

## CONCEIVING LANGUAGE AS A COMPLEX ADAPTIVE SYSTEM: A PROBLEM FOR SLA RESEARCHERS?

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### ABSTRACT

The present article aims at discussing the impact of the adoption of a perspective which conceives language as a Complex Adaptive System on the Second Language Acquisition research work. In order to achieve this goal, the text first presents a definition of language as a Complex Adaptive, as opposed to the perspective which traditionally permeates research in the field. Next, the main contributions of such a perspective to Second Language Acquisition are addressed. Finally, the implications of adopting this perspective for research in the field are approached. It is argued that conceiving language as a Complex Adaptive System presupposes a paradigm shift on the view of what this object of study is. As a consequence, researchers need to take into account multiple factors in interaction. Although, at first, this necessity might be faced as a problem for conducting scientific research on the field, it is concluded that this necessity may actually be seen as a motivational factor.

**Keywords:** Dynamic Systems Theory. Language as a Complex Adaptive System. Second Language Acquisition.

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Not long ago, after a graduate class discussion, a colleague told me how frustrated he was now that he had read papers on Second Language Acquisition (SLA)<sup>2</sup> from a Dynamic Systems Theory (DST)<sup>3</sup> approach. According to him, it was much easier to consider his life as a SLA researcher before studying DST; now, he would have to cope with the fact that nothing could ever be controlled, everything was possible and he would never get answers for anything. While that might be considered a little bit of an exaggeration, performing SLA research under a DST perspective can actually be “frustrating”: the individual constantly changes and is changed by the language of his community, source and target language are always

evolving, several factors influence SLA acquisition and they cannot be considered in isolation. These and other conceptions make the object of study difficult to grasp.

What causes the DST approach to language to have such an impact on those who study SLA might be that DST is more practical in evidencing the numerous boundaries to the generalizations researchers seek to construct. On the other hand, one might argue, other theoretical perspectives seem to provide us with more categorical (and therefore “comfortable”) explanations to the language acquisition phenomenon. Even so, studying SLA under this scope can also be motivating, since it raises several questions which we are far from being able to answer.

In this paper I aim to highlight the main characteristics of the DST approach to SLA which, in the sense stated above, complicates the job of a SLA researcher. I argue that, at the same time in which this approach seems to be the one which best explains linguistic phenomena and SLA, it is the one which evidences how little we know about these phenomena. This article is divided into three sections. Section 1 presents the main characteristics of a Dynamic System and explains how they can be associated with language. The second section aims to show the main contributions of DST to SLA studies. In the final section, I discuss how this approach should affect the way SLA researchers perform their investigations and see their results.

## **1 WHAT A COMPLEX/ADAPTIVE/DYNAMIC SYSTEM IS AND HOW IT CAN BE ASSOCIATED WITH LANGUAGE**

In her paper which aims to stress similarities between complex nonlinear systems in nature and language, Larssen-Freeman (1997) first defines these as systems which are resultant from the interaction of *multiple agents*. This means that a complex system is composed of several different units, and it is their interaction (or adaptation to one another) which determines both the way the system works and the individual behavior of these units. In this sense, each agent has its contribution to the system, but an agent cannot be regarded in isolation as one that represents the behavior and characteristics of the whole system.

From this starting point, we can easily draw an analogy between a speaker – inserted in a language community – and an agent – member of a complex adaptive system. This means that the language of the community is a product of the

individualities in the language of each speaker, as well as that it means that the language spoken by each speaker is a product of his interaction with the language community.

Considering that this complex system has to account for a multitude of individualities and their interactions, it can only be intrinsically *diverse* and perpetually *dynamic* (ELLIS, 2011): the system is always evolving, as a means of adaptation to the needs of its constituents and their interactive capability. The current behavior of a system is thus explained by its past experience, and it can be concluded that its future behavior is shaped by both its present and past conditions (FIVE GRACES GROUP, 2009).

Language variation is an obvious association to be made with that characteristic. Language is constantly changing, and such changes are not simply random: they reflect the system's necessity for alterations, mostly in search of facilitated interaction. It should be even clearer that, following this perspective, the source of this variation is the use of language – variation is not, for example, predicted by universal rules; rather, it originates from human cognition and experience with the world<sup>4</sup>.

Another characteristic of Dynamic Systems is *nonlinearity*. In linear systems, an alteration results in an effect which is both predictable and directly proportional to the dimension of that alteration (LARSEN-FREEMAN, 1997). In a Dynamic System, however, change can be chaotic: it affects all agents of the system in different ways and, therefore, the outcome is unpredictable. This is the case because we cannot predict the dimension of the effect on every agent, the reaction this will cause on each agent, how this reaction affects the other agents and how the other agents, in turn, react to the previous reaction. It is based on this sequence of an unpredictable chaotic chain reaction that many papers on Dynamic Systems associate their behavior with the butterfly effect (LARSEN-FREEMAN, 1997; DE BOT; LOWIE; VERSPOOR, 2007a; MERCER, 2011)

Resuming the analogy established before, between the relationship agent-system and speaker-language, we once more associate the constant changes in Dynamic Systems with language variation. It can thus be understood that every instance of language use provokes unpredictable changes in some level of the language system, whether we observe them or not. To put it simply, when we use language we change it, but it is impossible to know how.

The characteristics of Dynamic Systems I addressed so far might lead to the conclusion that nothing holds the agents of the system together and, if the system is chaotic, so should be language communication. That is clearly not the case. We turn, then, to three other characteristics of Dynamic Systems: these systems are *self-organizing*, *feedback sensitive* and *adaptive* (LARSSSEN-FREEMAN, 1997; FIVE GRACES GROUP, 2009; ELLIS, 2011). Although the system is constantly changing and the outcome of the interactions of its agents is unpredictable, it tends to find order between agents in a way that favors the proper functioning of the system. The necessary adaptations for the system to maintain its order are determined by feedback – whereas positive feedback serves as impulse to the continuous evolution of the system, negative feedback keeps the system from falling into disorder (LARSSSEN-FREEMAN, 1997).

We can therefore see that, as long as it is used, a language system is always evolving, and it has infinite possibilities of variation. Nonetheless, changes are limited to those which do not compromise the interaction between speakers of the language in question; that is, changes do not cause the system to malfunction.

It is important to notice that the DST approach to language diverges drastically from the traditional generativist view and, according to most of those who propose it, both views cannot be reconciled<sup>5</sup>. Basically, while DST proposes that language is a bottom-up product of human interactions from which patterns *emerge*, Generativism states that language is based on principles of a top-down innate grammar system, to which the human interaction with the environment is not determinant (ELLIS, 2011). Nonetheless, it is necessary to observe that the DST approach to language is relatively recent, and it has not yet consolidated its contribution to research studies. This can be stated once we observe that the works published under this perspective so far have been highly theoretical and have not had much empirical application (ORTEGA, 2009).

I also find it relevant to point out that some authors have criticized the position of those who defend a DST approach to language. Ionin (2007), in his comment on De Bot, Lowie and Verspoor (2007a), states that most of the critique done by the authors to previous SLA research only takes into consideration outdated studies. Another claim made by Ionin (*op cit*) is that DST defenders do not provide concrete solutions to the theoretical problems they bring, and that previous research did investigate the multiple factors of the language acquisition phenomenon. Pienemann

(2007), too, states that the paper by De Bot, Lowie and Verspoor (2007a) does not offer new explanations, and furthermore argues that there is an extensive literature on language variation outside the DST perspective which is ignored by those who defend it. While these criticisms on De Bot, Lowie and Verspoor (2007a) seem valid, it appears that they derive from consequent impact of the shifting view brought by DST over language. Regardless of whatever pieces of literature we cite on language variation, what is presented by the DST approach to language is a shift on the paradigm of what we understand about language as a system. The implication is that the object of study, from the point we adopt such a perspective, becomes distant from the rule-based system traditionally conceived. The behavior of a system whose main characteristics are intrinsic dynamism, variation and adaptation is not expected to be accounted for by that traditional view – and, clearly, no researcher is able to list a set of rules predicting this system's future behavior.

The conception of language of which I made an overview in this section is, as any other, far from being able to account for each and every phenomenon related to language. However, I believe that it seems more reasonable to try to explain linguistic phenomena such as variation by looking into the behavior of Complex/Adaptive/Dynamic Systems than by following other perspectives. At least, as I suggested in the introduction, this perspective suffices to evidence the complexity of the object of study that research on language and its acquisition deal with. In the next section I turn to the question of SLA, as approached by this perspective.

## **2 THE MAIN CONTRIBUTIONS OF A DST APPROACH TO SLA**

In the previous section, I presented an overview of a conception of language which regards a speaker as an active agent within a dynamic system. Once we now turn to SLA, another multitude of factors must be brought into consideration, by looking at different levels. As De Bot, Lowie and Verspoor (2007a, p. 14) put it, “from a DST perspective, a language learner is regarded as a dynamic subsystem within a social system with many interacting internal dynamic sub-subsystems, which work within a multitude of other external dynamics”.

Before we consider a multitude of external dynamics, we can start with the definition of grammar which fits the DST perspective, which diverges from the

traditional generativist view of grammar. If a given language is the product of the interaction between its users, it seems obvious that the “rules” of this language are defined by use. A *usage-based* conception of grammar sees it as the categorized instance of language use; something which originates from the human experience with language – there are no predefined rules; patterns in grammar emerge from human interaction (FIVE GRACES GROUP, 2009). Considering that grammar is defined by the human experience with language, it is directly related to cognition. As stated by Ellis (2011, p. 2), language and cognition are “mutually inextricable; they define each other.”

The role of cognition in SLA in a DST perspective deserves special attention. Unlike other traditional approaches, DST conceives language acquisition as a process which relies on domain-general cognitive capacities (FIVE GRACES GROUP, 2009; ELLIS, 2011, 2012). This is to say that there is not a specific cognitive device which the human brain uses for language acquisition. Rather, language is an extension of the human cognitive capacity, and multiple cognitive abilities are involved in its acquisition, such as attention, categorization, imitation and others (FIVE GRACES GROUP, 2009). Under this perspective, although it is more complex, the use of language is a piece of human knowledge of the world like any other (such as the knowledge of how to ride a bike or operate a computer, for example).

Once we consider that the learner grammar is defined by use and several cognitive abilities are involved in SLA, special attention must be given to factors such as the language input and the environment in which the learner is inserted. In the traditional Generativist view, the input does not have a fundamental role in language acquisition – a Universal Grammar (UG) is conceived, and predefined abstract rules are responsible for guiding language acquisition. Following the DST perspective, however, the input is fundamental: it suffices to drive language acquisition by presenting the learner with patterns and constraints, which are processed by the learner’s domain-general cognitive abilities (FIVE GRACES GROUP, 2009).

DST presents three major factors related to input and cognition which help us have a deeper understanding of the SLA phenomenon: *frequency*, *recency* and *context* (ELLIS, 2012). If language acquisition is an associative process of interaction, it relies (mainly) on how frequent input is, on how recently it has been accessed and on the context to which it is associated. It can be assumed that the

most frequent and recent items in the input to which a learner is exposed are going to be those which the learner makes more use of. Another assumption is that items are more easily accessed in the specific contexts with which they were associated.

When so much of SLA depends on the input, clearly, the environment is determinant: whether there is formal instruction or not, whether the learner is immersed or not, how much he interacts and with whom, what the purpose of this interaction is, among others. Considering these points, the analogy established by De Bot, Lowie and Verspoor (2007a) should be clearer: learners are inserted in social systems within dynamic subsystems which belong in a multitude of other external dynamics. That is, many factors interact in SLA and we cannot predict their outcome.

There are two other concepts in DST I find relevant for this discussion. Firstly, there is *sensitivity to initial conditions* in the development of Dynamic Systems (LARSEN-FREEMAN, 1997; DE BOT; LOWIE; VERSPOOR, 2007a). Moreover, De Bot, Lowie and Verspoor (2007a) talk about *nonlinear* development in SLA, which is a characteristic of Dynamic Systems I have addressed in the first section. This should account for the observed advantages in early SLA and nonlinear development of L2 knowledge.

Within a perspective which regards language acquisition as processed by multiple domain-general cognitive abilities, these stages of development seem to be more reasonably explained. Young learners have general cognitive advantages for they are starting to develop behaviors and are less affected by entrenched knowledge (roughly speaking, because they know less than adults). If we turn to SLA, we observe that the more solid L1 knowledge is, the more it represents a filter for L2 perception and production.

Language development is not, however, as simple as a gradual process, in which simple structures precede complex ones categorically, and no decline (e.g., misuse of a given structure which was well used in an earlier stage) is observed. It should be clear, therefore, that the idea of a Critical Period for language acquisition is strongly rejected in a DST approach to SLA: age-related effects on SLA are explained by a loss in the general cognitive capacity reinforced by the filter of entrenched knowledge.

This section briefly discussed some key aspects of the DST approach to SLA. These aspects again reflect a rupture from the top-down Generativist approach to

linguistic phenomena, as I referred to in the previous section. Moreover, they present a wide range of factors that should be taken into account by SLA researchers, which is the question I address in the following section.

### **3 IMPLICATIONS OF THE ADOPTION OF A DST APPROACH TO SLA RESEARCH**

In the previous sections I attempted to present an overview of the main aspects of the DST approach to language and SLA. As we have seen, this approach diverges from the traditional Generativist approach to linguistic phenomena. This is made through an association of the behavior of Dynamic Systems found in nature with language systems. Such an approach sheds light into the complexity and multitude of factors which must be taken into account by SLA research.

As my colleague pointed out in the conversation I referred to in the beginning of this paper, research work under this perspective may be difficult, or “frustrating”. It seems that this view of language and the SLA phenomenon evidences two facts which researchers of any field should bear in mind: for one thing, one can never be enough thorough about the methodological choices he makes when dealing with Dynamic Systems (and therefore language), since we cannot assume we have a full understanding of the wide range of factors which might interfere in our data. Secondly, perhaps for that same reason, whatever predictions we make based on research data analyses must be far from categorical.

Something which should be obvious for anyone dealing with science (and not because of the insights brought by DST) is that we must be highly aware of everything that can interfere in our investigation. If we intend to perform SLA research from a DST perspective, we can even think that such a thing is impossible. One can easily question how much we understand of an object of study which is a product of unpredictable multiple interactions.

Let us consider, for instance, the case of a researcher who wants to investigate the perception and production of English aspirated stop consonants /p/, /t/ and /k/ by Brazilian learners of English from a DST perspective. A possibly infinite range of methodological definitions is required: among those which first come to mind, the behavior of the phonetic aspect in question in both varieties of the L1 and the L2 investigated; the age of these learners; when they started learning the L2;



their amount and quality of exposure to the L2 (instruction, immersion and their duration); their proficiency level (and how to measure it); their differences in cognitive capacity; and the design of the task which will measure perception and production. Once all of these are considered, the number of participants to be found with similar conditions under all these criteria may be rather small.

The problem is that, even if a large number of participants could be attested to have the exact same conditions in the experiment, still this would not mean the results are capable of making predictions concerning the behavior of Brazilian L2 learners of English acquiring aspirated stop consonants. For one thing, DST tells us that both L1 and L2 are constantly changing, and we can certainly not assure learners experience with them is the same. Moreover, we know little about factors which might actually cause learners to have better or worse performances in the experiments. To be capable of predicting all factors and their interaction means to predict the behavior of a dynamic subsystem, a human being, as related to a series of other dynamic subsystems – which is impossible, under a DST perspective.

These issues lead us to question the nature of research studies themselves. Given the presented circumstances, one could suggest that, if we consider a DST approach to language, the one thing acceptable is to look into individual data at different stages of development, and limit the conclusions of the study to that single case. Indeed, this suggestion makes sense. However, as argued by De Bot, Lowie and Verspoor (2007b), this is not what the DST approach to SLA proposes. General tendencies do exist and they should not be ignored. It is important, however, to give more attention to “longitudinal research aimed at gathering dense data on development” (DE BOT; LOWIE; VERSPOOR, 2007b, p. 52).

I believe that the most important shift DST brings to this question is in the way we see research results. Even when a given generalization is not precisely correct, it is fundamental to help us understand whatever it is we are investigating. Some of these generalizations will partially predict the behavior of some agents of a Dynamic System and bring us close to understanding the way it works, while other generalizations will not. What DST evidences, therefore, is that categorical statements and their predictions are bound to fail, since when we try to explain phenomena related to language we only have suggestions of what might be the case.

Perhaps this is the reason why, as suggested by Ortega (2009), DST faces difficulty in making a solid contribution to SLA, and not much impact is observed in empirical studies. Moreover, the necessity of those who defend DST to reposition themselves<sup>6</sup> as regards the role of universals in language reflect both the incomplete state of DST as a theory of SLA and, once again, the ineffectiveness of categorical statements around the language acquisition phenomenon.

One might then question whether everything is actually lost for SLA researchers, as suggested by the classmate whom I addressed in the beginning of this writing. I understand that, for all the reasons that I have briefly mentioned, the adoption of this perspective does challenge SLA researchers. That should not, however, be a source of discouragement. For one thing, conceiving language as a Dynamic System seems to provide researchers with much more work to be done. Moreover, there certainly are generalizations to be made in analyzing language-related phenomena – some of which are even proposed by DST (I personally regard the assertion that all the multiple agents within the system are “adaptive” as a generalization). Once it is still possible for us to establish some aspects of language and its acquisition that can be true or false, there should still be motivation for SLA research.

#### **4 CONCLUSION**

Throughout this paper I tried to make an overview of the Dynamic Systems Theory approach to the complex phenomenon of language acquisition. The approach is recent, and seems to have brought an interesting paradigm shift to our understanding of phenomena related to language and language acquisition. While it seems to bring more questions than answers, the DST view of SLA suffices to limit research overgeneralizations considerably, once it defines its object of study as something naturally complex, dynamic and adaptive. The adoption of this view provides researchers with much to be taken into consideration while conducting studies on SLA, which perhaps should be seen as a problem, but certainly not as a source of discouragement.

## NOTAS

<sup>1</sup> Mestrando em Linguística Aplicada – (UFRGS/CAPES).

<sup>2</sup> I consider it irrelevant to make a distinction between Second Language (L2) and Foreign Language learning in order to pursue the aim of the present article; therefore, the former shall be interpreted as a synonym of the latter.

<sup>3</sup> The terms *complex*, *adaptive* and *dynamic* are used freely in this paper to refer to the same idea of *system* as defined by the three altogether.

<sup>4</sup> This question is further addressed in the following section, in which I discuss the construction of a usage-based grammar and the role of cognition in SLA.

<sup>5</sup> It should be clear that I do not intend to account for theories which explain language or language acquisition other than DST. However, contrasts between key-concepts in DST and Generativism are made whenever they seem useful for the understanding of the approach discussed in this paper.

<sup>6</sup> For example, Larssen-Freeman (1997; 2009 with the Five Graces Group) has divergent opinions regarding the possibility of reconciling Generativism and DST. De Bot, Lowie and Verspoor. do the same in their papers cited in this article (2007a; 2007b).

## CONCEBENDO A LÍNGUA COMO UM SISTEMA ADAPTATIVO COMPLEXO: UM PROBLEMA PARA A PESQUISA EM AQUISIÇÃO DE SEGUNDA LÍNGUA?

### RESUMO

O presente artigo visa a discutir o impacto da adoção de uma perspectiva que concebe a língua como um Sistema Adaptativo Complexo no trabalho desempenhado por pesquisadores da área de Aquisição de Segunda Língua. Para tal, o texto apresenta, inicialmente, a definição de língua como um sistema adaptativo complexo, em contraste com a perspectiva que tradicionalmente permeia pesquisas na área. Em seguida, disserta-se acerca das principais contribuições dessa perspectiva para a área de Aquisição de Segunda Língua. Finalmente, trata-se das implicações da adoção de tal perspectiva para a pesquisa na área. Argumenta-se que conceber a língua como um Sistema Adaptativo Complexo pressupõe uma mudança no paradigma de visão do que é esse objeto de estudo, fazendo com que pesquisadores precisem levar em consideração múltiplos fatores em interação. Embora, a princípio, tal necessidade possa ser encarada como uma barreira para a condução de estudos científicos na área, conclui-se que essa possa ser, na verdade, um fator motivacional.

**Palavras-chave:** Teoria dos Sistemas Dinâmicos. Língua como Sistema Adaptativo Complexo. Aquisição de Segunda Língua.

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