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Towards a complex-figurational socio-linguistics: Some contributions from physics, ecology and the sciences of complexity

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Abstract

As figurational sociologists and sociolinguists, we need to know that we currently find support from other fields in our efforts to construct a sociocultural science focused on interdependencies and processes, creating a multidimensional picture of human beings, one in which the brain and its mental and emotional processes are properly recognized. The paradigmatic revolutions in 20th-century physics, the contributions made by biology to our understanding of living beings, the conceptual constructions built around the theories of systems, self-organization and complexity, all these implore that we reflect on social sciences paradigms in the light of the great changes in these other disciplines. The application of metaphors or theoretical images of complexity and figurational sociology in understanding language and socio-communication phenomena is of great use, since language is not an 'object', but a 'complex'; it exists simultaneously in and among different domains. 'Languaging' and interaction are co-phenomena. The former exists within the latter, and the latter within the former. By visualizing, for instance, the different levels of linguistic structure not as separate entities but rather as united and integrated within the same theoretical frame, by seeing their functional interdependencies, by situating them in a greater multidimensionality that includes what for a long time was considered 'external' – the individual and his or her mind-brain, the sociocultural system, the physical world, etc. – and expanding in this way our classical view, we should be able to make important, if not essential, theoretical and practical advances.

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> [W]e must constantly reflect not only on the observations we make on the empirical level, but also on the forms of thinking we use to cope with what we observe. (Norbert Elias[1])

Introduction

In recent decades, I have focused on the objective of laying some theoretical foundations for a general sociolinguistics that is able to take into account phenomena occurring fundamentally in settings of language diversity and contact (see Bastardas, 1996, 2013a). On this journey, I have found many conceptual links between the contributions of a number of physicists and ecologists, thinkers engaged in the development of what have been called the 'sciences of complexity', and the work of Norbert Elias. I think that drawing such transversal inspiration is good, because it enables us to lever the conceptual creativity and modelling of other sciences to make progress in all fields. Although we must be careful not to apply ideas and imagery from one science to another directly or uncritically, there is certainly room for inter- and transdisciplinary collaboration that can be important and profitable.

Other scholars have had a journey similar to my own in other fields (Stacey, 2007; Mowles, Stacey and Griffin, 2008, for example) and have found it worthwhile to borrow ideas, concepts and models from thinkers who have spoken from ecological, holistic and complexity-oriented perspectives. Although Norbert Elias often cautioned against uncritically following or imitating ideas and methods borrowed from disciplines focused on lower levels of integration (1998a), being alert to conceptual and methodological developments in other fields – as in fact he himself was[2] – may prove not useless, but instead enriching to the field of sociology, offering constructive assertions and suggestions.

I can say that the ideas of Norbert Elias have been extraordinarily useful to me, but I have also enjoyed mixing them and supplementing them with other ideas arising out of the traditions of physicist-philosophers, ecologists and scholars with complexity perspectives. As figurational sociologists and sociolinguists, we need to know that we currently find support from other fields in our efforts to construct a sociocultural science focused on interdependencies and processes, creating a multidimensional picture of human beings, and one in which the brain and its mental and emotional processes are properly recognized. Therefore, it is probably wise to attempt a practicable synthesis and to take advantage of the progress made by each and every one of them, if we are to gain a greater understanding of the sociocultural processes of human beings.

This article explores a number of such similarities and analogies in the fields of theoretical physics, ecology and the sciences of complexity in order to strengthen the foundations of Norbert Elias's sociological approach and especially their application to the field of sociolinguistic phenomena.

Basics

> Multidimensional models of human societies are needed in order to come to grips with the empirical evidence. The difficulty is that social scientists and sociologists in particular are still captives of a philosophical science theory which started with Descartes and took its cue from physics at that early stage of development . . . Theoretical models of the type we call universal laws or generalizations were sufficient and sufficiently reality-congruent to serve the requirements of physicists at that stage . . . But for some time now they have been supplemented even in the physical sciences themselves by theoretical models which, unlike laws, are multidimensional and which make it possible to handle experimentally data about objects such as large molecules, genes and chromosomes with several levels of integration acting and reacting upon each other. (Elias, 1991a: 142)

These initial words of Norbert Elias reflect a problem that sociology has faced throughout its history. As empirical, rigorous knowledge, sociology was obliged to follow the procedures considered 'scientific' by the disciplines that had gone furthest in the understanding of their phenomena – physics, for example – even though at the same time the facts that sociology had to engage with occurred in rather higher, more complex dimensions than physical events. The theorizations that won through in the material sciences were taken as the fundamental model for advancing towards an understanding of sociocultural phenomena. And in fact this old mechanicist and relatively static gaze has been dominant in many segments of the human sciences.

Nonetheless, current critical traditions that, without rejecting the need for rigorous and methodologically proven knowledge, contended that the explanation of human phenomena had to progress along different paths, like the one pursued by Elias, did not give up. Today they find clear support in the physico-chemical sciences themselves and also in bio-ecological approaches, or in the more recent developments in the perspectives of 'complexity'. In fact Norbert Elias was a clear forerunner of these approaches and his figurational sociology is fully relevant today, and it finds full support in the general developments of the sciences of the other levels of existence and in the ones devoted to transdisciplinary matters. So while we used to say that the social sciences were moving towards the concepts and practices of the material sciences, today it is the material sciences that are approaching the visions and conceptualizations of figurational and processual sociology.

Some ideas from the epistemology of physics

Since Einstein's presentation of the theory of general relativity and its later confirmation – which raised such fundamental questions about the enduring validity of the traditional, tried and tested theory of Newton – science could no longer claim to offer an unassailable explanation of the configuration of reality. Two theories could both be empirically confirmed. The theories and models of scientists were now *attempts* to reflect reality – but not reality itself. Indeed, for Einstein, concepts and theoretical laws were *fictitious* in character (1986: 157). The state of provisionality and the potential for new theoretical

proposals even in domains, like physics, in which explanations had been accepted and proven, is now part and parcel of the scientific world.

The story of Einstein's theoretical challenge to Newton led to a reassessment and a new awareness of the role of the individual in science. Theoretical physics could make us reflect on the conscious subject. The observer-participant – to use the terminology of traditional qualitative research – is the starting point of any knowledge. After the Einsteinian revolution, the physical sciences incorporated the observer in their theories: they insisted that the observer forms part of the system.[3] That is to say, there is no knowledge without human beings, and more specifically there is no knowledge without the human brain/mind.

This may seem obvious today; but, at a certain stage in its development, 'science' had become so reified that we had all but forgotten the basis that made possible the existence of knowledge: human beings. We tended to see only the exterior nature of what we had learnt, and neglected the nature that made possible – and to a large extent determined – this learning. So in much of the mainstream social sciences that had most claimed to be 'scientific' in the traditional manner of the physical sciences, the problem of the observer was ignored. If physics takes account of the brain/mind, how can we ignore it in the sciences of social and cultural behaviour, in which two minds, or sets of minds, intervene – that of the individual who researches, and those of the individuals who are studied?

I say this because I am interested in the attempts by theoretical physicists to research new forms of *perceiving* the world, in the conviction that the most current method of analysing the various component parts of the world in isolation and stasis was not the most appropriate (see Bohm, 1980; Capra, 1982, 1996; Prigogine and Stengers, 1992, 1996; Gell-Mann, 1994).

The search for the best model for understanding the relations between the 'whole' and the 'parts' of reality reflects one of today's great scientific debates. Many authors are aware of the need to go beyond the traditional scientific approach based on analysis – that is, based on the breakdown of the data and the search for the *ultimate* components of phenomena – and to move towards more holistic images (e.g. Capra, 1982, 2003). These two modes of thought appear to be rather characteristic of two civilizations that have traditionally been in opposition: the western mode, more analytical and reductionist; and the eastern mode, based on global, integrated thought (think, for example, of Chinese medicine). It is no surprise then that some contemporary theoretical physicists have turned to eastern philosophies in their search for models of reality, leaving behind the traditional reductionist vision (see Capra, 1975).

For the physicist David Bohm, the metaphor of the hologram – in which each of its parts contains information about the whole object[4] – is also illustrative of this way of seeing the world more fruitfully. Bohm (1980) distinguishes between seeking to understand reality via an 'explicate' or an 'implicate' order. Seen from the first perspective things are unfolded and are found only in their own particular regions of space and time, and outside, therefore, of the regions to which other things belong. The elements are represented as being outside those of the others, separate and independent. By contrast, in the 'implicate' order, as in the hologram, 'everything is enfolded into everything', the interdependencies and integrations are the foundation of reality, and the universe is seen as an 'undivided whole in flowing movement'.

Ecological thinking

One of the aspects on which there appears to be most consensus in the new perspectives is, as I said, in the need to do away with the conception of objects of reality as entities that are isolated and described inwards, internally. The new vision emphasizes the importance of the study of the *contexts* of objects and phenomena, that is, of their external relations. So, for example, in physics, 'the atom emerges as a new object, an organized object or system whose explanation can no longer be found only in the nature of its constituent elements, but is found as well in its organizational and systemic nature, which itself transforms the characters of the components'[5] (Morin, 1977: 98).

The step to be taken, then, is towards a conception of the elements of reality – and, in particular, of living elements – as open systems in constant interaction with the ecosystem of which they are part (Allen and Hoekstra, 2014). The 'unit of survival is the organism plus its surroundings', said Bateson (1972: 483). The old linear causality is replaced by a circular, retroactive and non-linear one. Also interesting is the vision of models of systemic, multi-level interrelation in which each subsystem is a relatively autonomous unit, even though it is a component of a larger entity (Von Bertalanffy, 1981; Margalef, 1981, 1991). So this is an *ecologization* of thought that is aware of the involvement of the mind: 'any object of observation or study must from now on be conceived as a function of its organization, its environment, its observer'[6] (Morin, 1977: 379).

Indeed, this is Morin's proposal when he completes with the 'eco' prefix the concept of 'self-organization', the latter having been created to provide an awareness of the development of human beings and to transcend the theory of organization implicitly present in early cybernetics and information theory (see Wiener, 1948). If the idea of 'self-organization' emphasizes the individuality and autonomy of living systems, we discover in turn its weakness as it separates the self-organizing system from its environment; meanwhile more autonomous, living systems are at the same time more dependent on their environment. They need food, matter/energy, but also information, order. The environment is in their interior. It cannot be a 'closed' system but rather an 'open' one since 'it can only be totally logical by introducing into itself the foreign environment. It cannot complete itself, it cannot close itself, it cannot be self-sufficient'[7] (Morin, 1992: 46).

In fact, this 'ecologization' of thinking, this consideration of the contexts of phenomena in an integrated manner with the phenomena themselves, is a challenge for all human sciences (see the Gulbenkian Commission, 1996). Sociologies – and even psychologies – without the mind, psychologies without society/culture, economies without human beings and the environment, medicines without emotions or feelings, etc., have dominated most of the paradigms of the 20th century. We should quickly abandon the conception of *homo clausus* in favour of *homines aperti*, substituting it, as Norbert Elias says, for that of an 'individual fundamentally in relation to a world, to what is not himself or herself, to other objects and particularly to other human beings'[8] (1991b: 111).

However, this 'ecologization' of thought must be well understood, because there is a very great risk of its superficial and erroneous translation. On this matter, Norbert Elias is clear:

> We talk of the person and his environment, a child and his family, the individual and society, the subject and objects without always realizing that the person also forms a part of his 'environment', the child is a part of his family, the individual is a part of society, the subject is part of the objects . . . But our language and our concepts are largely set up as if everything that is outside of the individual person had the character of static objects. Concepts like 'family' or 'school' typically refer to a group of people. But our usual kinds of terminological and conceptual configurations make them sound as if they were objects of the same nature as rocks, trees or houses.[9] (Elias, 1982: 14)

In the case of sociocultural facts, Norbert Elias proposes in his figurational sociology that we do not think in terms of 'human beings and their environment' or the 'social framework', but in terms of configurations constituted by groups of individuals (with oneself among them): 'Nobody would think to define the process of a game involving a player as the player's "environment" or "milieu" or "framework"'[10] (Elias, 1982: 115). Morin concurs; based on his recursive thinking, in which the products and their effects are necessary for their own production, he says: 'Individuals are not in society as in a box. There are interactions among individuals that produce society, which never exist without the individuals . . . [W]e produce a society that produces us. We are part of the society that is part of us'[11] (Morin, 1994: 304–5). Our task here is to change our habitual images and develop visions that are closer to what actually occurs in reality.

Time and processuality

The static image of reality has also been challenged. Against the traditional approach, time is an essential, continually present variable. Apparent stability is always the result of a dynamic equilibrium that allows the conservation of the identity of the units even if their elements are changed. More than as a structure, reality should be seen as a set of events, or, to quote Bohm, 'in terms of universal flux of events and processes' (1980: 12).

In fact the (re)incorporation of time is essential for the accurate comprehension of all sociocultural phenomena. From the field of sociology, Norbert Elias is quite emphatic: 'If data observable only as changing, as happening in a condition of flux, are presented in scientific symbolization as totally unalterable, as wholly non-processual, one is usually confronted with phantom problems which admit of no solution' (1991a: 99). Elias is clearly opposed to a basically 'synchronic' theorization of reality in terms of states without origin or movement. He is against what he calls *process-reduction* (1982). This view concurs with that of David Bohm, who took issue with the excessively noun-based orientation that characterizes western languages and proposed a language – the *rheomode* – to enable us to think of reality as flowing (1980).

In fact, we urgently need to shift from a science 'of nouns' to one 'of verbs' or processes ('languaging', 'bilingualization', 'identitying', etc.; cf. Maturana, 1988; Arthur, 2013). By using forms of motion, we not only help our brain/mind to escape from its 'conservative' furrows and open ourselves up to a more creative conceptualization, but we also draw much nearer to the 'truth' of the characteristics of the observed facts, which are certainly the product of ceaseless interaction among real agents and elements.

Bohm goes on to say that 'relativity and quantum theory agree in that they both imply the need to look on the world as an *undivided whole*, in which all parts of the universe, including the observer and his instruments, merge and unite in one totality' (1980: 13). Seen in this light,

> . . . each relatively autonomous and stable structure (e.g. an atomic particle) is to be understood not as something independently and permanently existent, but rather as a product that has been formed in the whole flowing movement and that will ultimately dissolve back into this movement. How it forms and maintains itself, then, depends on its place and function within the whole. (1980: 17)

I consider the ideas of Bohm to be of great interest for sociology and communication sciences. His metaphor for seeing reality as 'a flowing stream, whose substance is never the same' is perfectly suited, for example, to a dynamic conceptualization of linguistic and communicative codes in general. Linguistic structures live, therefore, in this incessant flow, just as do the socio-meanings that adhere to them, changing and innovating in accordance with the vicissitudes of the general sociocultural current of the people. Our challenge, therefore, is to go beyond prevailing perspectives that are more static than dynamic, and to incorporate all the contributions and to imagine a new conceptualization that takes into account the flowing dynamicity of all phenomena.

With Elias, we concur that the need is to 'force the individual out of the isolation of his thinking and integrate him into a conceptual model that inscribes him within the succession of the generations' (Elias, 1991b: 125). Through our studies, we need to define the dynamics that, over time, affect the production of social meanings, to identify which social meanings are produced and to determine how and why this is so. To grasp these factors, we must move toward an understanding of 'the problems concerning the structure of unplanned social processes' and of 'the diachronic organization of succession, that is, of long-term social processes involving organization *sui generis*' (ibid.: 126). Only in this way will we gain an understanding of the diachronic sociocultural phenomena, invigorating the field's concepts and grappling with the complex interrelationships between given situations and historical processes.

Complexity perspectives and transdisciplinarity

In parallel, although originating from different fields and distinct lines of research, several authors have been constructing a perspective that has come to be known as the 'theory' or 'science(s)' of complexity' (Morin, 1980, 1991, 1992, 1999, 2001; Wagensberg, 1985; Gell-Mann, 1994; Heylighen, Cilliers and Gershenson, 2007; Gershenson, 2008; Castellani and Hafferty, 2009; Jörg, 2011; Wells, 2013; and others), perhaps the most appropriate name from those currently available,[12] which could include among others 'ecology' (Margalef, 1991; Allen and Hoekstra, 2014), 'systemics' (Von Bertalanffy, 1981), 'emergentism' (Holland, 1998), or 'networks science' (Newman, Barabási and Watz, 2006; Solé, 2009), and also 'complex systems' (Holland, 1995; San Miguel *et al*., 2012).

The new paradigms that have been emerging question many of the assumptions that predominant sociology has maintained in its attempt at making sociocultural phenomena, considered from a general perspective, intelligible. The paradigmatic revolutions in 20th-century physics, the contributions made by biology to our understanding of living beings (Kauffman, 1993), the conceptual constructions built around the theories of systems, self-organization, chaos and complexity, these implore that we reflect on social sciences paradigms in the light of the great changes in the other disciplines.

Besides Elias, perhaps the author in the social sciences I find most thought-provoking in this regard is Edgar Morin, through his works on *La méthode* and on the 'complexity' perspective of human reality:

> There is complexity when the various components that make up a whole (be they economic, political, sociological, psychological, affective or mythological) are inseparable and there is an interwoven fabric that is interdependent, interactive and inter-retroactive between the parts and the whole, the whole and the parts. (Morin, 1999: 14)

Morin rejects the polarization between the analytical and global extremes and proposes a holistic perspective actively aware of the relative autonomy of the units within a whole, aiming thereby to 'distinguish without separating' and 'associate without identifying or reducing'[13] (1992: 23). Here, Elias fully concurs:

> [T]he relative autonomy of social processes is based on the constant intermeshing of the feelings, thoughts and actions of many individual people and groups of people, and on non-human natural processes. From this constant intertwinement there continually emerge long-term changes in the social existence of people, which no one has planned and probably no one has foreseen. (2009: 7)

Generally taken, the perspective afforded by the 'complexity' view should prove to be positive and of great assistance for a better linguistic and social sciences theorization in general as it breaks with (1) the idea that knowledge can exist without an observer or meaning without a signifier, (2) the fragmented and reductionist view of reality and its overly mechanistic models, (3) exclusively 'linear' models of causation, (4) the tendency to dichotomize categories of reality, (5) the Aristotelian principle of the excluded third (binary logic: if something is here it is not there), (6) the neglect of the mind in some of the more advanced levels of the social sciences, (7) the inadequate approach to the relationship between the whole and its parts, and (8) an understanding of creativity that is overly based on logic as opposed to the scientist's 'artistic' intuition and imagination (Bastardas-Boada, 2013b).

From this view the fragmentation into disciplines is questioned. As reality is multidimensional, an inter- and transdisciplinary focus is necessary – especially in the sociocultural sciences. The new conceptual landscapes must then allow the integration of perspectives of the different approaches in a global theorization which considers simultaneously all the necessary dimensions of human beings in an integrated, coordinated way.

What the complex perspective has done first is to absorb the advances already noted in other disciplines, primarily physics – e.g. relativity and quantum theory – and biological ecosystems. In addition, cybernetics and systems theory (Wiener, 1948; Von Bertalanffy, 1981), which have pointed the way toward new forms of thinking about and formulating interrelationships, have already had a fundamental influence on some of the most powerful lines being pursued in the sciences of complexity (see Heylighen, Rosseel and Demeyere, 1990; Heylighen, Cilliers and Gershenson, 2007).

The development and application of complex principles, principles that assist us in devising conceptions of the world that take into account the complexity of reality, have drawn on the contributions of a variety of thinkers and disciplines striving to respond to the challenges posed by the facts and processes in their own areas. While Norbert Elias did not use the label 'complexity', he may be looked upon as one of the major contributors to this perspective; his ideas are wholly connected to the complex spirit and he has applied them with extraordinary effectiveness to sociocultural and historical facts.

Starting from these assumptions, the complex perspective adopts a multidimensional, integrated and dynamic way of looking at reality: the world is made up of the 'emergent' overlaying of different elements that produce new properties or organizations as they become increasingly more complex at higher levels. And this can go on from the most basic physical and genetic elements to entire human societies and cultures.[14]

To gain an adequate understanding of the interwoven fabric created by these domains in motion, we need to move past reductionist thinking that gives priority to the elementary units and quantitative aspects of phenomena. And another, related danger lies in dichotomous thinking. As Elias cautioned, we need to avoid categorizing the world in terms of antithetical elements, when these elements are frequently complementary, gradual and interdependent, requiring 'and/both' rather than 'either/or' thinking, calling for the application of fuzzy logic (Munné, 2013) instead of Aristotelian logic. We should critically analyse the inherited words/concepts that we use to 'tell ourselves' the world, because they can very often imprison us cognitively and impede our ability to understand complex social phenomena. As we undertake this review, however, we, too, must be careful not to fall into the same trap of dichotomies, because complex thought is not just the 'opposite' of 'simple' thought. Rather, the former contains the latter. As Morin and Le Moigne have said, 'the paradigm of complexity requires us to reconnect things, while distinguishing them'[15] (1999: 265).

Computational and mathematical approaches to complexity

It is clear that the appearance and/or consolidation of these new theoretical perspectives must necessarily have ramifications at the more practical level of methodology. New tools for the conception, apprehension and treatment of the data of experience will need to be devised to complement existing ones and to enable us to make headway toward practices that better fit complex theories.

Thus, alongside this elaboration of perspectives of complexity that take a more epistemological and theoretical viewpoint, there has also arisen a set of contributions that similarly make use of the label of 'complexity' or 'complex systems' and take a more methodological, more formalist viewpoint. From this angle, the so-called 'sciences of complexity' have also contributed important innovations connected to the potential of software and the appearance of new forms of mathematical reasoning that better suit complex, dynamic phenomena characterized by mutual high interactivity and feedback emergence.

In recent decades, it is by and large statistical physicists, mathematicians, computer scientists and some biologists who have been the driving force behind important lines of research and thought dedicated to studying the properties, potentialities and formal characteristics of 'complex systems'. Based on modelling such systems and running computational simulations of the evolving dynamics, the 'synthetic' method – as it has been called by Luc Steels (Steels and Brooks, 1995) – offers us something different from what the inductive and deductive methods have so far given us. They offer us an opportunity to understand the genesis and unfolding of phenomena.

By imagining new ways of thinking about and (re)presenting the phenomena of reality (e.g. cellular automata, agent-based models, network theory, etc.), these scientists create computing procedures, such as the study of complex adaptive systems or CASs (Holland, 1995), in order to pull out the general principles of this type of organization, which can be found, for example, in cities and in ecologies, in immunological and neural systems, and in the phenomena of language. They focus on simulating complex processes with programs based on agents whose behaviour is governed by simple rules formulated according to 'if stimulus, then response' (cf. Castelló, Vázquez *et al*., 2011). CASs can also learn from their relationships with the context in order to adapt better to it (more adequately using the environment to gain the maximum benefit for their own ends). This enables us to follow and better understand the formation of the 'wholes' produced by their interrelationships.

These types of activities are of utmost importance for the advancement of complex perspectives, because they enable us to go beyond the merely theoretical toward explicit, rule-based formulations using simulated but 'real' data for processes that are extremely difficult to unravel and clarify precisely because of their complex nature. In this way, modelling can 'materialize' the relationship between the activities of agents and the rules they follow, the products of their mutual (inter)actions, and the organizational forms that result from their activity.

If we look carefully, we can see that all of this is not far from the theoretical approaches to sociological facts proposed by Norbert Elias. The originator of figurational sociology urged us to distinguish between the individual intentions of human beings in carrying out their actions and the collective results of these actions in society, which were facts that would exhibit their own autonomous dynamics (such as, for example, the distinction between our intention to leave for holiday – all of us – on the same day and the specific 'forms' and dynamics presented by backed-up traffic on the highways). In Elias's 'figurations' or

'processual organizations', as in a dance, the resulting forms are, to some extent, independent of the specific individuals that sustain them in a given circumstance. This is why we can find such forms in other places and at other times, following the same or similar rules and processes of formation, much as the formalizations of network theory can help us to understand a variety of systems or figurations with different protagonists.

It is precisely 'network theory', to which researchers such as Barabási (2005) and Solé (2009) have made contributions, that presents one of the most interesting theoretical-methodological examples. Their formulations have resulted in enhanced tools for the representation and mathematical treatment of interconnections at distinct levels of reality. As a result, these tools have been applicable to a variety of disciplines. In the field of sociocultural and communication sciences, however, this contribution may yet be in an excessively one-dimensional state, given that greater stress is being put on the 'internal' interactions of a system than on what happens between the system and its other systems or environments. As proof of this, we now have access to 'big data' to represent and study certain characteristics of a phenomenon – for example, Internet connections between many corners of the globe – and yet we have very little knowledge about what is actually going on. Why do certain connections exist and not others? What communication occurs across these connections and what influence does it exert on the real behaviours that may ensue? What relationships do these points of connection maintain with the socio-political and economic ecosystems with which they co-inter-exist? And so on and so forth. There is much scope here yet for advancement.

Indeed, network theory could be 'ecologized' more in order to include the interrelated multidimensionality of reality. This is what probably lies behind the addition of 'adaptive' to the phrase 'complex systems' in the terminology of 'complex adaptive systems' (CAS), which has been popularized by the Santa Fe Institute, in New Mexico. According to Levin (2010), the Santa Fe Institute has rechristened the ecological perspective and made headway by offering new and significant conceptual and methodological proposals. The change of name has also been positive by enabling us to jettison the overly 'biologizing' resonance of the term 'ecology'. 'Complex adaptive systems' has a much wider range of association and application, which may be beneficial for its expansion into a far broader array of fields, such as economics, neurology and sociology. Certainly, researchers will produce new innovations to pave the way for yet more progress to be made.

New complex mathematical and computational contributions have continued to grow in number, thanks primarily to scholars in statistical physics and computer science, such as Stephen Wolfram (2002), for example, who are now taking an interest in social and economic phenomena (cf. Epstein and Axtell, 1997; Ball, 2005; Epstein, 2006). Drawing on analogies involving the study of systems that arise from the interaction of given agents and their rules in physics and in other disciplines, there is a rising number of contributions seeking to apply the new computational possibilities to our understanding of human social phenomena. This has also reached certain aspects of linguistics, such as the evolution of language, evolutionary contact and change.[16]

Especially in the field of sociolinguistics we do find valuable contributions that need to be understood and evaluated seriously.[17] To date, the studies have been based fundamentally on the use of computational techniques known as cellular automata and multi-agent models. Building on the complex ideas of self-organization and emergence, these models of complex systems have attempted to simulate and dynamically display on-screen the organizational results produced by the interactions among their 'agents',[18] such as, for example, the greater or lesser degree of use of a language relative to another language with which it is in contact (cf. Abrams and Strogatz, 2003). To achieve this aim, they have sought to identify the parameters that they believe may be more explanatory, such as the 'prestige' of languages and the 'volatility' (or the propensity of a speaker to switch language), and they simulate the evolution of the encounter between two groups, while also adding or not adding bilingual individuals (cf. Castelló, 2010; Castelló *et al*., 2007; Castelló, Loureiro-Porto and San Miguel, 2013). By controlling the degree of each of the parameters, we can see the evolutionary changes caused by any variations in these magnitudes. This can help us to understand better the factors determining how the encounter will develop.[19]

Socio/linguistics from a complex-figurational view

The application of metaphors or theoretical images of complexity and figurational sociology in understanding language and socio-communication phenomena is of great use. By visualizing, for instance, the different levels of linguistic structure not as separate entities but rather as united and integrated within the same theoretical frame, by seeing their functional interdependencies, by situating them in a greater multidimensionality that includes what for a long time was considered 'external' – the individual and her or his mind-brain, the sociocultural system, the physical world, etc. – and expanding in this way our classical view, we should be able to make important, if not essential, theoretical and practical advances.

It is from this multidimensional, ecologically integrated point of view that I feel we should formulate a unifying paradigm that can bring together not only the various research lines of contact sociolinguistics, but those of linguistics in the strict sense and those of psycholinguistics as well. Starting from the tripartite conception proposed by Morin (1991: 121) – the *psychosphere* relative to individual brains/minds, the *sociosphere* relating to the cultural products and the interactions of the brains/minds, and the *noosphere* which embraces language, knowledge and logical and paradigmatic rules – it should be possible, even preserving the necessary degree of autonomy, to progress towards a theoretical unification of what we have traditionally termed linguistics, psycholinguistics and sociolinguistics/pragmatics (see Bastardas, 1995a, 1995b). Elias (1991a: 12), like Morin, underscores the inseparability of the process: 'Languages, thoughts, memories and all the other aspects of knowledge complexes are not . . . either individual or social. They are always . . . potentially and actually both, social and individual at the same time.'

Below is a synthesis of my proposal for building a complex-figurational approach to social science and to general sociolinguistics in particular:

Table 1. Building a complex-figurational approach.

Traditional perspective	Complex-figurational perspective
conceptual reification	there is no science without an observer (centrality of brain/mind)
territory	maps (we see by means of concepts and words)
scientific truth	provisional theories
elements	elements-and-contexts, interweaving, figurations, interdependences, networks
objects	events and processes
steady state	dynamic flux, change, evolution, development
classical logic	fuzzy logic
linear causality	circular, retroactive and non-linear causality
either/or dichotomies	and/both; integration and complementarity
planned creation	self-organization and emergence
unidimensionality	inter-influential multidimensionality
'explicate order' (things are unfolded and each thing lies only in its own particular region of space)	'implicate order' (everything is folded into everything; a hologram: the parts contain information on the entire object)
fragmentation of disciplines	inter- and transdisciplinarity
structure, code	meaningful and emotional interaction

This approach would allow us to progress towards the resolution of unresolved or unclearly presented aspects such as the *locus* of language, the place of the individual in linguistic theory, the signification of forms, the relation of verbal and non-verbal elements, the phenomenon of intercomprehension, linguistic behaviour, the interrelation of language, the individual and society, social symbols, and the process of development.

As for more specifically sociolinguistic problems, the new scientific paradigms are also extremely useful. Their complex, ecological and figurational focus enables us to study the forms and systems of linguistic communication in their macro-micro-sociocultural context and to understand their determinations and dynamics. We can thus conceive language contact, for example, from the metaphorical perspective of the relation between the organism and the ecosystem and see the phenomenon as a process in which the organism can make changes, either in its own behaviour or in the sociocultural environment (Bastardas, 1996). It can adapt to the context or adapt the context to itself (Bateson, 1972: 445). For example, in the case of language use, adaptation to an extremely inhospitable context may lead to language shift and extinction. On the other hand, human beings who decide to transform the context to their own advantage, are setting in motion the macro-processes of reversing language shift, the success of which will depend on the degree of change that can be achieved in the environment (see Bastardas, 1995c).

Another complementary alternative is to conceive language phenomena as a dance, as Elias proposes:

> One can certainly speak of a dance in general, but no one will imagine a dance as a structure outside the individual or as a mere abstraction. The same dance figurations can certainly be danced by different people; but without a plurality of reciprocally oriented and dependent

> individuals, there is no dance. Like every other social figuration, a dance figuration is relatively independent of the specific individuals forming it here and now, but not of individuals as such. It would be absurd to say that dances are mental constructions abstracted from observations of individuals considered separately . . . Just as the small dance figurations change –becoming now slower, now quicker – so too, gradually or more suddenly, do the large figurations we call societies. (1998a: 137)

The same occurs in languages. Language is not an 'object', but a 'complex' (Vilarroya, 2002); it exists simultaneously *in* and *among* different domains (McGilchrist, 2009).

This is why in sociolinguistics we have moved toward the use of perspectives and metaphors related to figurational sociology, ecological complexity and complex adaptive systems, trying to grasp the interdependencies among the different levels of organization potentially involved in determining language behaviours (Bastardas, 1996, 2013a; Junyent, 1992; Ellis and Larsen-Freeman, 2009; Beckner *et al*., 2009). The brain/mind, habits at the level of interactions, demographic and social groupings, the media and political power, all interact constantly with language forms and codes through the pressures and social meanings felt by the individuals (Terborg and García-Landa, 2013).

Social meanings, which are extra-grammatical in nature, arise out of the diversity of 'ways in which we as human beings tell things',[20] and they thereby constitute one of the essential facts of sociolinguistics. Meaning comes not only out of pure linguistic structure in the traditional grammatical sense or out of the basic information that this evokes, but also out of the differences between one form and any other alternative forms for saying the same thing that exists simultaneously in the minds of individuals-in-society.

To the extent that, within a single human society or community, the same grammatical and lexical meaning can be expressed through other forms that differ in part – for example, phonetically – or in full – because the forms belong to entirely distinct language systems – social meanings can emerge in relation to the human groups that use a given mode to express themselves. As a result, speakers will select linguistic forms and make decisions about communicative behaviours in accordance with the social interpretation that they presume will be made of their communicative acts. For example, in societies where there are different languages, speaking in this or that language can be felt as significant by the interlocutors, much as the concurrence of distinct regional or social dialects can be judged differently by speakers.

From this approach, language is not a set of compulsive acts of no social meaning, carried out by individuals/automata programmed through socialization, but rather a significant subset of human actions that can be consciously controlled by individuals and yet, at the same time, can be routinized and carried into the subconscious until further notice, once they are demonstrated to be functional and relevant. Language forms and behaviours, thus, can signify in two ways: as classic 'information' conventions; and as actions that can be interpreted as revealing a speaker's state of mind, appraisal of interpersonal relationships, group origins, social position, level of culture, political leanings, etc. The potential of forms to convey social meanings comes from how they differ from other forms in use at each of these levels.

From the perspective of complex systems, modelling has also brought us nearer to the essential formal elements of processes and to the expression of their interweaving, as we

saw, for example, in the simulations of bilingualization and language shift dynamics (Beltran *et al*., 2011; Castelló, Loureiro-Porto and San Miguel, 2013). It seems, therefore, that human complexity must be seen as multi-methodological, insofar as necessary in combining quantitative-computation methodologies and more qualitative methodologies aimed at understanding the mental and emotional world of people (Roggero, 2008). The epistemic foundations of complex theory, set on gaining a deeper understanding of the world, seem to put this as a clear demand (Solana Ruiz, 2011). So do human facts, with their peculiarities and their differences in relation to the dynamics that occur at hierarchically 'inferior' levels of organization in the universe (cf. Malaina, 2012).

Therefore, we need to have a critical eye and ask to what extent these transdisciplinary computational models, probably valid for other phenomena, are also the most appropriate for an understanding of shifting human phenomena. Their utility – which is based primarily on the simplified representation of human beings as 'agents' with little autonomous, creative, cognitive-emotional activity – may be limited if we want to grasp not only the possible evolutions of a situation with 'stably' defined rules, but also, as a whole, the causal dynamics that have given rise to and determined the social meaningful actions of its units.[21]

Closing thoughts

Drawing on the ideas contributed by the new physics, ecology, complexity and processual sociology, the perspective adopted by sociolinguistics must inevitably be inter- and transdisciplinary. This is because sociolinguistics addresses a 'higher' level of reality, in the sense that it must, in complex ways, incorporate the other domains that exist simultaneously at the same sociocultural level as well as the pre-existing domains at 'lower' levels of human reality, such as the aspects belonging to the biological or psychological levels. Not only does sociolinguistics need to be mindful of the contributions of general sociology and other, more specialized sub-fields, but it must also attend to potentially interesting contributions from the fields of demography, social psychology, the psychobiology of development, the cognitive sciences, cultural anthropology, communication sciences, political science, economics, law, and any other fields that may have a bearing on the phenomenon of language. We exist in a society of minds and languages. In this respect, sociolinguistics, from a complex-figurational perspective, clearly stands at a crossroads where paths and perspectives must be woven together, and needs to be able to move effectively between these options depending on the questions that we are trying to answer.

The conceptual resources and tools currently at our disposal are, in all likelihood, not up to the task yet to be done. This is why we need to push towards new theoretical and methodological instruments able to help us better imagine and understand how the various aspects of sociocultural and linguistic events are dynamically interwoven.

The challenge lies before us. A complex-figurational vision of the socio-communicative facts, one that is both eco-co-dependent and processual, one that can be framed by the notion that languages exist in human societies/cultures and in brains/minds and that these, in turn, exist in languages – this is what will be able to help us significantly deepen our understanding. The aim, after all, is to advance as far as possible toward the objective marked out for us by Norbert Elias: 'the opening up of new levels of the universe requires

a new effort to study the different types of connections we encounter there and to develop not only new mathematical but also new non-mathematical forms of thinking to fit them' (Elias, 1998b: 143).

Notes

1. 'An interview in Amsterdam (1969). Interview with Johan Goudsblom', in Elias (2013: 160–71).
2. Elias was a fervent proponent and practitioner of broad interdisciplinary training for social scientists. For example, he bemoaned the fact that 'sociologists who have never studied medicine often speak of society without including in their discourse the biological aspects of human beings'. And he continued:

   > This seems to me a mistake . . . In my opinion, you cannot build a theory about human activity without grasping how the human body is put together and how it works . . . For my part, I decided to add a cross-section of the brain to my sociology courses to show students how humans are built, because this is the only way that they will understand how societies function. But I do not in any sense reduce sociology to biology. (1991b: 42–3)

   (All quotations from this book are free translations from French.) See also Elias (1990).
3. Heisenberg stated that the 'natural laws that are formulated mathematically in quantum theory do not refer to elementary particles per se, but to our knowledge of these particles . . . Natural science always presupposes man' (1985: 14; free translation from Spanish).
4. In the hologram, unlike a normal photograph, each section contains information of the whole of the object, so that if we were to light up only one part we would still obtain an image of the whole (see Bohm and Peat, 1989: 175).
5. Free translation from French.
6. Free translation from French.
7. Free translation from French.
8. Free translation from French.
9. Free translation from Spanish.
10. Free translation from Spanish.
11. Free translation from French.
12. The terms 'complex' and 'complexity' do not appear to have been chosen at random. Their Latin etymology – *complexus* [to weave, braid, or entwine] – indicates the frequent characteristic of phenomena at this level being formed of a series of interwoven elements that are interdependent in their operation.
13. Free translations from French.
14. In the same sense, see the stages of integration proposed by Elias (Dunning and Hughes, 2013: 55).
15. Free translation from French.
16. Mathematical or computer models can be useful in the formulation of concepts and in the consideration of properties of the social sphere that are intrinsically linked to its character as a complex dynamic system. From this perspective, the objective is not to draw a realistic portrait of social systems, but rather to explore types of systems in which the relationships between the different levels of organization involved enable us to reflect on the different levels of organization that we identify within social systems. (Chavalarias, 2013: 186; free translation from Spanish)

17. The applications of computational and complex perspectives are also of great interest in the field of general linguistics, cognition and communication. See, for example, the works of Luc Steels, who starts from the belief that

> . . . the view that emerges . . . is that language can best be seen as a living system that is continuously evolving and adapting in a cultural process based on the distributed activity of its users. Consequently the computational investigations into genetic evolution, ant path formation, neural networks, and other biological systems are an important source of insight. (Steels, 2000: 24)

18. The use of computational simulations as a heuristic tool and in the production of theories is potentially of great interest. See Ihrig and Troitzsch (2013).
19. For more on the experience of 'playing' with this kind of tool, see @: http://www.ifisc.uib-csic.es/research/complex/APPLET_LANGDYN.html
20. As Pierre Bourdieu clearly put it, 'inevitably, linguistic practice communicates not just the information stated, but also information on a (different) way of communicating . . . which, as it is perceived and appraised in reference to the universe of theoretically or practically concurrent styles, receives a social value and a symbolic effectiveness' (1982: 60; free translation from French).
21. One characteristic of this kind of modelling is that it uses few parameters. This clashes with the aspiration of complex theory to build a comprehensive ecology out of the elements involved: 'Several models have been proposed to account for different mechanisms of social interaction in the dynamics of social consensus. The idea is to capture the essence of different social behaviours by simple interaction rules: following the idea of universality classes, in collective emergent phenomena details might not matter' (Castelló, 2010: 24). Morin (2005: 4) takes a rather more critical view: 'Restricted complexity has enabled important advances to be made in formalisation, in the possibilities of models, which in turn stimulates the potential for interdisciplinary efforts. But one is still within the epistemology of classical science . . . In some sense, complexity is acknowledged, but it is decomplexified.'

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