

**WHY IS EVERYONE SO EXCITED ABOUT
COMPLEXITY THEORY IN APPLIED LINGUISTICS?¹**

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Mots-clés

Complexité – émergence – non-linéarité – interaction – système dynamique

Keywords

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Résumé

Les théories dominantes de l'acquisition des langues – l'*input-output* des années '70, l'interaction des années '80, l'interculturel des années '90, et la linéarité qu'elles présupposent dans l'apprentissage, sont devenues difficiles à maintenir à une époque où la communication prend des formes de plus en plus électroniques et décontextualisées. Le tournant écologique en didactique des langues est une réponse aux nouveaux paramètres multidimensionnels de l'apprentissage des langues en contexte plurilingue et pluriculturel. La théorie de la complexité a ses adhérents et ses critiques, mais les passions qu'elle déchaîne semble indiquer un besoin de comprendre des phénomènes importants que cet article tente d'explorer.

Abstract

The dominant theories of SLA: input-output in the '70s, interaction in the '80s, interculturality in the '90s, and their linear assumptions regarding language acquisition and use have become difficult to sustain in the face of computer-mediated and decontextualized forms of communication. The ecological turn in applied linguistics is a response to the new multidimensional parameters of the language learning experience in multilingual and multicultural environments. Complexity theory has its adherents and its critics, but the excitement it generates shows that it is on to something important that this paper attempts to explore.

1. I wish to thank the organizers of the colloquium in honor of Richard Duda at the Crapel for inviting me to participate in this event. I am grateful for the feedback received.

Introduction

Why is everyone so excited about complexity theory in applied linguistics? The interest comes not only from doctoral students eager to escape the dichotomies of traditional SLA research and to break new ground, but also from more seasoned researchers who, like Diane Larsen-Freeman, have established their reputation in hardcore psycholinguistic SLA and are now branching out into the poststructuralist and even postmodern waters of language ecology and complexity theory (Larsen-Freeman, 1997; Larsen-Freeman & Cameron, 2008). These scholars have turned to complexity theory, dynamic systems theory, and ecological perspectives on language learning to try and find a way of bringing together domains of SLA that have hitherto developed independently of one another: the cognitive and the social in SLA, discourse studies and language acquisition studies, language acquisition and language socialization research (Kramsch, 2002; Schieffelin & Ochs, 1986), second and foreign language acquisition, SLA and bilingualism (Ortega, 2012), and, in general, the humanities and the social sciences. They are looking for a comprehensive and unified field of research that can study language acquisition from a cognitive, social, cultural, historical and even aesthetic perspective and emancipate language learners from the reduced personalities they have been given in traditional SLA research (Harder, 1980).

In this paper I want to first take the measure of “complexity” in its ecological, and dynamic systems theoretical aspects, based on the work of Larsen-Freeman (1997) for SLA. I then consider four advocates of complexity theory broadly conceived: Schmenk, Kramsch, Morin and Osberg and how they have drawn on complex thought to conceptualize the “emancipation” of the language learner. Finally, I discuss some of the challenges that complexity theory presents for SLA research and foreign language education.

1. Complexity theory and SLA

Chaos / complexity theory was first brought to the attention of SLA researchers in the US with the pathbreaking article by Diane Larsen-Freeman in *Applied Linguistics* (1997) that offered an alternative to the simplistic input-output, linear, information processing model of second language acquisition. It has been followed by a host of other studies that flesh out general principles of complexity / dynamic systems theory as applied to SLA (see for example, Larsen-Freeman, 2002; de Bot et al., 2007; Larsen-Freeman & Cameron, 2008; Larsen-Freeman, 2011). In 1997, Larsen-Freeman spelled out seven principles of a chaos / complexity theory for language learning, of which she identified four (#1, 3, 5 and 7 below) that she elaborated on in her address at the 2011 Annual Meeting of the American Association for Applied

Linguistics titled 'The Emancipation of the Language Learner'. In what follows I draw heavily from Larsen-Freeman 1997 and 2011.

1.1. Complex systems (like the weather, economic systems, human learning) are open and dynamic

Complex 'systems' have no distinct boundaries; they exist only because of the fluxes that feed them, and they disappear in the absence of such fluxes. One could therefore say that a complex system is dynamic rather than static; it exists only in the interaction between things and is therefore not itself a thing (Osberg, 2008). Applied to language learning, unlike the interlanguage model of SLA, in which the learner is conceived as moving linearly between a state of non-knowledge to a state of knowledge slowly approximating the native speaker, a complex model does not posit an initial and an end state. Instead, it sees learning as creating its own conditions of development in open interaction with its environment, and always susceptible to change. Rather than an engine of development situated outside the learner, in the form of input or a given social environment, a complex model of SLA posits a dynamic system, i.e. both structuring and structured by its environment. As we shall see below, 'environment' here means not only the geographical space and the social situation in which learning takes place and communication unfolds, but also memories of past interactions, expectations of future ones, imagined exchanges and fantasy worlds.

Corollaries to this first principle are the following:

- Because the systems are open, what arises may be in nonlinear relation to its cause. In other words, an unexpected occurrence may take place at any time.
- The structure of a complex system is maintained even though its components may change.

1.2. Complex systems operate under conditions that are not in equilibrium

When you learn one additional piece of knowledge, this new knowledge doesn't just add itself to the other things you acquired previously. The equilibrium you thought you had reached in your prior state of knowledge gets disrupted as one new piece of knowledge reconfigures the whole picture. For example, even though one of the past tenses is called the 'present perfect', and is grammatically built from a present form plus a past participle (e.g. *I have been*), this past tense in this new configuration is not necessarily continuous in the minds of the learners with the simple present tense (e.g. *I have*). Language teachers are often astonished that the learners have difficulty learning the present perfect, since they already know the present form of the auxiliary and all they have to do is add a past participle. But they do not know how to form the present tense or do not recognize the present form of the auxiliary as a present tense.

Language learning is neither cumulative nor additive: when you add one piece, the rest changes and the whole thing needs to be resignified and restructured.

1.3. Change / dynamism are central: The systems adapt both through interaction with the environment and through internal reorganization / self-organization

Complex systems are systems because they are comprised of many elements or agents, which interact. Despite the linear nature of textbooks and the sequential order of items on the syllabus, learning does not grow in chapters or units that one can check off, test, and consider 'acquired'. Each new item presented in a new chapter is related to an item learned earlier, but on a more complex plane, because one can now illuminate the item from more angles in light of other items acquired since then.

This most important principle of complexity theory has been glossed generally in the following way: "The act of playing the game has a way of changing the rules" (Gleick, 1987: 24). True innovation actually changes the rules of the game, i.e. changes the system – an open system that is constantly self-modifying. By applying this insight to SLA, Larsen-Freeman is not talking about lexical rules you can find in a dictionary or grammatical rules you find in a grammar book. Instead, she is referring to the rules of the learning game itself. Foreign language learners, through experience or hearsay, think they know how one learns a foreign language, namely, item by item, tense by tense, word by word. They are often dismayed to see that their linear efforts at accumulating this knowledge do not yield the success they expect when they are asked to actually communicate orally or in writing. They start out thinking they know the rules of the pedagogic game and they suddenly realize that actually playing the game in live interaction with others changes the game's rules. Understanding and accepting this dynamic nature of SLA is one of the main steps to success in the SLA game.

1.4. The strength of the interactions changes over time: Therefore, there are often multiple routes possible between components, mediated in different ways

Unlike learning historical or mathematical facts, learning how to communicate in a second language is variously successful within an individual's biography and among individuals. Individual differences in language acquisition have been the object of intense study in SLA (e.g. Schumann, 1978; Wong-Fillmore, 1979; Ellis, 1994). But they have been studied exclusively from the perspective of individual learners: learners' motivation, their cognitive and social make-up, their 'investment' (Peirce, 1995), and the host of personality factors and learning styles identified by social psychologists such as extrovert / introvert, field-dependent / independent, or visually / acoustically inclined. By contrast, complexity theory looks at the whole ecology of learning: the learner in interaction with current others (teacher, textbook,

fellow learners, native speakers), with absent or with past others (through texts), with his/her perceptions of present and past others, of past and present selves, and with whole discourses about the language, its speakers, its writers and the ideologies and worldviews they vehiculate.

1.5. The complexity of complex systems is emergent: It is not built into any one element or agent, but rather arises from their interaction

Through soft assembly and co-adaptation, patterns emerge or self-organize. As the biologist Sandra Mitchell writes: "Self-organization refers to any set of processes in which order emerges from the interaction of the components of system without direction from external factors and without a plan of the order embedded in an individual component" (Mitchell, 2003: 6). These patterns or performance stabilities are transformed with further usage. In other words, you don't learn the rules and then apply them; instead, the rule emerges out of the interaction itself. This is what makes predictability particularly difficult in matters like the weather or human learning because there is no linear causality between your teaching and the students' learning. As the psychologist Leon Jakobovits quipped, we know what teachers teach, but what learners learn is anybody's guess. So we hope that before the end of their lives our learners remember or have benefitted from what we teach but we can never be sure of what it is they will remember. What learners learn is not the product of any one factor or agent, but rather it arises from the interaction of a multitude of factors. Which would explain why, in order to learn a language and learn how to use it, you have to have interaction because it is the interaction that enables you not only to negotiate meaning but to negotiate your understanding of what meaning you may construct for yourself.

1.6. The environment in which these components operate is part of a complex system of meaning making

In biology, "organisms not only determine what aspects of the outside world are relevant to them by peculiarities of their shape and metabolism, but they actively construct, in the literal sense of the word, a world around themselves" (Lewontin, 2000: 54). In complexity theory, we don't learn the grammar and then put it to use in a communicative context. Instead, as cybernetics philosopher Gregory Bateson said, "contextual shaping is only another term for grammar" (1979: 18). Language, as a cybernetic, dynamic system of making meaning and constructing social and psychological reality, is relational, changing and potentially conflictual. Context is not a backdrop to learning the language, it is the very object of learning. Thus we need to study context itself and its relation to the texts that both structure and are structured by it.

This effort to link text and social context in foreign language education explains current efforts by applied linguists to teach grammar as ‘grammaring’ reality (Larsen-Freeman, 2003), or to teach the structure of texts as expressing social structure within a Hallidayan systemic functional perspective (Byrnes, 2009). If we replace the term ‘social structure’ through ‘culture’, complexity theory offers a way of linking language and culture within a sociohistorical approach to texts. Here the term culture as applied to context reinstates a historical dimension to an environmental context usually seen exclusively in social terms. Indeed, the last principle introduces the crucial element of time in any complex vision of language teaching. As the linguistic anthropologist William Hanks remarked recently, cultural anthropology no longer deals with culture as the product of history and tradition, but as historicity itself (personal communication).

1.7. Complex systems display behavior over a range of timescales

This last principle brings historicity into the system. Language learners acquire the ability to communicate not only with other human beings (native speakers, non-native speakers, students in the same classroom, teachers), but also with imagined and remembered interlocutors (imagined selves in their diaries, imagined and remembered others on line, on face-book, over the phone, constructed others in novels, plays and poems). In addition, the notion of timescale makes it possible to understand how people learn one language while remembering how they learned other languages or how they learned their mother tongue. The body of the learner replicates previous ways of learning that get reactivated somatically. It makes him/her operate on different timescales: the adult relearns the ways of the child and at the same time learns to become a multilingual adult (Kramsch, 2009). These different timescales correspond to different levels of complexity nested within each other. This important principle has two corollaries:

- *Complex systems sometimes display chaotic variation.* Various factors can block memories of past experiences and projections of future aspirational identities. Conversely, a sudden memory triggered by a smell, taste, touch, sight, or sound, can tip the scales of time and transport someone into a different world of experience related to the language that mediated that experience.
- *Complex systems iterate.* They revisit a territory again and again. When you learn one foreign language, for example German, and then you learn another, for example Russian, you are likely to put all your verbs at the end of subordinate clauses in Russian, because Russian sounds foreign in the same way as German was foreign. Your experience learning Russian places you again in the familiar timescale of ‘learning foreignness’ – and your body reacts accordingly.

In sum: as applied to SLA, complexity theory sees language as a dynamic set of patterns emerging from use; complexity arises from the self-organizing locally-situated interactions of many components, the contributions of each being subject to change over time. Complexity theory enables us to avoid decontextualizing, idealizing, segregating, and a-temporalized language. It helps us to understand that the language system is always in flux (Larsen-Freeman & Cameron, 2008). It reminds teachers that linguistic signs are not “autonomous objects of any kind, either social or psychological,” but “contextualized products of the integration of various activities by individuals in particular communicative situations (Harris, 1993: 311); it logically follows that they are continually created to meet new needs and circumstances” (Toolan, 2003: 125).

2. Complexity theory: An emancipatory vision for SLA?

Larsen-Freeman titled her 2011 talk “Emancipation of the language learner”, implying that a complexity theoretical approach to language learning could emancipate the learner from the stigma of being merely a “nonnative” or “defective communicator” (Firth & Wagner, 1997: 285). To explore further this emancipatory potential of complexity theory in applied linguistics, I examine four views on complexity theory from four different fields: language pedagogy (Schmenk), ecological applied linguistics (Kramersch), philosophy (Morin), and critical education (Osberg). They all take their cue from the work of natural scientists and biologists (e.g. Bateson, Varela, Prigogine) as well as that of linguists and philosophers keen on escaping the Cartesian dichotomy of mind and body (e.g. Johnson, Morin).

2.1. A pedagogic perspective: Barbara Schmenk

In her monograph on *Learner autonomy* (2008), the German language learning methodologist Barbara Schmenk shows her debt to the work of the Crapel on autonomy and language learning. She sees the concept of autonomy as a worthy ideal in language learning but in her view it has over the years lost its original educational meaning and become a convenient pedagogical slogan, hostage to the control processes of neoliberal thinking. Born at the time of the Enlightenment, she argues, the notion of autonomy was originally associated with critical and emancipatory thinking and with Immanuel Kant’s concept of *Mündigkeit* (maturity) or think-for-yourself without appeal to external authority. Today, it has been co-opted by the marketing industry to refer to self-directed learning in the service of goals set by corporate powers. Schmenk feels that the notion of autonomy has become commodified for economic and political gains. Real maturity, she argues, consists of being aware of the paradox of auto- and heteronomy and the fact that we have “agency without sovereignty” (Weedon, 1987: 40; see also Butler, 1997). That means that we are free to act but at the same time are not in control of the choices that are given to us.

Such a stance is a complex stance that embraces paradox and tolerates the ambiguity of complexity². It follows Larsen-Freeman's first principle to retain the openness and unpredictability of the dynamic language learning process. Rather than liberating the learner from the teacher only to attach him/her to pre-programmed worksheets, or to a computer program that tutors or controls his/her every move, complexity theory calls for capitalizing on serendipitous discoveries and unprogrammed explorations (for a concrete example of how a prepared lesson plan and spontaneous talk are negotiated in language classrooms, see Bannink, 2002; van Dam, 2002).

2.2. An ecological SLA perspective: Claire Kramsch

The language ecology perspective represented among others in Kramsch (2002) is captured by the following definition of language ecology given in the introduction:

The ecology metaphor is a convenient shorthand for the poststructuralist realization that learning is a nonlinear, relational human activity, co-constructed between humans and their environment, contingent upon their position in space and history, and a site of struggle for the control of social power and cultural memory. (Kramsch, 2002: 5)

Like Larsen-Freeman, Kramsch (2002) sees the learning process as open-ended: "An ecological approach to language education does not seek dialectical unity, or bounded analyses of discrete events, but on the contrary open-endedness and unfinalizability" (Kramsch, 2009: 247). An ecological perspective on SLA draws on some of the same principles of complexity as Larsen-Freeman (1997), which I list below in telegraphic form:

- The open-ended, fractal nature of experience, whereby the acquisition or the understanding of one linguistic phenomenon is metonymic for the acquisition of a much larger phenomenon. (Principle 1)
- The relationality / interactivity of Self and Other and the reflexivity of the multilingual subject who is at once observer and observed as an object of inquiry. (Principle 3)
- The emergence of meaning in the process of meaning making. (Principle 5)
- The iterability or recursivity of production and reception in time and space. (Principle 7)

To these principles of complexity, an ecological perspective adds a phenomenological stance that insists on the embodied nature of learning. As Bourdieu writes in his *Pascalian Meditations* (2000: 141): "We learn bodily. The social order

2. At the colloquium, Richard Duda asked whether the term *empowerment* would be equivalent to the term *emancipation* used by Larsen-Freeman in her 2011 talk and an equally good way of representing what is called learner autonomy. In my mind, the term *empowerment* has been so used and abused by the marketing strategists in the USA that I could only use it in an ironic sense. The term *emancipation* has the advantage of referring back to the 18th century.

inscribes itself in bodies through this permanent confrontation, which may be more or less dramatic but is always largely marked by affectivity and, more precisely, by affective transactions with the environment.” The body here stands for perceptions, sensations, memories, emotions, feelings and other somatic states. This embodied view of language learning is indissociable from an awareness of the symbolic power at work in the making of meaning and the control of cultural memory. This symbolic power can do symbolic violence to the body of the language learner, if it conflicts with how he/she identifies him/herself with regard to his/her own language and culture (May, 2011). While the body is what Bourdieu calls a “memory pad” (2000: 141), linking us to the physical and affective experiences we have made in our speech community, it is also a portable memory pad that accompanies us beyond our speech community and into the new environments we encounter in a new language. Complexity theory:

problematizes the notion of bounded speech communities and focuses our attention on open-ended, deterritorialized communicative practices rather than on the ‘territorial boundedness’ posited by the ‘one language, one culture’ assumption (Blommaert, 2005: 216). (Kramsch, 2008: 392)

2.3. A philosophical perspective: Edgar Morin

In his *Introduction à la Pensée Complexe* (2005), Edgar Morin deals with what he calls “the core problem of the one and the many” (p. 19). How can I be open to other languages, worldviews, ideologies, and internalize the other in me without losing myself in the process? How can I be at once outside the phenomena that I study and part of these phenomena? This is the fundamental philosophical problem of learning someone else’s language. I am in fact both a self and an other: the other is me, I am in the other. The foreign language is there for me to appropriate, but it will never be mine, because it has always already belonged to others. As Morin puts it:

To be a subject means to be autonomous while being dependent... This autonomy feeds off dependence; we depend on our education, our language, our culture, our society, we depend of course on our brain, itself product of a genetic program and we depend also on our genes... we are both autonomous and possessed. (p. 89-90 my translation)

This line of thinking draws on the Pascalian tradition found in Bourdieu but also in Bakhtin (1981) and others who put into question the Cartesian dichotomy of mind and body (e.g. Johnson, 1987; Varela et al., 1991). More than Schmenk and Larsen-Freeman, Morin, as a philosopher, dwells on the inherently tragic nature of knowledge and its transmission: the unavoidable simplification of facts necessary for reaching the learners, and at the same time the need to teach them the complexity that gives meaning to these facts. Morin’s view of complexity points to the fundamental pedagogic dilemma of teaching language through language itself, for the very linguistic tool we use to make meaning at the same time limits the range of meanings we may teach. This dilemma is, ultimately, at the core of the freedom and the responsibility

associated with our use of language, and which Deborah Osberg frames in terms of two kinds of logic: the logic of determinism and the logic of emergence, as I discuss below.

2.4. Critical educational perspectives: Deborah Osberg

In her 2008 article “The logic of emergence: An alternative conceptual space for theorizing critical education”, the British education philosopher Deborah Osberg proposes an alternative way of theorizing critical education. She is interested in complexity theory, less for what it reveals about the relation of self and other (as in Kramsch), or the one and the many (as in Morin), but for the possibility it offers of an education to democratic freedom. We have here an ideologization of complexity theory for education to democracy and for adopting a critical educational stance³. As she describes it, a “logic of determinism” is a “fundamentally ‘object-based’ logic which understands causality and process in terms of a series of individual stages or states that are all logically derivable from each other” (Osberg, 2008: 144). An example would be the logic of textbooks or curricula built to lead learners through various stages in their acquisition of linguistic objects like grammar and vocabulary. Syllabi and tests also obey the logic of determinism, because they aim in the name of fairness and meritocracy to predict performance and rewards. The “logic of emergence”, by contrast, ushers in a different understanding of causality and process. As the chemist Ilya Prigogine has shown, with complex or emergent processes the system has the freedom to develop along alternative trajectories (Prigogine & Stengers, 1984). Prigogine’s logic is a logic in which choice is an operator in the process itself – part of its internal ‘mechanics’ – not something that happens to a process, something applied to it from the outside. Since emergent processes are not fully determined – they contain within themselves the possibility of freedom – the logic of emergence could therefore also be characterized as a logic of freedom (rather than a logic of determination) (Osberg, 2008).

Instead of deterministic causality in which everything can be fully calculated, predicted and known, we are faced, then, with probabilistic causality in which an essential component of the process is the unknown (chance). Each new level of order introduces a different order of logic. Critical education guides learners by presenting them with alternatives which complicate the scene, unsettling the doings and understandings of others. It intentionally opens up the spaces of the possible⁴.

3. Such a political agenda can be found in Michael Byram’s (1997) notions of *savoir s’engager* and *savoir être* that are two of the five components of intercultural competence.

4. At the colloquium, Jean Paul Narcy-Combes raised the question of freedom vs. determinism in Laborit, who concludes in his latest work that we are both more free and more determined than we think. Through this paradox, he suggests, Laborit would clearly affiliate himself with complexity theory.

The term “logic of freedom” within an educational context moves complexity theory from an explanatory model of language acquisition to an educational model of political action.

If we ask if complexity theory is critical in an educational context, we are asking if it can address political concerns, especially concerns about freedom. The way in which complexity addresses the issue of freedom is from the perspective of process. Complexity cannot see freedom as being the outcome of a process; it can only understand freedom as being internal to complex processes... With a complex and open-ended understanding of process, it becomes possible to conceive of the educational process as an exploration or movement into that which cannot currently be conceived as a possibility. (Osberg, 2007, cited in Larsen-Freeman, 2011)

In sum: all four scholars add to the complexity / ecological agenda a concern for the workings of symbolic power and the ethical challenges raised by placing the context, not the text, in central position in language teaching. Larsen-Freeman herself waxed idealistically eloquent in her talk at AAAL. Indeed, her complexity theory affords SLA research a chance to associate scientific inquiry with a political agenda of education to democratic freedom and emancipation of the individual. In the following section I consider the educational challenge presented by such a link between science and ideology.

3. The educational challenge

In her 2011 talk, Diane Larsen-Freeman builds on all the perspectives mentioned above to carve out a vision of the language learner as a total human being – a cognitive, affective, social, physical, and neural being. She argues that the modern-day field of SLA was founded on the revolutionary idea that learners are actively involved in their own learning – inducing rules / hypotheses from the input data, generating and testing hypotheses, corroborating, modifying or refuting them. This focus on the cognitive dimensions of the language learner were quickly supplemented by the social dimensions. SLA researchers were advised to concern themselves not only with language learning as an individual and primarily cognitive process, but also as a sociohistorically situated phenomenon, indissociable from its affective resonances in the individual learner. Schumann (1978) in particular argued that social factors and affective variables cluster into a single variable – the desire to acculturate – which he saw as the major causal variable in SLA. But this focus on the cognitive and the social was still a very modernist one. It did not do away with the sovereignty of the individual learner to shape his/her own learning. Later, SLA researchers became interested in the neural dimensions of language acquisition (Schumann, 1997) and the embodied nature of learning. It was proposed that the areas of the nervous system which subserve stimulus appraisal, attachment, affective regulation, and social cognition, also subserve decision-making in language pragmatics (Schumann et al., 2004). And, since perceptual processes shape experience and experience is a function of

how our bodies interact with the world, the meanings that cognition develops are also embodied meanings. These developments, too, espoused a modernist view of the individual learner, whose success in learning the language lay mostly in his/her motivation or investment in the language learning enterprise.

Beyond these descriptive aspects of the language learner, Larsen-Freeman, drawing on the work of Kramsch and Kroskrity, points out the limitations of this modernist view. Kroskrity, writing about language ideologies, shows how the traditionally structural bias of linguistics has limited our understanding of the language learner, who is seen as a mere “host for language”, not as an active agent of meaning making.

Modern linguistics, since Saussure, has been interested only in the inner logic of the systems of signs itself, taken... independently of the meaning that gives signs their content... Speakers were neither part of the language nor capable of being agents of linguistic change. Rather than being viewed as partially aware or as potentially agentive, speakers – in Chomskyan models – were merely hosts for language. (Kroskrity, 2004: 499)

Kramsch, echoing Firth and Wagner (1997), explains how such an active meaning-making is mediated by a host of embodied experiences that have not been taken seriously enough by SLA research. Indeed, SLA has taken its clues from information processing theories of communication rather than from semiotic and somatic theories of identity (Kramsch, 2009).

Language learners are not just communicators and problem solvers, but whole persons with hearts, bodies, and minds, with memories, fantasies, loyalties, identities. Symbolic forms are not just items of vocabulary or communication strategies, but embodied experiences, emotional resonances, and moral imaginings. (Kramsch, 2006: 251)

The transformative potential of complexity theory is echoed by applied linguists like Thorne and Lantolf (2007) from the Vygotskyian sociocultural strand of SLA.

Our counter-narrative... is to put forward a linguistics of communicative activity that is based on a view of language as a historically contingent emergent system, one that provides a repertoire of semiotic devices that people can use to realize their communicative intentions, to interpret the communicative intentions of others and, perhaps most importantly, to foster the conditions of possibility for transforming self and community. (Thorne & Lantolf, 2007: 171)

Larsen-Freeman herself ends her 2011 talk with an upbeat picture of a banyan tree with its many interconnected roots, followed by a setting sun on a wide open view of the ocean:

Much like the banyan tree so common in Southeast Asia, bilingualism, and especially multilingualism, needs to be recognized for its interconnectivity and multiplicity, grounded not only vertically, but also horizontally. It is precisely these associations and linkages that potentialize not only communication, but also protect the structure, the temple that is the individual speaker. (Larsen-Freeman, 2011)

She concludes:

Thus, for complex systems, while a system's potential might be constrained by its history, it is not fully determined by it. Knowing how to negotiate our way through a world that is not fixed and pregiven but that is continually shaped by the types of actions in which we engage (Varela et al., 1991: 144) is a challenge of being human.

However, it is one thing to consider the individual speaker as a sacred 'temple', and to know that "the world is not pregiven but continually shaped by our actions", it is quite another thing to be subjected to the relentless control of educational institutions and corporate imperatives that seem to discipline rather than emancipate the individual, and that leave no space for individual agency and creativity. Interestingly enough, Larsen-Freeman's talk ends with a quote from Varela et al. (see above) who, through their Buddhist orientation, call into question the modernist orientation of much of Western research. Complexity theory, however attractive for Western educators, needs to be aware of its paradoxical nature in the face of increasing pressures for learners to compete and outdo others, for educators to discriminate and select through the ever more controlled processes of testing, measuring, assessing, scoring, ranking and other discriminatory measures imposed by present-day educational institutions in global competition with one another.

In its relational outlook, complexity theory challenges the excessive emphasis placed on individual, competitive performance in the name of freedom and democracy. It also challenges the growing corporate pressure to standardize the criteria of performance for greater economic profitability and for greater control of the workforce, in the name of efficiency and productivity. Complexity theory also presents a threat to a scientific community in search of credibility and legitimacy. While it enhances the validity of SLA research, it makes the findings of such a research less reliable and ultimately less predictable because it makes it more difficult to isolate variables and to establish causal relationships between the phenomena under study⁵. Ultimately, the increasingly multidisciplinary nature of applied linguistics is symptomatic of a field whose object of study requires, like the global climate, inordinately more complex methods of inquiry than heretofore envisaged. Complexity theory as applied to language education reminds us of the complex humanistic goals of language learning and teaching, but at the same time it exhorts us to beware of easy metaphors, that can constrain while claiming to liberate, and close horizons while claiming to open up possibilities.

5. Alex Boulton expressed concerns about the 'death of the variable' in social science research. How to research the context if you can't isolate variables? This puts into question the whole traditional methodology of the social sciences. Does complexity theory push us in the direction of the Human Sciences?

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