Redesigning Worldwide Connections

Redesigning Worldwide Connections

Edited by

Michele Bonazzi
and Valentina Di Simone

Redesigning Worldwide Connections

Edited by Michele Bonazzi and Valentina Di Simone

This book first published 2015

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

TABLE OF CONTENTS

Prologue

Societal Challenges, Complexity Theory and the Systemic Approach

Valentina Di Simone
G.D'Annunzio University Chieti-Pescara

In the next twenty years, the convergence of robotics, informatics, nano- and bio-technologies and genetics with information technologies and cognitive science will have a significant impact on society. This convergence will lead to a revolution in ways of thinking about science, health, energy, resources, production and consumption, and the environment. However, enabling technologies also raise specific new challenges themselves. These challenges must be identified and addressed as these technologies become more readily available. In fact, despite technological developments, the word "future" is nowadays often associated with pessimism and catastrophism more than it was in the past; however, inventing the future is ever more strategic and complex, as in the new forthcoming era, the human race faces the emergence of infinite possibilities.

The development of new enabling technology applications and their translation into valuable outcomes for society need to overcome many risks and barriers, for example those represented by the idea of New Feudal systems. The adoption and utilization of these technologies to address key social challenges will require, on the one hand, close collaboration between government, industry and the broader community, and on the other hand, understanding their developments and social implications in advance in a clear, systemic and integrated framework.

The aim of this book is thus to look at these global challenges through the lens of complexity theory and a systemic approach, a paradigm that features systemic thinking developed from the 1980s onwards, leading to some radical epistemological changes at the crossroads between sociology and communication sciences through the impact of the emerging technology

sciences. It summarizes the most recent achievements of the theoretical debate on complexity and systemic theory and the uses of these theories in specific, practical domains. The research aims to provide an answer to the need for problem solving ideas from a different perspective, overcoming traditional, local and territorial patterns and identities. In fact, it represents an attempt to develop a global interdisciplinary platform for supporting a cosmopolitan cognition, which would unify more points of view and merge basic and applied research in order to cope with problem solving needs in context of challenges.

The contributions collected in this book have been selected from those presented at the 4th World Complexity Science Academy (WCSA) Annual Conference, held in Tenerife in December 2013.

The first three contributions focus on the general framework by addressing the systematic theories and paradigms from a broad point of view.

Magali Orillard deals with cognitive networks and social complexity. He introduces the concepts of hybrid structures, social forms and complex mediation, social opacity and ambiguity, social learning and ephemeral structures. The author's purpose is to study the behavior of the different types of actors within a heterogeneous population, as well as their interactions, from a multi-disciplinary point of view. Through a cross analysis of the fields of economics, sociology and philosophy, he aims to establish the dimensions of the notion of social complexity, particularly that which concerns the architecture of knowledge, the co-construction of representations and the complex mediation processes which the interacting agents require.

The second contribution, by Jiří Šubrt, looks at systemic analysis applied to society, comparing the integrated to the multi-centric view of the world. Starting from the viewpoint of a model of society in the form of an integrated whole a la Talcott Parsons, Šubrt examines the consequences of Luhmann's perspective for sociological theory, where modern society is a functionally differentiated object composed of autonomous subsystems, and how these consequences can be overcome.

Michele Infante examines the problems related to the transformation of the mass media to the online context. After drawing a general picture, he links complexity and the theory of digital media by debating new methodologies and approaches to the study of social media and digital networks and developing a new systemic semantics for media research. By using big data, sentiment analysis and data mining, he explores the opportunity to understand the social aspects of digital media in social research, and, at the same time, he debates critical and controversial points

regarding the use of these methodologies. The author also shows how an improper use of these methodologies leads to a reduction in complexity due to the misclassification and stemming processes, and addresses certain biases in human behavior, their social leanings and orientation in believing that web-crawlers can automatically read social media.

Digital reality and social complexity are the core of the next three contributions, which investigate disorder and order selection in a connected world.

Elena Cedrola and Stefania Masè take the theory to the real world by investigating the Italian network contract of "Polo Alta Moda Area Vestina", stressing the managerial implication of a change from a territorial to a system view. After describing the evolution of inter-firm collaborations in the Italian industrial system, they discuss flexibility and autonomy as points in favor of firms' collaboration in network contracts.

The next contribution, by Michele Bonazzi, looks at changes in the way people are connected in an evolving world. Starting with a description of traditional and digital media, he investigates the process of identity creation in the internet complexity and the impact on social life and revolutionary movements in depth.

In the last contribution of this section, Emilia Ferone focuses on the systemic construction of academic capitalism within a knowledge-based society and intellectual capitalism. Specifically, the author asks how training and development, recruitment and human resources management are linked. The research aims to study the development of standards emblematic of the academic system and intellectual capital by taking a latent function approach. The objective of this research is social construction and its development into isotropic standards of the mechanisms underpinning the HR policies of academic intellectual capitalism.

In an ideal next section, the collected contributions investigate continuity and differences in systemic and natural environments, concentrating on the role of science.

Jim Sheffield, in his paper, investigates local solutions to respond to the multiple, intertwined and fast-changing impacts of globalization in a global environment, focusing on New Zealand as a case study. Specifically, he frames the facilitation of selected local solutions in a global environment within the theoretical perspective of pluralism and communicative action a la Habermas. The facilitation of aspects of national policies in the domains of science funding, economic development and regional growth is reviewed. Electronic meeting technology was employed during this research. The main question posed

by Sheffield is: "Does electronic discourse increase the success of local solutions in a global environment?"

In another contribution, Andrè Folloni studies complexity epistemology and contemporary law issues, focusing on economics, social science and ecology. In this context, by looking at the dysfunction in the relationship between legal science and the interdisciplinary content that runs throughout the legal system, he shows how the epistemology of complexity presents categories able to produce legal knowledge closer to reality, such as recursive systems, organization and disorganization.

In the next contribution, Franco Vaio starts from the well-known observation that human behavior violates the assumptions of "classical" rationality, as documented by many empirical studies. This observation has stimulated the development of many alternative approaches, from agent-based models to bounded rationality. The author explores quantum mechanics based on the non-classical interference of probability, which correctly explains the double-slit experiment, and contextual probability. He emphasizes how the higher flexibility of techniques based on quantum mechanics compared to classical mathematics and probability might be helpful in better understanding and modeling psychological phenomena as well.

Finally, Andrea Pitasi traces the frontiers of the systemic approach. He proposes a development of the approach along the lines of nine turbo-conditions for understanding the emergent ideas of hyper-citizenship within the wider global scenarios, characterized by the convergence of the robotics, informatics, nanotechnologies and genetics singularity and the development of the process that Pitasi defines as "time zero of desire".

CHAPTER ONE

COGNITIVE NETWORKS
AND SOCIAL COMPLEXITY

MAGALI ORILLARD
AIX-MARSEILLE UNIVERSITY

Abstract: The purpose here is to study the behaviour of different types of actors within a heterogeneous population, as well as their interactions, from a pluridisciplinary point of view. Through a cross analysis of the fields of economics, sociology and philosophy, we try to establish the dimensions of the notion of social complexity, particularly that which concerns the architecture of knowledge, the co-construction of representations and the complex mediation processes which the interacting agents require. Therefore, this study concerns a world where the actor is plural in the sense described by Bernard Lahire; the latter takes us to Jon Elster's notion of the multi-self. This plural character is seen here using different coding processes as manipulations of symbols and overcoding processes; as manipulations of codes among themselves.

The basic question confronting us here brings us to the interaction between the notions of social identity, social complexity and complex action, which gives rise to the occurrence of the different forms of engagement - to be taken into account in the sense used by Laurent Thévenot - related to the behaviours of actors participating in the emergence and development of social networks, of forums, like hybrid forms emerging from the modeling of complex systems as described by Herbert Simon.

From a methodological point of view, the paradigms of methodological individualism and holism are abandoned by taking the systemic approach based on the interactionist paradigm. The works of Mark Granovetter and his notion of embeddedness, as well as those of Harrison White on his notion of decoupling, are used in order to develop this analysis and thus to establish the links between codes, overcodes and different types of device

within the meaning of the aesthetics of philosophy. The purpose here is to lend epistemological content to the actor-network notion within the meaning of the sociology of translation as artefact in the sense used by Simon.

The operating character of this type of modelling rests in particular on cognitive shortcuts, whose nature is closely linked with the identity of actors.

At this level, we examine the link existing between the autonomy of actors and the different forms of engagement participating in the emergence of hybrid structures, and we study this emergence in terms of opacity and ambiguity.

Keywords: Ambiguity, Social complexity, Identity, Network, Opacity.

1.1. Cognitive Approach to Social Complexity

The point of departure is the following:

Let us consider a population of heterogeneous agents from the point of their identities and their representations. This heterogeneity activates through the plurality of logics of action, as described by Lahire, which brings us to Elster's notion of multiple-self and the potential belongingness of an agent to different cities, as referred to by Boltanski and Thévenot.

In the case of behaviour modelling (the cognitive turning point in Orléan is a reference), different artefacts enable agents to participate in the social game, therefore we rely on the notions of:

- the process of coding (that is to say, systems of manipulation of symbols, construction of repertoires, codebooks and so on), language and the process of overcoding as defined by Sfez. This allows us to take into account the creativity and ambiguity brought about by the construction of artefacts that support these actions.
- representations (which, naturally, are incomplete here) and procedural rationality (in the sense used by Simon), which are the typical features of complex modelling systems.
- translation based on the works of Callon concerning the definition of the actor-network theory as well as those of Quine on the indetermination of translation due to the incompleteness of representations.
- the device as defined by Lyotard and Déotte, which we find particularly in the field of aesthetics in philosophy. This helps to explain how the different social forms emerge.

The question addressed here is of a dual nature: to start with, it is the question of modelling the behaviour of agents, but later we want to stretch the model to different actors, different entities emerging within the population, for example hybrid structures like groups, communities etc. These different social forms, reflections of democracy, intervene within the population since "usually, the theories of action and of actor oppose each other around a series of interpretative tensions: tensions between the theories that privilege the unicity and homogeneity of the actor (of its identity, of its relationship to the world, of its "self", of its system of dispositions…) and those that describe the infinite fragmentation of the "self", the roles of experiences…." (Lahire). We find the same in Elster. In the same way, Sen, in "Social Identity", observes that agents have a veritable multiplicity of identities. He questions the impact that this can have on their behaviour and on interactions.

Description of the model:

- Let E be the set of states of nature and P a population of n agents (i =1…n)
- The socio-cultural identity and heterogeneity of the agents are revealed by set of codes Ci that agent i uses to build his representation of E denoted as Ei (individual cognitive space where he selects certain states denoted as Ei) and his representation of P denoted as Pi.

Here, through the set of codes Ci, an agent is plural in the sense used by Lahire, which is related to Elster's notion of the multiple-self.

As has been said before, we take the interactionist paradigm as our basis:

- Let i $\in$ P and j $\in$ P; we posit:
- i R j if and only if i and j know each other and use at least one common coding process
- i and j are said to be "cognitively close"

In a general way, it is considered that the agents are part of different embedded networks, as descibred by Granovetter, here illustrated in the following manner:
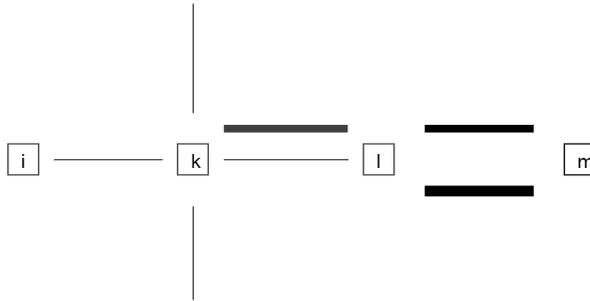
Fig. 1-1 Diagram 1

The individuals are therefore "cognitively situated" (this is linked to the individual representations of P). Here, for example, the red part of the diagram refers to the representation of P concerning agent k.

In this way, a cognitive graph can be drawn relative to population P, generalising the idea of a cognitive chain; the heterogeneity of agents appears clearly.

The definition of cognitive proximity (see Nooteboom) between two individuals rests on the existence of a cognitive chain between the two.

From then on:

- The cognitive shortcuts correspond to the shortest paths between i and j relative to the graph of the relation R
- The quality of a shortcut, or a translation (see "the indeterminacy of the translation" in Quine) depends both on the number of intermediaries situated between i and j and the number of codes that these agents have in common

Here we have a simple case corresponding to the previous diagram:

Fig. 1-2 Diagram 2

In a general way, we suppose that the smaller the number of intermediaries, the higher the quality of the translation and the higher the number of coding processes used, the higher the richness of the translation.

In complex situations, we could have different sorts of shortcut; as we can see on the next diagram, a cognitive shortcut can be very poor or very rich from the point of view of the use of different coding processes:
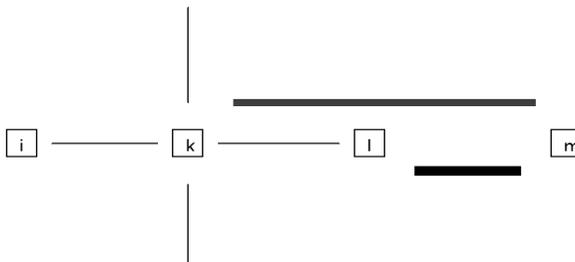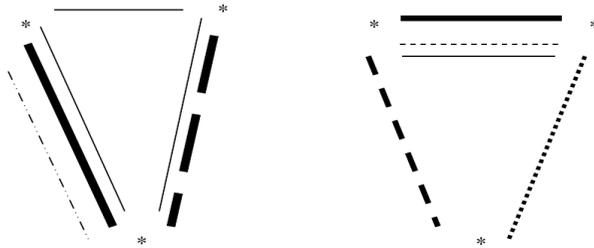

Fig. 1-3 Diagram 3

This takes us back to the notion of decoupling (see White) where agents have to select specific coding processes to form an autonomous group, as is explained later.

We can also refer to "language games", considering a language as a social construction, and discuss Sen's idea that "there is no particular reason why such plurality of motivations cannot be accommodated within a social choice framework with more richly described social states and more articulated characterisation of individual choices and behaviour".

1.2. Hybrid Structures, Social Forms and Complex Mediation

Hence the question that can be asked is about the link between the human or non-human characters of the different entities represented here, going from the notion of the agent to the notion of the actor, of the group, and of hybrid structures.

In fact, we alight upon the basic idea found in the actor-network theory and in the developments relevant to the sociology of translation as described by Callon. This is where hybrid structures come in. They take us to the combination of humans and non-humans, where the non-human

element, e.g. the communication network, participates in the construction of links between agents and coordinates the groups or communities.

The presence or absence of common repertoires and the cognitive distance between two agents i and j enables us to describe the agent-to-agent relations, and as such, the notion of distance has to be defined in a contextualised way. Therefore reference must be made both to common codes and to the representations of agents in order to describe the way they are linked, which is why, in like manner, it is necessary to make reference to the notion of cognitive chains.

Then we introduce the membership function in a pretopological way to identify the potential allies of a group A and we propose some possible pretopological structures (see Orillard).

Suppose $A \subset P$:

- If $A \neq \emptyset$: adh1 (A) = { j $\in$ P/ $\exists$ i $\in$ A and j R i} $\cup$ A

In this first case, we only link j to a member of A, whatever A is

- If $A \neq \emptyset$ and if $\cap$ i $\in$ A Ci $\neq \emptyset$:
  adh2 (A) = { j $\in$ P/ $\exists$ i' $\in$ A and j R i' with Cj $\cap$ ($\cap$ i $\in$ A Ci) $\neq \emptyset$ } $\cup$ A

Here there is a certain homogeneity within A and we link j (through i) to A if he uses at least one code in common with A

- If $A \neq \emptyset$ and if $\exists$ i' $\in$ A as whoever i $\in$ A : Ci $\cap$ Ci' $\neq \emptyset$
  adh3 (A) = { j $\in$ P/ j R i' } $\cup$ A

In this last case i' can be seen as a mediator inside A and we link j to i. In the other cases, we posit adh (A) = A, that is to say that A is closed (see the annex)

These definitions are particularly interesting if we refer to the connexity of A, which introduces the notion of cognitive autonomy. Here the function adh (which defines the linkage of an agent to a group A) could be interpreted in terms of cognitive proximity through the notion of a cognitive shortcut. Hence, the framework set down here leads the way from the notion of agent to that of group or of community.

Obviously, reference to the works of Simmel must be made in order to show that the game of interactions between agents is a part of society, to show how the different social forms emerge, and thereby to describe their characteristics.

Cognitive chains translate the social links existing in population P and through the presence of one or several links that exist between two agents, here we revisit Granovetter's idea of strong links and weak links. The importance, the strength, of one weak link between two agents needs to be noted if they share only one code, this code, this process of translation, giving rise to a group emerging from the notion of connexity, which will be dealt with further on.

If we refer to each agent and to all the links that ensue from each, the notion of the actor-network (Callon) becomes evident, as well as the notion of device from the point of view of the aesthetics of philosophy (Lyotard) and that of social identity (Sen).

From a technical point of view, pretopology enables us not only to work on agent-to-agent relations, i.e. the individual construction of social links, but also to describe the emergence of groups as social forms (Simmel) in order to envisage agent-group relations and group-group relations.

This aid has multiple applications in terms of recognition of forms; here it is a case of the recognition of social forms.

In fact, here we find duality between the forms and contents at the sociological interactionist level, enabling us to address the issue of the construction of social entities, since we consider the interactions between agents to be the founding features of society.

Hence, it is also of interest to remember the notion of devices (see Lyotard), which refers back to the notion of artefacts that we encounter in Simon's "The Sciences of the Artificial".

Indeed, "the theory of the devices is constructed as an answer to the problem of seeming of things which is built itself like a problem of mediation", where one has to "understand individual-environment relation as reciprocal production in constant evolution".

The question of evolution through learning mechanisms will be dealt with further on.

These definitions are particularly interesting if we refer to the connexity of A, which introduces the notion of cognitive autonomy.

In fact, we can suppose it is of great importance to find the shortest combinations of coding processes (overcoding processes) and the lowest number of intermediaries A' required for the emergence of a cognitively autonomous group A (defined through the connexity of the relation R, the function adh and the individual representations of P) to minimise cognitive bias.

Referring to decoupling processes (White) as cognitive autonomisation mechanisms, we can then define the potential devices that explain the

emergence of group A; the crucial problem is that of explaining the self-organisation mechanisms related to the emergence of different groups.

In this way, we use CA to denote the set of coding processes (repertoires, scripts or codebooks) effectively used by A (corresponding to his socio-cultural identity) and EA to denote the collective cognitive space corresponding to the co-representation of E that A and A' have constructed from cognitive autonomisation mechanisms, and thereby different forms of commitments (this is linked to the notion of procedural rationality).

We are referring to:

- Orléan and the notion of collective beliefs (which are not explicitly built)
- Buchanan and his idea of social rationality: imputation to the group of an organic existence apart from that of its individual components
- Sen and the plurality of motivations articulated through embedded networks

The procedural aspect here (Simon) corresponds to the selection of A' and CA (within $\cup \, i \in A \, Ci$) in a complex mediation context.

The actor-network or device (or medium) is identified with the couple (A', CA) where A' is the group of intermediaries manipulating the codes belonging to CA and we define EA corresponding to the collective projects (as selections of sets of states of the nature in EA) co-constructed by A' and accepted by the members of A referring to different forms of commitment (Thévenot).

Then we can see the groups as communities (Amin and Cohendet) but we can also suppose that individuals who want to act together do not have to use exactly the same coding processes.

Here, the identity of group A is defined through overcoding processes referring to the notion of social cognition, which corresponds to the heuristics (rules or forms of commitment) used in the selection of te translation processes.

The couple (A', CA) as a device or medium characterises both the identity of A and the procedure that makes A emerge in the heterogeneous population P.

We can also consider the cognitively autonomous groups (as social forms – see Simmel) which emerge to be linked to each other through (A', CA) and define a new relationship R', which generalises R as a meta-relationship. Here we obtain hybrid structures and then we can identify different types of relations: individual (as specific group) to group, group

to group, etc. as in the following diagram concerning the generalisation of the relation R:
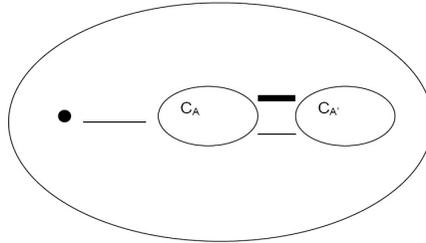

Fig. 1-4 Diagram 4

1.3. Social Opacity and Ambiguity

First of all, we have to define the opacity existing between an agent (in light of the definition that has been adopted of its identity) and the way it is represented as a member of a group A.

Therefore we have to make the link between:

- intersubjectivity and codebook construction
- cognitive bias and semantic opacity

We suppose that coding and overcoding processes produce social constructions. We are then confronted with the problem of the indeterminacy of the translation (Quine), because there is no a priori uniqueness in the selection of codes and intermediaries. To understand effectively selected heuristics we can observe EA or projects which are built by groups, but the indeterminacy of translation in the overcoding processes produces ambiguity.

This is linked to the definition of opacity, from the cognitive and social point of view, between the initial population and the set of cognitively autonomous groups A which have emerged within the population P. The opacity between P and the social oligopoly, as referred to by Lesourne, constituted by the set of groups that have emerged, de noted (A, A', CA), is quite dependent on the cognitive identity of the groups, on the intermediaries that have participated in their construction and therefore on the frameworks or devices from which they originate as hybrid structures.

In a more general way, at this level we refer to the multiplicity of frameworks (devices, engagements, commitments etc.) that able to

implement these groups in a synthetic way, as follows: we start with the initial population P and progress to cognitively autonomous groups that emerge through overcoding processes (this illustrates the notion of opacity). Then the ambiguity corresponds to different heuristics and different devices as mechanisms of selection corresponding to (A, A', CA), (B, B', CB) etc. as illustrated in the following diagram:
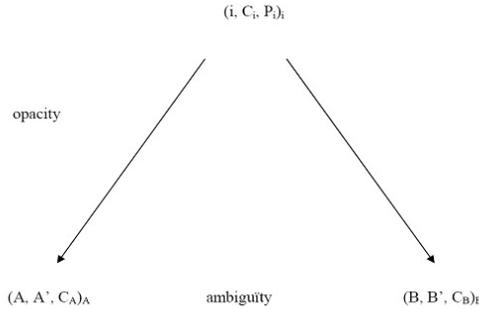
Fig. 1-5 Diagram 5

In the same way, we can represent the hybrid structures as follows:
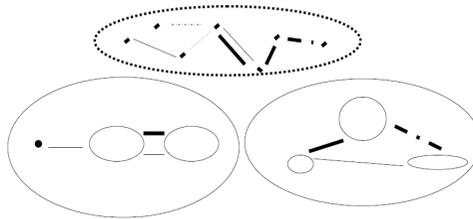
Fig. 1-6 Diagram 6

1.4. Social Learning and Ephemeral Structures

Finally, we can design mechanisms corresponding to the learning processes: let $C_{i,t}$ be the set of codes used by i at time t. According to the coding processes corresponding to $C_{A,t}$ used by group A at time t, let us consider agent i to belong, at time t, to a certain number of autonomous groups (autonomous in the cognitive sens. We posit:

$$C_{i,t+1} = C_{i,t} \cup_{i \in A} C_{A,t}$$

and then we observe, at time t+1, new connections and the emergence of new groups.

Here, social learning concerning the use of coding and overcoding processes is connected to the membership of cognitively autonomous groups, which evolve and co-construct different projects corresponding to concrete and observable situations using the great potential of overcoding processes.

Therefore, this work makes it possible to foresee the consequences of the emergence and development of hybrid structures within populations of heterogeneous agents, in particular in terms of opacity and ambiguity. This is obviously the characteristic of social complexity most relevant to the management of interactions (interactive governance and learning) within these populations and to the forms of action conceivable in a complex socio-economic world.

Annex

A 1: Let a set P and an application adh from P(P) to P(P) such as:
adh $(\emptyset) = \emptyset$
$\forall$ A, A $\subset$ P   adh (A) $\supset$ A
Then the couple (P, adh) is called a pretopological space.
A 2: $\forall$ A, A $\subset$ P, A is said to be a closed set if adh(A) = A.

References

Akrich, M., Callon, M. and Latour, B. 2006. Sociologie de la Traduction: textes fondateurs, Paris: Presses de l'Ecole des Mines.

Amin, A., Cohendet, P. 2004. Architectures of Knowledge: Firms, Capabilities and Communities. Oxford University Press.

Boltanski, L. et Thevenot, L. 1991. De la Justification: les économies de la grandeur. Paris: Gallimard.

Buchanan, James, Mc. 1954. "Social Choice, Democracy and Free Markets". Journal of Political Economy.

Callon, M. 2004. "The Role of Hybrid Communities and Socio-Technical Arangements in the Participatory Design". Journal of the Center for Information Studies.

Cohendet, P., Diani, M. 2003. "L'organisation comme une communauté de communautés: croyances collectives et culture d'entreprise". Revue d'Economie Politique.

Deotte, Jean-L. 2007. Qu'est-ce qu'un appareil? Benjamin, Lyotard, Rancière. Paris: L'Harmattan.

Deotte, Jean-L., Froger, M., Mariniello, S. 2008. Appareil et Intermédialité. Paris: L'Harmattan.

Elster, J. 1996. The Multiple Self, Cambridge University Press.

Granovetter, M. 1985. "Economic Action and Social Structure: The Problem of Embeddedness". American Journal of Sociology.

Lahire, B. 2009. L'Homme Pluriel: les ressorts de l'action. Paris: Hachette Littérature.

Lesourne, J. 1981. Les Mille Sentiers de l'Avenir. Paris: Seghers.

Livet, Pierre, 2008. "La cognition sociale et son envers" in Déterminismes et complexités: du physique à l'éthique, la Découverte, Paris.

Lyotard, Jean-F. 2008. Discours et Figure. Paris: Klincksieck.

Nooteboom, B. 2002. Trust: Forms, Foundations, Functions, Failures and Figures. Northampton: Edward Elgar.

Orillard, M. 2011. "Co-construction des représentations: opacité et médiation complexe dans une population hétérogène" Revue Acta Europeana Systemica.

Orlean, A. 2004. "What is a Collective Belief" in Cognitive Economics: An Interdisciplinary Approach (Bougine and Nadal eds), Berlin: Springer.

Quine, W. Van Orman. 1960. Word and Object, MIT Press.

Sen, A. 1995. "Rationality and Social Choice". The American Economic Review.

—. 2004. "Social Identity". Revue de Philosophie Economique.

Sfez, L. 1993. Critique de la décision. Paris: Armand Colin.

Simmel, G. 1981. Sociologie et Epistémologie. Paris: PUF.

Simon, H. 1982. Models of Bounded Rationality. Cambridge Mass: MIT Pres.

—. 1996. Les sciences de l'Atificiel. Paris: Gallimard.

Thevenot, Laurent. 2006. L'Action au Pluriel: sociologie des régimes d'engagement. Paris: La Découverte.

White, H. 2008. Identity and Control: How Social Formations Emerge. Princeton University Press.

CHAPTER TWO

THE SOCIETY IN SYSTEMIC PERSPECTIVE: AN INTEGRATED WHOLE, OR A MULTICENTRIC WORLD?

JIŘÍ ŠUBRT
MASARYK UNIVERSITY

Abstract: In its early days, systemic sociology created – as can be seen in the theory of Talcott Parsons – a model of society in the form of an integrated whole. But it is different in the theory of Niklas Luhmann. For Luhmann, modern society is a functionally differentiated society, i.e. it is composed of heterogeneous but equal parts, which are relatively independent and are defined as societal subsystems. Luhmann's analysis presents contemporary society as a whole differentiated into autonomous subsystems which constitute neighbouring worlds for each other. This paper examines the consequences of Luhmann's perspective for sociological theory, and how these consequences can be overcome.

Keywords: Society; systems differentiation; subsystems; media; codes; integration; disintegration.

Sociology, from its beginnings, used an integrated model of society, with parts that made up an interconnected whole. Before talk of social systems, there was a theory which equated society with a biological organism. In this respect, Herbert Spencer may be considered a predecessor of system theory; he referred to the social organism (Spencer 1895-1897). Spencer still inspires system theory with the idea that the evolution of social organisms is characterised by the gradual deepening of their internal differentiation.

The main theoretical sociologist in the period after World War II was Talcott Parsons, who at that time worked out the concept of the social system on the basis of structural functionalism. The main concepts of the

theory are the terms system, structure, and function (Parsons 1960). From this perspective, society may be seen as a system that represents a dynamic entity which is structured in a certain way, and whose structural components perform certain functions ("functions" meaning contributions to maintaining the system as a whole). The whole Parsonian model is based on the assumption that the ideal condition of a social system is a state of dynamic equilibrium and integrity. The main issue that the author tackles is the question of how to maintain the cohesion of the system with the help of value consensus and other social mechanisms, which include socialisation, education, conformity, social control, norms and sanctions. Not only for Parsons, but also in later approaches, it is typical for the majority of sociological conceptions to be characterised by an understanding of society as a unity, as an integrated whole, organised on the basis of certain unifying principles.

One of the first thinkers to question this idea was Daniel Bell in the book The Cultural Contradictions of Capitalism, in which he expressed the view that contemporary society cannot be understood properly in this way. Against the so-called holistic approach Bell puts forward his own conception, which is established on the idea of a split into societal spheres. In this conception, society is more divided than united. It is described, in Bell's own words, as an unstable "alloy" of three different "elements", three different spheres: techno-economical structure (or economy), political system and culture. The relations among these three spheres are, according to Bell, complicated and they change over time. Individual spheres are mutually incompatible; they fall under different axial principles, and have different rhythms of change. Bell claims that disharmony among these three spheres is a source of the societal contradictions that are connected with many latent conflicts. Luhmann's thinking is in a similar vein – actually, he is more radical in his thinking about society.

Unlike his predecessor Talcott Parsons, Niklas Luhmann foregrounds not the question of systems integration, but the question of differentiation. Developing the idea of social differentiation formulated long ago by Herbert Spencer, he regards the process of system functional differentiation as key for modern society, which he argues is composed of heterogeneous but equal parts that are relatively independent in character and are termed societal partial systems (Teilsysteme; subsystems, systems within systems). Nowhere in his work does Luhmann offer a comprehensive list of these partial systems, but it is clear that there must be at least ten. They include the economy, politics, law, the army, science,

arts, religion, the mass media, education, the health system, sport, the family and intimate relations.

The essential thing is that each of these systems has its own peculiar functional specialisation for a certain, specific field of actions that take place within it (economic behaviour is different from religion or intimate relations etc; a different meaning and purpose is attributed to each of these kinds of actions). Each of these partial systems contributes in a different way, with regard to its own functional specialisation, to the reproduction of society. Despite their heterogeneity, the subsystems are equal in the sense that they are all essential for this reproduction, and one might say irreplaceable if society is to maintain its character.

The mutual unity of these subsystems is formed by relations based on the combination of their functional closure and, at the same time, openness towards the environment. This means that modern society represents a differentiated unity, i.e. a whole composed of functionally dependent (i.e. dependent on the functions of other systems), and at the same time autonomous, partial systems. Here, autonomy and dependence are in a mutually potentiated, stepped relationship (partial systems have become independent but the collapse of one may have fatal consequences for the societal system as a whole).

Societal systems are self-referential, which means that in the constitution of their elements, operations and structures they refer and relate to themselves. Although they are closed systems in terms of structure and reproduction, this does not mean that they cannot or do not make contact with their surroundings. Indeed, without this contact, the dynamic of operationally closed systems would cease to exist: for example, a university as a system can exist only against the background of a functioning economy, political system, legal system etc. In no way does the outside world represent some meaningless residual category. On the contrary, for systems, the relationship to the surroundings is constitutive, and systems can only endure in their existence in differentiation from that outside world.

The condition for the existence of social systems is communication. Systems create for themselves mechanisms, the purpose of which is to stabilise communication processes. Luhmann calls these mechanisms media. Luhmann's concept of symbolically generalised communication media cannot be narrowed down to the mass media as generally understood, because it also relates to media such as power, money, laws, faith and knowledge. Luhmann considers one of the main marks of social evolution to be the differentiation of separate communication fields such as politics, the economy, law, religion, science, but also education, art and

intimate relations, together with the communication media corresponding to them.

The communication made possible in the separate subsystems by these media always takes place in a certain binary code (e.g. in the political system: to have power-not to have power; in the economic system: paid-not paid; in the legal system: law-lawlessness; in science: truth-falsehood), in religion: immanence-transcendence). Thanks to these binary codes, which always express a particular type of single leading difference, specific subsystem semantics are created in which the autonomy of each different system is based on the application of the system's own leading difference. For example, the differentiation of the economy as an autonomous societal subsystem starts with the establishment of a symbolically generalised communication medium - the development of money (Luhmann 1988: 230). The elements of economics (unit acts) are payments, the binary code is paid-unpaid, and prices, which condition and programme payments, represent the language.

Overall, the logic of the functioning of the different systems is such that it has the character of a narrowed, one-sided view based on a highly specialised binary code through which operations in the system concerned are controlled. On the basis of its own observations, each partial system creates its own picture of society (what the legal system observes, for example, is nothing other than society, but society seen through the application of the distinction law-lawlessness). As a result of their accepted binary schematisations, therefore, the individual systems can only see what these schematisations allow them to see, and not what they do not. The unified picture of society fragments into these partial observations and, instead of a centrally conceived world, a multicentric world emerges (Luhmann 1984: 284).

From the perspective of Luhmann's systems theory we can look at nature, for example, as physical, chemical and biological systems and connections, the existence of which is a precondition for the functioning of the societal system. Luhmann links the way in which the different social subsystems are able to perceive ecological threat and risk with the expression "resonance", and comes to the conclusion that the problem of contemporary functional differentiation is that what is taking place in surrounding systems has too little resonance. If in the economic system the processing of information is bound to prices, it means that everything is "filtered" by this language and that the economy cannot react to breakdowns that cannot be expressed in this language. This limitation is not necessarily just a disadvantage, for it guarantees that if a problem is expressed in prices then it will be processed in the system (Luhmann

1986: 122an.). Just as the economy sees the surrounding world selectively - through its own codes and programmes - so too do the other partial systems. As a result, all kinds of interactive effects may arise between the different subsystems, which may dampen the resonance but may also disproportionately increase it, and so cause all sorts of social breakdowns. Thus, paradoxically, there may be too much resonance created in the social system, as well as too little. Luhmann demonstrates that we cannot take for granted that the state of and changes in the environment will find adequate resonance in society.

Despite the self-referential communication closure of the different societal subsystems, it is not true to say that these subsystems operate only in their own worlds and independent of each other. On the contrary, all kinds of structural bonds (Koplungen) exist between them. At the same time, however, this self-referential closure means that for systems analysis, modern polycontextual society can no longer be represented as a substantially comprehensible unity (as was still the case with Parsons). According to Luhmann, the character of contemporary society is created by the existence alongside each other of a range of different subsystems, between which all kinds of structural bonds form, but to look for any overall systems integration of the whole societal system in the sense of the co-ordination or direction of this complex network from some controlling centre is an empty and unjustified exercise.

Luhmann's multicentric theory of the world surprisingly corresponds with the diagnosis of post-modern thinkers such as Jean-François Lyotard (1993), who is developing Wittgenstein's theory of language games (Sprachspiele). According to this theory, communication has effects within various kinds of discourse (religion, arts, science etc.), which are heterogeneous and mutually untranslatable. There are no universal rules determining which kind of discourse should have priority. It is a situation of radical plurality that cannot be understood and perceived on the grounds of one model.

The affinity between Luhmann's theory and postmodernism is affirmed by Zygmunt Bauman (1995: 20), who points out the need to revise our understanding of the way in which various elements of human community, diverse activities and life processes, and various regulative ideas, conceptions and perceptions interlock with one another and by which they enter into interaction and co-operative relationships. Bauman considers it necessary to admit that "systemness" does not rest on the mutual balancing and adjustment of system elements, on the creation of formulas of levelling and, in effect, the elimination of all departures from those formulas, but that it is more likely created as a kaleidoscopic picture

based on the game of antagonism, strain and ambivalence, arguing and disputes, understanding and misunderstanding. Thus the indefiniteness and ambiguity of communicating elements is not a manifestation of the system's illness but the condition for its vitality.

Luhmann's analysis presents contemporary society as a whole differentiated into functionally dependent but autonomous partial systems that represent surrounding worlds for each other. This logically raises the question of the existence or non-existence of possible unifying forces or integrating mechanisms.

The concept of the division of labour dominated the history of the system approach from Emil Durkheim to Talcott Parsons. According to this tradition, different areas co-operate in a common whole, rather like different departments co-operate in a company. If a major deviation or breakdown occurs in one of the co-operating parts, the central regulating mechanisms (whether consciously or, as it were, instinctually) try to remove the fault and re-establish proportional mutual co-operation between the individual parts. Luhmann, however, sees this problem in a rather different light. He comes to the conclusion that "a functionally differentiated society operates without a top and without a centre" (Luhmann 1997: 802). Each subsystem has a tendency toward self-realisation, combined with a certain "indifference" to what is taking place in the surrounding systems (for example, the economic system is orientated towards the economic view regardless of whether it is valuable to it, or beneficial from the point of view of art, health or family).

Here, the question logically arises of how social order is possible in conditions where there can be no reliance on general social "solidarity", no shared goal of action, and no inter-system consensus. The German sociologists Georg Kneer and Armin Nassehi (1993) interpret Luhmann's standpoint simply as the assumption that order arises spontaneously through social systems operating within the boundaries that they have created. In other words, the different operations of different systems align themselves in relation to each other and so order is automatically constructed without any shared perspectives or agreement on common goals, norm or values being necessary. The fact that order comes into being spontaneously does not, however, mean that it is problem-free. Functional differentiation does not mean that the different parts of society no longer have anything to do with each other, but more that they find themselves in a tense relationship (Pongs 2000: 172).

Conclusions of this kind offer practically no hope of finding an approach to the self-reference of the societal system as a whole, but even today there are theorists who have not given up the enterprise. For many

years, the German sociologist Richard Münch has been formulating his
own system theory (1991) in opposition to Luhmann's. Unlike Luhmann,
he admits the possibility of the mutuality of the subsystems and develops
the idea of their intersection. Münch believes that the possibility of solving
the problem of their "co-ordination" can be found precisely in the zones of
interpenetration of these systems. For Luhmann, this possibility is out of
the question because, as a result of the differentiation of codes and
programmes, the individual systems essentially cannot understand or
"grasp" each other.

A path away from Luhmann's theory but different to Münch's has been
advanced by Helmut Willke, who has tried in a striking way to modify
earlier ideas on the leading role of the political system. Willke (1997) does
not speak of the necessity of integration, but of the need for "supervision".
For Wilke, contemporary society is above all a "knowledge society"
(Pongs 2000: 243–262) and a society of processes of globalisation. In line
with the conclusions of Luhmann's analysis, Wilke argues that society has
lost its ordinary form of unity and become a "polycentric" society. For
these reasons it does not require integration but "supervision". Wilke has
developed his own concept of supervision, in critical confrontation with
the way in which the term is understood and employed in society. He
argues that supervision should not be narrowed in meaning to checking,
auditing, overseeing or consulting, even though all these elements are
contained within it. It is not just some repetition or strengthening of
managing processes, and neither is it some pure reflexive inspection of
these. Wilke associates supervision with what is known as the
management of context; he argues that supervision assumes a supervisor,
who has "additional perspectives of a second order" (Willke 1997: 42).
The supervisor must be capable of taking the position of an observer of
second degree (an observer of observers), from which he can see the
criteria by which the observed systems observe themselves, and at the
same time, he must know how to render visible that which systems, as a
result of the way in which they select their information, cannot rather than
will not see.

Wilke believes that supervision as a particular regime of management
corresponds to the current historical epoch of the creation of a knowledge
society. He assigns the role of supervision to politics and the role of
supervisor to the state as a political system. This is not, however,
something automatic and to be taken for granted: the state should
gradually develop its capacities for the role of supervisor and politics must
learn how to operate in contemporary polycentric and decentralised
society. As Wilke says, supervision by the state should not be something

"coercive" towards its surroundings, but must respect the inner structure of the surrounding systems.

In its capacity to highlight certain problems, the analysis of the functional differentiation of contemporary society has proved an inspiration to sociological thought even outside the systems paradigm. One example is Ulrich Beck, who has set this theme in the context of the concept of the risk society. Among the problems that attract Beck's attention is what he calls "organised irresponsibility" (organisierte Unverantwortlichkeit (Beck 1988: 96-112)). He argues that the roots of this phenomenon lie precisely in the differentiation of the social system into relatively autonomous subsystems with their own closed codes of communication. In Beck's view, what is fatal is above all that the three key subsystems - science, the economy, and politics - are mutually cut off from each other in terms of communication and unable to work together effectively. Actors, who think, decide and act only within the intentions of one particular system, cannot and will not accept responsibility for the results of their actions and decisions outside "their" subsystem. Despite the rationality and organised quality peculiar to these individual systems, and despite all best efforts, a sense of insecurity and loss of control has been growing.

The risks of modernisation cannot be put down only to science, or to economics or politics: they belong to all these subsystems at the same time, and are "co-productions" of the lack of communication and co-ordination. Beck believes that the systems crisis and its solution require social subsystems to be able to work as both autonomous and co-ordinated subsystems. What is needed is the ability to see and tackle problems from a perspective transcending the individual subsystems and so to get over the state of organised irresponsibility. To achieve this goal a new orientation is needed, one which Beck characterises as "specialisation in connections" (Beck 2004: 295-297). This new orientation can only be reached by overcoming the narrow self-definitions of science, economics and politics.

The problem of co-operation and communication does not, however, relate only to relations between social subsystems. We meet something similar even within the internally much differentiated system of science. With the progressive differentiation of the separate scientific disciplines there has been a huge increase in specialised findings, which science is often incapable of putting together as a basis for understanding risk as a poly-causal, multi-factorial phenomenon. Research in the field of risk is often associated with competitive clashes between different scientific progressions. At the same time, a kind of pluralism of supply arises in the interpretation of the problems investigated, which means that every