mainstream of the "complexity turn" (Urry 2005a; 2005b)—are in their capacity to offer particularly effective categories for the innovative interpretation of the social, therefore useful to the analysis of the current society and of its "global disorder". Concepts such as the ones of "emergence", "self-eco-organization", "order from noise/order from chaos", and "unitas multiplex" constitute a magmatic interdisciplinary field of particular interest for the interpretation of the relation local/global and, more in general, to consider a global society.

The paper suggests the argumentative line according to which the issue of complexity, lifted from globalization, cannot be the sociological result of contemporaneity and of everything that is recognized within its specific traits: the high process of differentiation, globalization, cosmopolitanism, technology and its network, hypermobility of things and people. Complexity has a potential first of all epistemological, since it leads sociology towards a radical questioning, that is to say, to re-confront itself with its own origins and to redefine itself together with its own object. This is a challenge because, as

Giddens (1994) highlighted, sociology sees itself and its scientific trait in relation to its object which is society. The fact that society is the key concept of sociology is widely accepted. The challenge of complexity needs to be caught in the theme of the possibility to uncheck the concept of society from that naturalistic definition that allowed Durkheim to consider society as an object of sociology and that interpreted society as guarantor and reason of order. In a more radical manner, the challenge of complexity is intertwined with the revisitation of the modern science and of the epistemological identification among order, intelligibility, and science.

The epistemological distinction of modern science in "experimental" sciences—considered "strong" and "mature"—and in "historical-social" science—considered "weak", "immature", and "dirty"—is based on the conception according to which the scientific method is unique. All the disciplines that aspire to define themselves "scientific" must be submitted to the regulations of this method, and they must be aimed at: determining invariant laws and giving quantitative mathematical formulations to these laws; eliminating the local, the singular, and the event as contingent and residual; isolating the object from its environment; separating the object and the subject; reducing the knowledge of organization to the order principle, that is to say, laws, invariable, constancy; and decomposing the complexity in simple parts. These requirements have orientated science to research an invisible simple behind a complexity of phenomena judged only apparent. But it has been the development of science orientated by these requirements that has led to the discovery of levels of reality not easily framed in such a modern view of science. It is in this context that the challenge of complexity is outlined, first of all through the following questioning (Bocchi and Ceruti 2007): Is it possible to reconduct the idea of scientific rationality—if not the idea of rationality *tout court*—to the model of rationality outlined by science

in the eighteenth and nineteenth century? Or is it necessary to recognize an epistemological and ontological pluralism to reopen the horizons and the directions of development of the scientific research towards dimensions of the universe very different? The challenge of complexity is outlined through numerous ways. To use Morin's expression: Chance, contingency, singularity, locality, temporality, revisionability, and disorder are not by any means indicators of the temporary and limited trait of our theories, but they reveal the neverending and multiplicity of the architectures of the universe. The challenge of complexity is outlined as criticism towards the idea according to which the "modern" view of science identifies with the "scientific worldview".

The fundamental contribution of Morin's research consists above all in pushing away complexity from the horizon of the analysis of the contemporary globalized society. Morin states:

For a long time many believed—and maybe many still believe—that the lack of human and social sciences consisted in their inability to free themselves from the seeming complexity of human phenomena, in order to rise and reach the values of natural sciences, sciences that established simple laws and let the order of determinism rule. Today we can see that physical and biological sciences are characterized by a crisis of simple explanation. (Morin 1985: 49)

Complexity, therefore, not only reconnects sociology with its object, but with the complexity, those which were considered non-scientific residues of human and social sciences—uncertainty, disorder, contradiction, etc.—become part of scientific knowledge (Morin 1985; Castells 2000). The positive aspect which could derive from the response to the challenge of complexity consists, as Morin states, in opening the way to multidimensional thinking, which integrates but at the same time exceeds formalization and quantification, which were dominant in modern science.

References

- Ashby, W. R. 1952. *Design for a Brain*. New York: John Wiley & Sons Inc.
- . 1957. *An Introduction to Cybernetics*. London: Chapman & Hall Ltd.
- . 1962. "Principles of the Self-Organizing System." In *Principles of Self-Organization*, edited by H. von Foerster and G. W. Zopf. New York: Pergamon Press.
- Atlan, H. 1972. *L'Organisation biologique et la Théorie de l'information (Biological Organization)*. Paris: Hermann.
- . 1974. "On a Formal Definition of Organization." *Journal of Theoretical Biology* 45:1-9.
- . 1979. *Entre le cristal et la fumée (Between Crystal and Cloud)*. Paris: Le Seuil.
- Bateson, G. 1972. *Steps to an Ecology of Mind*. New York: Ballantine.
- . 1979. *Mind and Nature: A Necessary Unity*. New York: Ballantine.
- Bauman, Z. 2001. *La solitudine del cittadino globale (The Solitude of the Global Citizen)*. Milano: Feltrinelli.
- . 2002. *La società individualizzata (The Individualized Society)*. Bologna: Il Mulino.
- Beck, U. 1999. *Che cos'è la globalizzazione. Rischi e prospettive della società planetaria (What Is Globalization?)*. Roma: Carocci.
- . 2003. *La società cosmopolita. Prospettive dell'epoca post-nazionale (The Cosmopolitan Society)*. Bologna: Il Mulino.
- Bocchi, G. and M. Ceruti. 2007. *La sfida della complessità (The Challenge of Complexity)*. Milano: Mondadori.
- Boudon, R. 1985. *Il posto del disordine. Critica delle teorie del mutamento sociale (The Place of Disorder)*. Bologna: Il Mulino.
- Castells, M. 2000. "Materials for an Explanatory Theory of the Network Society." *British Journal of Sociology* 5(1):5-24.
- Ceruti, M. 2014. *La fine dell'onniscienza (The End of Omniscience)*. Roma: Studium.
- Cesareo, V. 1985. *La società flessibile (Flexible Society)*. Milano: FrancoAngeli.
- Cesareo, V. and I. Vaccarini. 2009. *La libertà responsabile. Una discussione (Responsible Freedom)*. Milano: FrancoAngeli.
- . 2012. *L'era del narcisismo (The Era of Narcissism)*. Milano: FrancoAngeli.
- Contini, R. M. 2006. *Complessità e analisi sociologica in Edgar Morin (Complexity and Sociological Analysis in Edgar Morin)*. Chieti: Libreria Universitaria Editrice.
- . 2012. *Nuove generazioni nella società multi-etnica. Una ricerca nelle scuole d'Abruzzo (New Generation in the Multiethnic Society. A Research in School in Abruzzo)*.

- Milano: FrancoAngeli.
- . 2013. “The Paradigm of the Complex Dynamic Systems and Sociological Analysis”. *Procedia—Social and Behavioral Sciences* 92:207-214.
- Contini, R. M. and A. Maturò. 2009. “Application of the Analytic Hierarchy Process to the Sociological Analysis.” Pp. 1-13 in *ISAHP Proceedings*. Pittsburgh: Creative Decision Foundation.
- Emery, F. E. 1985. *La teoria dei sistemi (Systems Theory)*. Milano: FrancoAngeli.
- Giddens, A. 1994. *Le conseguenze della modernità. Fiducia e rischio, sicurezza e pericolo (The Consequences of Modernity)*. Bologna: Il Mulino.
- Harvey, D. 2015. *La crisi della modernità (The Crisis of Modernity)*. Milano: Il Saggiatore.
- Introini, F. 2017. *Un mondo aperto. Itinerari nella sociologia della complessità (An Open World. Itineraries in Sociology of Complexity)*. Milano: FrancoAngeli.
- Jabob, F. 1970. *La logique du vivant (The Logic of Life)*. Paris: Gallimard.
- Luhman, N. 1990. *Sistemi sociali. Fondamenti di una teoria generale (Social Systems)*. Bologna: Il Mulino.
- Maturana, H. and F. Varela. 1972. *Autopoietic Systems*. Santiago du Chili: Facultad de Ciencias, Universidad de Santiago.
- . 1980. *Autopoiesis and Cognition. The Realization of the Living*. Dordrecht: Reidel.
- . 1985. *The Tree of Knowledge*. Boston: New Science Library.
- McCulloch, W. 1965. *Embodiments of Mind*. Boston: MIT Press.
- Monod, J. 1970. *Le Hasard et la Nécessité (Change and Necessity)*. Paris: Le Seuil.
- Morin, E. 1973. *Le paradigme perdu: la nature humaine (Paradigm Lost)*. Paris: Le Seuil.
- . 1977. *La Méthode. I. La nature de la nature (The Method. I)*. Paris: Le Seuil.
- . 1980. *La Méthode. II. La vie de la vie (The Method. II)*. Paris: Le Seuil.
- . 1984a. “Epistémologie de la complexité” (Epistemology of Complexity). In *Edgar Morin. Science et conscience de la complexité (Edgar Morin. Science and Conscience of Complexity)*, edited by C. Atias and J. L. Le Moigne. Aix-en-Provence: Librairie de l’Université.
- . 1984b. *Sociologie (Sociology)*. Paris: Fayard.
- . 1985. “Le vie della complessità” (The Routes of Complexity). In *La sfida della complessità (The Challenge of Complexity)*, edited by G. Bocchi and M. Ceruti. Milano: Feltrinelli.
- . 1986. *La Méthode. III. La connaissance de la connaissance/I (The Method. III)*. Paris: Le Seuil.
- . 1991. *La Méthode. IV. Les idées. Leur habitat, leur vie, leurs mœurs, leur organisation (The Method. IV)*. Paris: Le Seuil.
- . 2012. *La sfida della complessità (The Challenge of Complexity)*. Firenze: Le Lettere.
- Piaget, J. 1967. *Biologie et connaissance (Biology and Knowledge)*. Paris: Gallimard.
- . 1974. *Adaptation vitale et psychologie de l’intelligence, Sélection organique et phénotypie (The Psychology of Intelligence)*. Paris: Hermann.
- . 1975. *L’équilibration des structures cognitives. Problème central du développement (Equilibration of Cognitive Development)*. Paris: PUF.
- Prigogine, I. 1968. *Introduction à la thermodynamique des processus irréversibles (Modern Thermodynamics: From Heat Engines to Dissipative Structures)*. Paris: Dunod.
- . 1985. “L’esplorazione della complessità” (The Exploration of Complexity). Pp. 179-193 in *La sfida della complessità (The Challenge of Complexity)*, edited by G. Bocchi and M. Ceruti. Milano: Feltrinelli.
- Prigogine, I. and I. Stengers. 1979. *La Nouvelle Alliance (The New Alliance)*. Paris: Gallimard.
- Rapoport, A. 1968. “General Systems Theory.” Pp. 452-458 in *International Encyclopedia of the Social Sciences*. New York: The Free Press.
- Serres, M. 1974. “Les sciences” (Science). Pp. 203-228 in *Faire de l’histoire. Nouvelles Approches (Making History. New Approaches)*, edited by J. Le Goff and P. Nora. Paris: Gallimard.
- Simon, H. A. 1962. “The Architecture of Complexity.” *Proceedings of the American Philosophical Society* 106(6):467-482.
- . 1982. *Models of Bounded Rationality*. Cambridge: MIT Press.
- Stengers, I. 1985. “Perché non può esserci un paradigma della complessità” (Why There Can’t Be a Paradigm of Complexity). In *La sfida della complessità (The Challenge of Complexity)*, edited by G. Bocchi and M. Ceruti. Milano: Feltrinelli.
- Touraine, A. 2000. *Can We Live Together? Equality and Difference*. Cambridge: Polity Press.
- Urry, J. 2000. *Sociology Beyond Societies. Mobilities for the XXI Century*. London: Routledge.
- . 2003. *Global Complexity*. Cambridge: Polity Press.
- . 2005a. “The Complexity Turn.” *Theory, Culture and Society* 22(5):1-14.
- . 2005b. “The Complexity of the Global.” *Theory, Culture and Society* 22(5):235-254.
- Urry, J. and A. Elliot. 2010. *Mobile Lives*. New York: Routledge.
- Von Bertalanffy, L. 1968. *General Systems Theory. Essay on*

- Its Foundation and Development*. New York: George Braziller.
- Von Foerster, H. 1960. "On Self-Organizing Systems and Their Environments." In *Self-Organizing Systems*. New York: Pergamon.
- . 1982. *Observing Systems*. Seaside: Intersystems Publications.
- . 1984. "Disorder/Order: Discovery or Invention?" In *Disorder and Order*, edited by P. Livingstone. Stanford: Anma Libri.
- . 1985. "Cibernetica ed epistemologia: Storia e prospettive" (Cybernetics and Epistemology). Pp. 112-140 in *La sfida della complessità (The Challenge of Complexity)*, edited by G. Bocchi and M. Ceruti. Milano: Feltrinelli.
- Von Foerster, H. and G. W. Zopf. 1962. *Principles of Self-Organization*. New York: Pergamon Press.
- Von Neuman, J. 1951. "The General and Logical Theory of Automata." In *Cerebral Mechanism in Behaviour*, edited by J. Jaffres. New York: Wiley.
- . 1966. *Theory of Self-Reproducing Automata*. Urbana (III): University of Illinois Press.
- Von Neumann, J. and O. Morgenstern. 1947. *Theory of Games and Economic Behaviour*. Princeton: Princeton University Press.
- Waddington, C. H. 1977. *Tools for Thought*. London, UK: Jonathan Cape.
- Wellman, B. 2001. "Physical Place and Cyberspace: The Rise of Personalized Networking." *International Journal of Urban and Regional Research* 25(2):227-252.
- Wienberg, G. 1975. *An Introduction to General Systems Thinking*. New York: Wiley.
- Wiener, N. 1948. *Cybernetics: Or Control and Communication in the Animal and in the Machine*. Cambridge: MIT Press.

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