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ORCHESTRATING CHAOS: TEACHING FOREIGN LANGUAGE PRONUNCIATION IN THE COMPLEXITY PARADIGM

ORQUESTRANDO O CAOS: O ENSINO DE PRONÚNCIA DE LÍNGUA ESTRANGEIRA À LUZ DO PARADIGMA DA COMPLEXIDADE[1]

ORQUESTANDO EL CAOS: LA ENSEÑANZA DE PRONUNCIACIÓN DE LENGUA EXTRANJERA A LA LUZ DEL PARADIGMA DE LA COMPLEJIDAD

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ABSTRACT: In this paper, we propose a theoretical discussion on foreign language pronunciation teaching considering the Complexity Theory (e.g., BECKNER et al., 2009). To this end, we analyzed the framework for communicative pronunciation instruction proposed by Celce-Murcia et al. (1996) and Celce-Murcia et al. (2010), taking the Complex Adaptive Systems Theory as reference. In this analysis, the framework proposed is considered to be able to sustain the metaphor of Complexity applied to language, as it considers that multiple agents must interact in an organic manner during the teaching and learning processes, and that the behavior of a speaker is gradually built based on his past experiences. However, we point out that following the steps proposed in the framework does not necessarily guarantee the dynamicity needed in teaching. Therefore, we highlight the role of qualified professionals to implement and to orchestrate Complexity in the foreign language classroom.
KEYWORDS: Complexity theory. Complex adaptive system. Pronunciation teaching.

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RESUMO: No presente trabalho, propomos uma reflexão teórica sobre o ensino de pronúncia de língua estrangeira à luz da Teoria da Complexidade (e.g., BECKNER et al., 2009). Para tanto, analisamos o *framework* para o ensino comunicativo proposto por Celce-Murcia et al. (1996) e Celce-Murcia et al. (2010), tendo como base os Sistemas Adaptativos Complexos. Nesta análise, fica colocado que o modelo proposto poderia vir a ser capaz de sustentar a metáfora da Complexidade aplicada à linguagem, por contemplar o fato de que múltiplos agentes devem interagir organicamente durante os processos de ensino e aprendizagem, e que o comportamento de um falante é gradualmente construído tendo como base suas experiências anteriores. Todavia, apontamos que apenas seguir os passos propostos pelo *framework* não garante que a dinamicidade se instaurará no ensino. Destacamos, então, o papel do profissional devidamente qualificado para implementar e orquestrar a Complexidade na sala de aula de língua estrangeira.

PALAVRAS-CHAVE: Teoria da complexidade. Sistemas adaptativos complexos. Ensino de pronúncia.

RESUMEN: En el presente trabajo, proponemos una reflexión teórica sobre la enseñanza de pronunciación de lengua extranjera a la luz de la Teoría de la Complejidad (e.g., BECKNER et al., 2009). Para tal fin, analizamos el modelo para la enseñanza comunicativa propuesto por Celce-Murcia et al. (1996) y Celce-Murcia et al. (2010), teniendo como base los Sistemas Adaptativos Complejos. De nuestro análisis surge que el modelo propuesto podría ser capaz de sustentar la metáfora de la Complejidad aplicada al lenguaje, toda vez que contempla el hecho de que múltiples agentes deben interactuar orgánicamente durante los procesos de enseñanza y aprendizaje, así como que el comportamiento de un hablante es gradualmente construido teniendo como base sus experiencias anteriores. Sin embargo, apuntamos que apenas seguir los pasos propuestos por el modelo no garantiza que el mismo venga a instaurarse de una forma dinámica en la enseñanza. Destacamos, de esta forma, el papel del profesional debidamente cualificado para implementar y orquestar la Complejidad en las clases de lengua extranjera.

PALABRAS CLAVE: Teoría de la Complejidad. Sistemas adaptativos complejos. Enseñanza de pronunciación.

1 INTRODUCTION

Although Complexity Theory (CT) only had its own identity as a research field recognized in the mid-1980s, it dates back to the early 20th century (NEWELL, 2008). Despite being based on mathematical theories and Physics, its concepts and techniques have been applied to several other fields, which include, for example, Anthropology, Economics and Meteorology, Education, and General and Applied Linguistics. In relation to the latter, more specifically to language teaching, authors such as Holland (1998), Kindt et al. (1999), and Finch (2001) have already manifested a positive position in favor of the application of Complexity to foreign language teaching (FLT) in the last decades. Van Lier in 1996, before Larsen-Freeman's seminal work on language (1997), already suggested the instructional context could be considered a Complex Adaptive System (CAS). However, in the area of language as a whole, though growing, studies in CT still represent an embryonic movement.

In regard to language, Larsen-Freeman (2013) points out CT is capable of challenging the conception that language is a static and rule-governed system, pointing out THE language use itself can change its very own patterns. In addition, CT does not advocate the need for an innate acquisition device, since it assumes that the creation of a complex system does not demand an initial stage characterized by detailed plans or templates (LARSEN-FREEMAN, 2013, p. 369). Thus, we believe in the potential of CT to shed light on phenomena that are inherent to Applied Linguistics, as CT opposes to the group of Language Acquisition theories that are deterministic and that, by being so, fail to include dynamicity and/or variation in their assumptions. This proposed view also breaks with the models that are unable to consider the nonlinearity of the developmental process.

Therefore, by believing in its potentiality and in an attempt to feed the theoretical current that has been placed in language studies, we intend to review some concepts of CT in order to apply them to foreign language pronunciation teaching (FLT). In other words, this article revisits the teaching of FL pronunciation, considering language a Complex Adaptive System (CAS). To our knowledge, there are no studies still in this very specific perspective – i.e. that aim to bridge the gap between CAS theory and pronunciation teaching.

Concerning the methodological trends in FLT, in addition to having undergone a series of transformations throughout history, the phonetic-phonological component is an aspect whose pedagogical treatment has always raised effervescent debates. Regarding pronunciation teaching over the years, we may observe some approaches ranging from highly mechanistic to perspectives that advocate no instruction at all. In the midst of these divergent positions, we find authors who argue in favor of communicative pronunciation teaching. For instance, Celce-Murcia et al. (1996) and Celce-Murcia et al. (2010) propose five communicative steps for pronunciation teaching: (i) description and analysis; (ii) listening discrimination; (iii) controlled practice and feedback; (iv) guided practice and feedback; and (v) communicative practice and feedback.[2] Through this pedagogical routine, we find a framework in which pronunciation teaching would start from an analytical treatment of the target items, evolving to teaching stages in which learners use the FL sounds in an organic way and with authentic communicative purposes.

The CT, as Larsen-Freeman (2013) points out, is understood as a metaphor and may rely on other language approaches that are consistent with its postulates. This approximation allows CT to take a scientifically valid form, representing an effective benefit to General and Applied Linguistics. A theory based on Complexity does not conceive a set of pre-established static rules for language teaching, as a system depends on the peculiarity of the agents such as distinct subjects and distinct idiosyncrasies that may vary from one context to another. With this in mind, in this study we intend to analyze whether the pronunciation teaching framework proposed by Celce-Murcia et al. (1996) and Celce-Murcia et al. (2010) could be applied following the tenets of CT; in other words, we aim to discuss if this model is capable of sustaining the complex phenomena found in language teaching. According to Borges and Paiva (2011), scientific revolutions do not manifest themselves as a strict break with the scientific knowledge produced previously, but as a new way of looking at the same object of study. Thus, we intend to analyze if the methodology contemplated by the framework is congruent with Complexity, which we see as of paramount importance so that linguistic knowledge may arise.

We begin this article with a brief introduction to Complexity and a characterization of Complex Adaptive Systems (CAS). Then, we approximate CAS to natural language processes, by addressing how this new paradigm comprises language development. Finally, we approach FL pronunciation teaching under the Complex scope, providing an initial analysis of the framework proposed by Celce-Murcia et al. (1996) and Celce-Murcia et al. (2010). We conclude by pointing out our considerations about the possible consonance between this pedagogical proposal and CT.

2 COMPLEX ADAPTIVE SYSTEMS

According to Mercer (2013, p. 376), under the aegis of Complexity theories, there are innumerable approaches, such as Complex Adaptive Systems Theory, Dynamic Systems Theory, Chaos Theory, Network Theory, among others. Although there are, of course, differences between Complexity-related theories, they all share some basic characteristics. Essentially, a dynamic perspective to language describes holistic, organic, and emerging systems that are composed of two or more interrelated systems, which may *per se* represent other complex/dynamic systems (MERCER, 2013). Barriers between systems, therefore, are no longer clear, since a system is usually also part of other systems. All elements of a given system are at the same time influencing and being influenced by all the others. Thus, it would be virtually impossible to comprehend the whole of a system, since boundaries and interdependencies are almost infinite.

According to Horn (2008), we can distinguish the Paradigm of Simplicity – which, in terms of linguistic models, finds theoretical contributions in proposals based on Generative Grammar (CHOMSKY, 1957), for example – from the Paradigm of Complexity by means of seven principles. First, (i) Simplicity adheres to the principles of universality, while Complexity, without denying a possible universality, also adopts the principle that the individual and the local are intelligible in themselves. Horn (2008) points out (ii) Simplicity seeks to reduce wholes into simple constituents, while Complexity integrates elements into their sets. The third aspect that differs these paradigms is that (iii) Simplicity seeks principles/rules for order in a given system; Complexity, on the other hand,

[2] Further details about these steps will be provided in the fourth section below.

seeks to self-structure even in disorder without the consideration of rules. As already mentioned, (iv) Simplicity assumes determinism and linear causality, while Complexity seeks possible, paradigmatic and parallel relations. Separating the subject from the object, as well as the observer from the observed (v), are characteristics of Simplicity, while the observer is integral in relation to experimentation in Complexity. In addition, (vi) Simplicity treats contradictions as errors, and Complexity refers to contradictions as paradoxes/indices of the fact that an even deeper reality may exist. To conclude, Horn (2008) points out (vii) Simplicity fosters monological thinking, while Complexity gives rise to a dialogical reasoning, by relating opposing concepts in a complementary way.

Even if we understand the difference between the Simple and the Complex, it is worth mentioning that Larsen-Freeman (2013) highlights that there is still a lot of confusion about the term 'Complexity'. We cannot, for example, confuse "Complex" with "complicated", as Davis and Sumara (2006) signal this difference. To the authors, although a complicated system may have numerous components, the relationship between such components is fixed and clearly defined, as in the gears that operate a watch, for example. We may also say the constituent elements of these systems have a relation of independence with each other. As Miller and Page (2007) point out, it would be even possible to remove one of these components without having the system presenting changes in its final behavior, even if it presents minor faults. The example that the authors bring is that of removing one of the seats of a car. Even without one or all of its seats, the vehicle will continue to function perfectly.

On the other hand, some systems present a distinguished relationship between their elements and cannot be disassembled and then reorganized. One of these systems is the Complex System, in which the interactions between components are not fixed and well defined, but are always subject to new adaptations, though an organization, even if bordering Chaos, is always the estimated behavior. The complexity of these systems arises precisely from this relationship of interdependence between its constituents. Removing one of these constituents might compromise the behavior of the system in an unpredictable way. In this case, a dynamic system can be even sentenced to death (MILLER; PAGE, 2007), or even present a completely different behavior from that seen before the removal of one of its components. Thus, "the global behavior of the system emerges from those interactions, but cannot be described as the simple sum of the behaviors of each agent." (PAIVA, 2011, p. 44, our translation). As Holland (1995) points out, complex systems are composed of active elements. Such elements can adapt and change their behaviors due to their interactions. In view of this, all elements of a system are at the same time influencing each other. Thus, behaviors or changes are not proportional to their causes, and a small variation or a small new input might bring about great changes in the whole system. Then, as defended by Paiva (2011), every complex system is an open system and energy can either enter or leave it in unpredictable proportions. We can also point out complex systems are self-structuring and self-sustaining by having the capacity to adapt according to the environment and with the energy received or expended. Therefore, these systems are subject to constant transformation; in this fashion, to Williams (1997), a complex system is everything that moves, changes, or evolves with time.

Another point that needs to be addressed is that most Complex Adaptive Systems present what mathematical theorists call 'attractors', the states in which the system reaches stability or a comfort zone, depending on its peculiarities. According to Larsen-Freeman and Cameron (2008), attractors would be the particular states of behavior that a given complex system "prefers". Thus, the term 'attractor' does not characterize something that attracts, but refers to the (temporary) behavior or stability of a system. As stated by Mercer (2013), an element of the system can also act as an attractor, that is, this element can influence the developmental trajectory of a complex system.

In addition, we cannot fail to mention that complex systems are emergent. This means that, at a given point in time, agents of these systems show interactions and collaborations that underlie the structure that governs their existence. This is the point at which the components create something greater than they could constitute individually, as a structure without divisible constituents and whose connectivity is (should be) permanent. A complex system has a self-structuring tendency to seek some balance in its inherent unpredictability. This system, thus, only exists at the edge of Chaos.

3 CHAOS AND LANGUAGE

With regard to language development, it is known that the patterns of use, as pointed out by Usage-based Phonology (BYBEE, 2001), affect how a language is developed, used, organized, and even how it may vary throughout the life of an individual. These processes would thus be interdependent, according to Beckner et al. (2009). For these authors, the language as a CAS account has the following basic characteristics:

(i) the system consists of multiple agents that interact with each other, such as, for example, speakers in a given community;

(ii) the system is adaptive, since the behavior of a speaker is based on his past interactions; however, such interactions, alongside current ones, are the factors that will delineate future interactions;

(iii) the behavior of a speaker is the consequence of competing factors, ranging from perceptual restrictions to social motivations;

(iv) the structures of a language emerge from the interrelated patterns of experience, social interaction and cognitive mechanisms/processes.

Concerning language development under this prism, usage-based theories, according to Larsen-Freeman (2013), provide CT with a direction. These theories (e.g. BYBEE, 2001) advocate that one learns language constructions and linguistic categories by engaging in organic communication through interpersonal and cognitive processes (SLOBIN, 1977). To Beckner et al. (2009), development is a complex and probabilistic analysis of language samples. This involves the estimate of the norms of a given speech community, through limited samples derived from the experiences perceived by one's cognitive machinery, psychomotor capacities, as well as by the dynamics of social interaction itself.

Bybee and Hopper (2001), for example, point out that each event of effective (authentic and purposeful) language use exerts influence on the learner's system. Therefore, in order to understand more about language development in Complexity, we must consider it under this usage-based context. Bybee (2001) and Heine and Kuteva (2007) assume that grammar is, in a certain way, a replication process. Since mankind became able to put two words into the same sentence, we have been able to develop grammar by using sequential processing, categorization, conventionalization, and inferencing mechanisms. Therefore, grammar is seen as an uninterrupted process in all languages at all times. In this sense, as Mercer (2013) points out, changes can be gradual or abrupt over time. In both cases, changes are caused by the cumulative effect of factors. As already seen, a small disturbance in the system can lead to wide changes in the whole system, and the language is not immune to such effect.

As for FL development, language constructions are closely related to frequency, recency[3] and context. According to Larsen-Freeman (1997, p. 62), just like what happens in their mother tongue, learners do not conform to the FL; "they go beyond, building new forms through analogies and recombination of patterns." Although first language (L1) and FL are somewhat similar in their constant reorganization of patterns, their developmental processes differ in a number of ways. Both L1 and FL development are sociocognitive processes; however, the environment or conditions in which FL development takes place is significantly different, as the learner is more cognitively mature (BECKNER et al., 2009). Thus, the task of elucidating FL phenomena involves some complexity that goes much beyond the one found in L1 studies. In order to pursue this goal, we must compulsorily depart from the L1 systems.

We can therefore conclude that a linguistic system, according to this view, is the result of dynamic cycles involving language use, language change, as well as perception and learning in the interactions of members in a linguistic community. Sequential processing, the planning and categorization abilities enable us to construct a linguistic system. However, these skills do not demand the effective use of language; we need to speak because of social interaction. Thus, although language is shaped by cognitive abilities, social life determines what we know as language. Therefore, both the origin and our linguistic abilities should be guided by the social environment (BECKNER et al., 2009). We learn language constructions/ patterns by engaging in real communicative acts, through

[3] Ability or ease of memorizing elements from recent stimuli.

authentic interpersonal processes. Linguistic knowledge is then the result of a probabilistic analysis of the norms of a speech community through the cognitive apparatus, the human body and the very system of social interaction. From this perspective, a linguistic system is constructed via and only via actual language use. Thus, the cognitive organization of a language is directly marked by the linguistic experience of a speaker.

4 COMPLEXITY IN LANGUAGE TEACHING

Learning a language is a chaotic process; it represents a constant reorganization of a system that is constantly changing. Although each student may learn in a specific way, based on different variables and at different times, there are, however, certain stages that all learners apparently have to go through. Complex Adaptive Systems, therefore, can also be used to understand these stages. In addition to the complexity of language, any teacher who has actually engaged in teaching practices knows that only rarely will a sole factor change the dynamics of the class and the learning process. In fact, according to Mercer (2013), there are multiple causes that make changes in the surface, as in any nonlinear system. Thus, the classroom is a CAS by nature, presenting the unpredictability that is fit for it. There are several agents; however, some factors or components play a more robust role in this complex language classroom, such as teachers and the language systems themselves. These items, for Mercer (2013), would be the attractors of/in that system.

In order to understand language teaching in this paradigm, we must first keep in mind that (i) use leads to change, change affects perception, perception affects learning, and learning affects use; and (ii), according to Van Lier (1996, p.1 70), we cannot conceive learning is caused by environmental stimuli only (a behaviorist position), or that it is genetically determined (an innatist position). It is, in fact, the result of complex interactions between individuals and the environment (PAIVA, 2011).

Larsen-Freeman (1997) states that languages go through periods of chaos and order, as well as any living system. This borderline between chaos and order – the point at which the system is almost becoming chaotic – is called the "edge of chaos". Waldrop (1992) coined the term "life on the edge of chaos" to refer to the learning capacity of a CAS when it is neither chaotic nor stable (FINCH, 2001). We can then see that a system can only self-structure when it faces/borders the edge of chaos. In other words, the system must first be unstructured or "messed up" in order to stabilize in a new state, according to its new attractors.

A closed system – one that does not receive or release energy, according to Kindt et al. (1999) – tends to stabilize in a "dead" state, while an open system can become intensely animated and highly coordinated. As for language teaching, the term "closed", according to the authors (KINDT et al., 2009, p.14), refers to the language class that presents mechanistic exercises restricted to answers of "right" or "wrong", and which are not likely to remain in the learners' memory. On the other hand, organic communicative activities with real communicative purposes contribute to wider, productive and almost inexhaustible knowledge. Since a CAS is an open system, and because language teaching should be viewed as a CAS, we must consider which exercises, or even which methods or frameworks should be applied to the FL class, so that Complexity and (consequently) learning perpetuate.

Almost all aspects of language teaching are complex, since any learner or teacher has several factors/agents to deal with. Even the best planned class could become ineffective for various unpredictable reasons, given its complexity and unpredictability. In this sense, CT does not offer a set of rules to teachers so that they can deal with the Chaos of a classroom. Rather, it can serve as a basis for reflection on teaching methodologies that do not reduce teaching to a level of Simplicity and reductionism. CT does not conceptualize a classroom as a machine in which inputs are processed and outputs are generated, as a place of exercise, or even as an exercise. Indeed, CT accounts for the convergence of several distinct elements that extend beyond the time and spatial location of a "room" and that combine in dynamic relations (BURNS; KNOX, 2011). Behavior, linguistic or not, is a product of the interactions of these distinct elements. According to Clarke (1999), in this perspective, the role of the teacher is to manage this change of active agents in this system. This is more than simply providing information to a passive and purely receptive and reproductive student. In other words, teachers should play the role of attractors.

As we turn our attention to more specific issues on pronunciation teaching, we should bear in mind that Complexity predicts a dynamic developmental process, based on language use. Usage-based models such as Exemplar Theory, in tune with CT, point out we relate already categorized L1 sound patterns to still unknown FL patterns (CRISTÓFARO-SILVA, 2007). In this way, the learning of pronunciation implies categorizing new sounds as distinct units, and this process departs from the L1 sound system, which influences the FL learning process directly (FLEGE, 1995; BEST, 1995; BEST; TYLER, 2007). This is precisely why this process is permeated by phonetic-phonological transfer.

Phonetic-phonological transfer refers to the use of already established L1 patterns in FL production. Based on the assumption that FL learners already have a complete and operative cognitive system in their L1, phonetic and phonological aspects of their FL connect to the L1 system, maintaining relations of similarity and difference between them (FLEGE, 2002). Thus, in a complex perspective to language, the transfer of patterns is a learning strategy that is inherent to the process itself, since the brain works in parallel, in an interconnected way, not linearly. In its beginning, FL development is strongly influenced by the L1, which is a highly organized cognitive system. However, according to MacWhinney (2002), this strong association between the L1 and the FL will gradually dissipate, even if residual transfer remains throughout life. In a dynamic view, the concepts of 'transfer' and 'entrenchment' are imbricated (ZIMMER, 2004, 2008; ZIMMER; ALVES, 2006, 2012; SEIDENBERG; ZEVIN, 2006). As MacWhinney (2006) points out, when a task is practiced several times, it is expected to be automatized or entrenched, and the more effective the use of this task, the deeper the entrenchment. Therefore, the L1 is expected to be more robust than the FL. This will have effects in processing, and in phonology results in a foreign accent, since the FL sounds can be processed through similar L1 sounds. Concerning the perception of FL sounds, according to Flege (1995), L1 and FL sounds coexist in a single phonological space; this allows for phonetic-phonological transfer.

Aiming to reduce the impact of phonetic-phonological transfer in the developmental process, in agreement with Cristófaro-Silva (2007), a pedagogical practice that can be of great value involves explicit instruction.[4] However, in a Complexity perspective, linguistic knowledge is seen as a product of social constructivism, as it is the result of the collaborative use of language by learners. In a system that promotes collaboration, the exchange of ideas and information does not follow linearity, in a single direction without considering feedback; instead, they are always at the edge of Chaos. This involves all agents in an activity that does not have an established direction, which evolves in all directions, which goes backwards when necessary, which impacts and modifies the initial state of the activity. In CT, this is called *feedback loops*, which cannot be sustained by a mechanistic or formulaic method. We cannot control our learners, but we can guide the classroom so that learners notice details in the target language hitherto unnoticed. We can help them deconstruct their starting systems, to the edge of chaos, and, by means of organic communicative activities, attract them to potential linguistic reorganization. For this, we must not forget the role of feedback, which is found in nature and is central to language teaching, as we consider that gradualness in inherent to the whole learning process.

Taking this into consideration, an ideal model for pronunciation teaching guided by Complexity should contemplate both explicit instruction and socio-communicative practices in the target language. This entails bringing the experiences and realities of the learner to the classroom environment, and making the phonetic-phonological aspect correspond to a mechanism through which he/she will be able to share such experiences. In the next section, we analyze the framework for communicative pronunciation teaching proposed by Celce-Murcia et al. (1996) and Celce-Murcia et al. (2010).

[4] According to Zimmer, Silveira and Alves (2009), 'explicit instruction' may be interpreted as an umbrella term, referring to classroom activities that go much beyond the simple task of systematizing target items. In accordance with these authors, we also conceive that 'explicit instruction' encompasses classroom procedures such as highlighting, practicing, revising and drawing explicit attention to the target items, which tend not to be noticed in the absence of this classroom practice.

5 PRONUNCIATION TEACHING AND CT: INITIAL UNFOLDING

Both the FL classroom and the practice of FL teaching itself are complex systems. When analyzing a teaching approach in this perspective, we do not try to classify it as complex or not. Rather, we consider its potential to both maintain the complexity inherent in the teaching process/system and build new scientific knowledge on language teaching. As our goal is to analyze a framework for pronunciation teaching, it is worth emphasizing that this analysis is based on a hypothetical application of what is proposed by Celce-Murcia et al. (1996; 2010) in what would be ideal learning conditions, that is, taking students as actively autonomous and participatory in the process. In this sense, we characterize the teacher as a qualified individual for the proposed task, which must have a consistent formal and applied training in the English language and Applied Linguistics.

Basically, the framework proposed by Celce-Murcia et al. (1996) and Celce-Murcia et al. (2010), aiming at what the authors conceive as "communicative pronunciation teaching", comprises five steps: (i) **description and analysis**, in which the target form is made explicit; (ii) **listening discrimination**, in which perceptual discrimination tasks are applied; (iii) **controlled practice and feedback**, including the repetition of some preset items by the teacher in a still controlled and mechanistic way; (iv) **guided practice and feedback**, in which learners have a little more autonomy to use the items seen in the previous step in a less controlled and mechanistic way; and (v) **communicative practice and feedback**, which takes place when the learner can produce target forms freely, facing organic communicational situations without being instructed to use the target forms.

It should be noted that although the model provides five steps, they are not based on a Cartesian logic, according to which one step is tightly applied after the other in a single direction. They are, on the other hand, based on a perspective of gradualness, which implies that linguistic evolution comes to light through the accumulation of small modifications as a function of time. In addition to predicting an evolution in periods of discrete time, the steps do not encapsulate the learners' linguistic behavior; this may give rise to random and individual behavior, justifying the presence of feedback. Thus, depending on the target items addressed and the classroom setting itself, it may not be necessary to apply all five steps, and the sequence can also be modified. In addition, the progression of the five steps should guarantee that the use of the phonetic-phonological aspects follow a logical sequence. This is possible because target items become systematized in a more controlled environment; then, they progress along the framework and are inserted in larger communicative contexts, where their use is not controlled as an item *per se*, but rather as part of a larger goal. Zimmer, Silveira and Alves (2009) point out these five steps, alone, are not effective without the commitment of a trained teacher, or without the articulation of the phonetic-phonological components with other language domains.

As seen earlier, one of the issues that we should take into consideration in pronunciation teaching is the role of entrenchment (and hence the role of language transfer) in the developmental process. Silveira and Alves (2009) point out that the development of a FL sound system is a complex process, since it certainly involves a certain degree of awareness about the target forms. In order to acquire a FL sound system, learners: "[…] must be aware that the target language sounds are not necessarily the same ones produced in their L1. It should also be known that the possibilities of sound sequences that occur in the target language differ from those that emerge in their mother tongue." (SILVEIRA; ALVES, 2009, p. 149).

Moreover, another argument in favor of explicit instruction is the fact that learners cannot always segment into smaller units the acoustic string to which they are exposed to (CELCE-MURCIA et al., 1996). There is also the tendentious act of interpreting new FL sounds as belonging to L1 similar categories, and these sounds are not perceived as new (FLEGE, 1995; BEST; TYLER, 2007). Thus, as the behavior of a speaker also results in the competition for perceptual constraints, the model proposed by Celce-Murcia et al. (1996) and Celce-Murcia et al. (2010) includes the explicit instruction of target language sounds, leading the learners' system to structural disorganization, which is gradually structured by means of communicational situations. We can then point out the proposed framework understands that FL structures emerge from patterns of *empeiriai*, interaction and cognitive processes. In this sense, the first steps proposed by Celce-Murcia et al. (1996; 2010) contemplate a practice that may potentially develop sequential processing mechanisms, categorization and conventionalization, which are pertinent to the acquisition of an FL.

As we can see in the description of the five steps, this framework assumes that the cognitive organization of language is directly marked by the linguistic experience of a speaker, also considering a dialogical character in development. In addition, we conceive

that the individual, both in terms of linguistic development and world views and positions, may share knowledge and ideas with others in the fourth and fifth steps. In these two steps, target items are used in activities in which the learner is invited to present his/her points of view regarding different issues. This reflects the interpersonal processing of data to which the learner is exposed and the socio-communicative practice itself, which are the founding agents of the complex system that the classroom is.

We consider the framework proposed by Celce-Murcia et al. (1996) and Celce-Murcia et al. (2010) to be in tune with what the complexity theory predicts for language teaching. In addition to being permeated by feedback loops, the activities that may be proposed in this communicative framework gradually evolve from the perceptual to the communicative, from the disturbance of a system to its new stabilization. This is made clear in the last two stages, which have the merit of escaping from the traditional perspective of FL teaching. Thus, the framework contemplates the fact that multiple agents must interact organically, and that the behavior of a speaker is gradual and based on previous experiences, also represented by the gradualness contained in the steps proposed in the framework.

In the fifth step (communicative practice and feedback), learners are faced with tasks that require the use of the newly learned structures in a genuine exchange of information (CELCE-MURCIA et al., 2010, p. 48). By doing so, learners are found in a real communicative sphere where they can experience the uncrystallized use of what has been learned and begin to reorganize their linguistic system, since it is the very use that guides language development. Most importantly, the phonetic-phonological component is no longer regarded as a linguistic entity that is isolated from the other language components. Indeed, it becomes one among other several structures whose employment can guarantee a better performance in the communicative goal.

We consider it imperative that all steps of the framework be turned into organic realities and, preferably, linked to an authentic communicative purpose, relating the phonetic-phonological knowledge to other target language competences. Throughout the development of all stages, a communicative goal must be made clear. It is precisely this integrationist motivation between form and function that effectively allows us to think about the five steps proposed by Celce-Murcia et al. (1996) and Celce-Murcia et al. (2010) in a CAS perspective. Otherwise, these five steps run the risk of being used as a mere pedagogical routine, focusing solely on a non-communicative linguistic goal. This would reflect a traditional approach to pronunciation teaching, as it does not link the phonetic-phonological component to the other language components, without reflecting the dynamism that characterizes the process of language development. Therefore, it is the teacher's task to use this framework in a dynamic/complex way, making it representative of a situation of authentic language use.

If the framework by Celce-Murcia et al. (1996) and Celce-Murcia et al. (2010) is then implemented within a communicative context, learners may be on the edge of (communicational) chaos. They will then work as active agents of a complex and adaptive system as they attempt to deal with its perceptual and social constraints, leading this very same system to self-structuring. Through the five steps, there is some potential for the students' language systems to change and self-structure, since a language is understood as an open system. There are, therefore, formal mechanisms that allow the maintenance as well as the exchange of energy with the environment. In addition, the model proposes a gradual interaction between the first and foreign language. This enables coadaptation and facilitates the reconstruction of the linguistic system by means of a guided trajectory; as stated by Demo (2008), we reconstruct knowledge from what is already known and is culturally available. It is important to clarify, however, this dynamic scenario is not an intrinsic characteristic of the model itself: although the framework plays a role in it, Complexity is established from and with such a framework, in a given classroom and among the agents that belong to it. The role of the teacher is fundamental in this learning environment, and the teacher-student interaction is an essential condition for the framework to allow for complex and meaningful pronunciation learning.

Language in Complexity must be composed of multiple adaptive agents, based on gradual experiences. Above all, language must be emergent, dynamic, and take into account cognitive and social features (BECKNER et al., 2009). The pronunciation teaching framework we analyzed does not corrupt any of these characteristics. It allows the system to gradually adjust in order to establish the greatest attractor of this system, which corresponds to effective and intelligible communication in the foreign language. We consider that the use of this framework may allow the integration of the phonetic-phonological component to other language aspects, thus enabling language-in-use situations that express the dynamism of a CAS. In addition, the model is in tune with the

four goals that, according to Larsen-Freeman and Cameron (2008), a complex teaching approach should pursue: (i) to foster the connection between brain, body and world; (ii) to organize itself in the complexity of language and other components of a classroom; (iii) to emphasize the negotiation of meaning; and (iv) to focus on the processes of learning and performance.

It is worth noting that an appropriate implementation of the framework depends on the teacher, and requires constant readjustments according to the dynamics in his/ her classroom. As explained by Borges and Paiva (2011), we must conceive the teacher as one of the elements that provide the teaching-learning process with dynamicity, since linguistic knowledge is organized through the co-construction among teachers and students. We cannot disregard that the proposition of the five steps *per se*, depending on how such steps are used by the teaching professional, can also enable the teaching of five unrelated tasks, resulting in a rather mechanistic approach. In other words, teachers play a pivotal role in their ability to deal with interactional situations within the reality of their classrooms. Teachers may make it possible for the five steps in the framework to characterize a communicative environment, following the tenets of facing language as a CAS. This pedagogical role will only be instantiated through teacher-student interaction, which corresponds to a fundamental entity in the midst of the complexity established in the teaching environment. The sole application of the five steps in the framework does not necessarily guarantee a communicative approach to the teaching process. In other words, this framework may work as a possible pedagogical alternative, but it is not enough by itself, as teachers and students are a fundamental piece in this complexity. We should conclude, therefore, that models/approaches for successful FL teaching should aim to guide pedagogical actions in the classroom, instead of being seen as a norm.

6 FINAL REMARKS

Complexity Theory sees teaching as a promotion to Chaos. It is through teaching that new energy is potentially destined to a complex system, which might already be in a state of preference or comfort. When receiving new input, the system must readapt in order to find a new zone of preference/attractor so that it can bring about new (learned) behavior. Therefore, it is only through Chaos, it is by being at the edge of Chaos, that a learner may be able to build new linguistic knowledge. This considered, we should always be concerned with comfort zones that are deliberately implemented by linear and purely mechanistic methods for pronunciation teaching. This is why we should consider the possibility of using the communicative framework proposed by Celce-Murcia et al. (1996; 2010). Indeed, if embedded in a conception of language development that emphasizes dynamism and the integration of the active components in the process, this framework may be able to give rise to some destructuring of the learner's system. This would represent the first step in its restructuring, as linguistic development is characterized by this constant process between (dis) and (re)organizing and constructing. In this sense, the use of the term "to be able" should be emphasized, since the dynamism that characterizes the integration of pronunciation into the establishment of the communicative environment involves, but is not limited to, the five teaching steps *per se*. The possibility of conjugating pronunciation teaching to the reality of the learner, made possible in this framework, allows Complexity to be established. In this environment, students and teacher bring their experiences and make them explicit through the use of language. This combination of many factors is what characterizes Complexity.

In this paper, we attempted to approximate Complexity Theory to FL pronunciation teaching (traditionally seen as a mechanistic activity). We sought to point out that learning is a product of a complex system of forces and agents that are in constant interaction. By considering language as an open system, we conclude that protocol exercises or methods would not be able to change the weights of some of these agents and, consequently, there would be no new adaptation of this system in search of a new attractor. With this in mind, we analyzed the framework proposed by Celce-Murcia et al. (1996) and Celce-Murcia et al. (2010), as well as the assumptions regarding the success of their proposal. We can then conclude that this framework, depending on the interaction between teacher and students, can relate to the paradigms that advocate both the role of explicit instruction and that of effective language use. In the midst of this complex process, the phonetic-phonological component is no longer the only target aspect to be reached; students learn to interact through language, which implies the use of all its components. In other words, in this complex scenario, the solution is not to be found in the framework itself, but rather in the interactions and in the conjugated action of

variables that such a framework can bring about. Considering that this teaching model may go far beyond the mere "listen and repeat" practice, we conclude that its contextualized use might be able to lead learning to the edge of Chaos. This should enable their developing systems to seek new configurations and, consequently, new linguistic behavior, providing room for learning.

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