THE INFLUENCE OF AGENTS IN LANGUAGE LEARNING AS A COMPLEX SYSTEM: THE BUTTERFLY EFFECT AND THE EDGE OF CHAOS

A INFLUÊNCIA DE AGENTES NA APRENDIZAGEM DE LÍNGUAS COMO SISTEMA COMPLEXO: O EFEITO BORBOLETA E A BEIRA DO CAOS

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Abstract: *Complexity Theory studies complex systems, which present phenomena that contribute to change: the edge of chaos and the butterfly effect. This study aims to identify aspects of Complexity Theory in Advising in Language Learning (ALL), to evidence the consequences of the edge of chaos and the butterfly effect in complex systems and to analyze the influence of agents in the emergence of these chaotic situations. Some of the theoretical references of this research were Larsen-Freeman (1997), Larsen-Freeman and Cameron (2008) and Mynard (2012). In order to conduct this study, it was necessary to conduct ALL sessions. At the end, it was possible to notice that agents present in the complex system of the student contributed to the appearance of the edge of chaos and the butterfly effect. These phenomena had positive and negative effects on the advisee's learning trajectory, which were unpredictable in the initial conditions of the system.*
Keywords: *Language Learning. Complex Systems. Butterfly Effect. Edge of Chaos.*

Resumo: *A Teoria da Complexidade estuda sistemas complexos, que apresentam fenômenos que contribuem para mudança: a beira do caos e o efeito borboleta. Este estudo possui como objetivo principal identificar aspectos da Teoria da Complexidade no aconselhamento linguageiro, evidenciar as consequências da beira do caos e do efeito borboleta no sistema complexo em pauta e analisar a influência de agentes no surgimento dessas situações caóticas. Alguns dos referenciais teóricos utilizados na investigação foram Larsen-Freeman (1997), Larsen-Freeman e Cameron (2008) and Mynard (2012). Para a condução desta pesquisa, foi necessário recorrer às sessões de aconselhamento linguageiro. Ao final, foi possível perceber que agentes presentes no sistema complexo da aluna contribuíram para o aparecimento da beira do caos e do efeito borboleta. Esses tiveram efeitos positivos e negativos na trajetória de aprendizagem da aconselhada, os quais eram imprevisíveis nas condições iniciais do sistema.*
Palavras-chave: *Aprendizagem de Línguas. Sistemas Complexos. Efeito Borboleta. Beira do Caos.*

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Introduction

According to the complex paradigm history, Complexity Theory is primarily related to Physics, however it can also be observed in areas such as Mathematics, Biology, Social Studies and Language Learning. This paradigm deals with complex systems and the interaction of their components and agents. Interaction is related to dynamicity, which provides the system with changes.

Advising in Language Learning (ALL) is another relevant topic which guided the theoretical part of this research. This practice aims at helping learners in finding ways to have a meaningful language learning experience. In this process, advisor and advisee work together in order to construct an autonomous learning trajectory.

Complex systems present characteristics that indicate their intricacy. The butterfly effect and the edge of chaos are examples of aspects that outline this complex nature. These aspects are influenced by agents that are part of the systems. Understanding the role of these agents is valuable to explain the systems' trajectory.

The idea of Complexity Theory being associated to Language Learning has been established in the last 20 years. Many authors have conducted researches in using this paradigm. In the United States of America, Larsen-Freeman (1997) was the first author who made this link. In Brazil, Paiva and Nascimento (2011) and Magno e Silva and Borges (2016) have contributed to the growth of this research field. In ALL, Reinders (2008) and Mynard (2012) have supplied Foreign Languages Acquisition (FLA) with significant ideas.

The conduction of this study, which focuses on Complexity Theory as well as on ALL, is justified due to the complex feature in Language Learning which helps students and teachers in seeing the learning and teching processes holistically. It is interesting to notice that once people observe these concepts in their real life, they cannot be unseen by them.

The main objective of this research is to identify evidences of aspects that are related to Complexity Theory in the ALL process. More specifically, the study reported in this article aims at exposing the possible consequences of the butterfly effect and the edge of chaos experienced by complex systems. Another specific objective is to analyze the influence of agents when the systems faced the butterfly effect and the chaotic situations aforementioned.

This empirical research is based on the qualitative approach. In order to collect data, ALL sessions (MYNARD, 2012) were conducted by the author of this study. The analyzed participant is an advisee and undergraduate student from the English Language Teaching Program at the Federal University of Pará (UFPA). Describing her learning trajectory was necessary to analyze two aspects from Complexity Theory: the butterfly effect and the edge of chaos.

Literature Review

This section is divided in two parts: Complexity Theory and Advising in Language Learning. In the first one, Complexity Theory and concepts related to this interdisciplinary theory are explored. In the second part, the focus moves to relevant notions to ALL.

Complexity Theory

In this subsection, aspects related to Complexity Theory are explored. First, the definition and characteristics of complex systems are mentioned. Next, concepts about the butterfly effect and the edge of chaos are highlighted. To finish, the role of elements and agents in complex systems is discussed.

Definition and aspects of complexity theory

In the 1950's, physicists first discussed Complexity Theory. In this context, "although it can be seen that the language of complexity originates in the physical sciences, the social sciences have contributed to and benefitted from similar theoretical perspectives of their own" (LARSEN-

FREEMAN, 2017, p. 13).

According to Paiva and Nascimento (2011), its origin is related to the theory of systems, Biological Sciences and cybernetics. Apart from traditional science, this theory does not deal with objective facts. It means that facts are admitted in a non-continuous line. Complexity is surrounded by "uncertainties, indeterminations and random phenomena. In a certain way, it is always related to chance" (MORIN, 2011, p. 35).

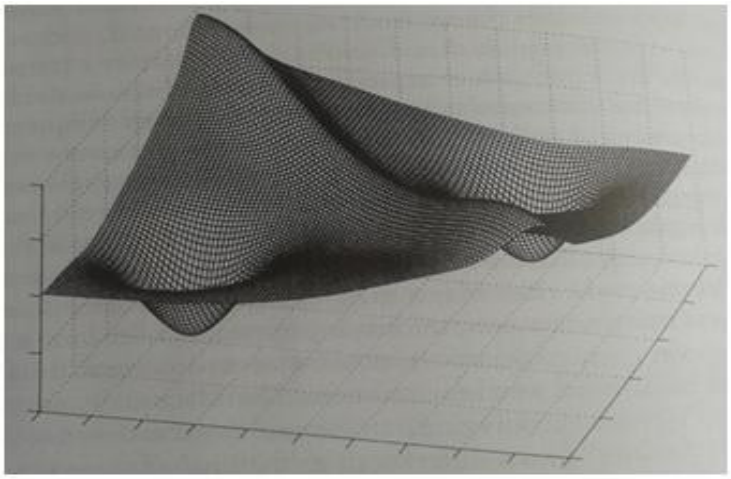
The holistic characteristic of Complexity Theory complements traditional Science and its reductionism since it considers the whole instead of the parts. Therefore, isolated elements are less important than the relation they create among themselves.

Complexity Theory deals with complex systems that interact with other complex systems. All of them are part of a bigger system. It means that there are mutual interactions among many components. From these interactions, the wholeness emerges. Larsen-Freeman and Cameron (2008, p. 26) say that "a complex system is a system with different types of elements, usually in large number, which connect and interact in different and changing ways".

Many of the Complexity Theory concepts are explained by metaphors. One of them is that complex systems can be represented topologically (Figure 1). Larsen-Freeman and Cameron (2008, p. 46) explain:

> In a vivid spatial metaphor, a complex dynamic system is visualized as wandering across a landscape, up hills and down through valleys, occasionally coming to a halt when a valley is too deep to get out of easily but resuming its journey if it gathers enough energy to escape. The landscape includes areas where the system hovers on the edge of various, very different possibilities.

Figure 1. A complex system being represented topologically



Source: (LARSEN-FREEMAN; CAMERON, 2008, p. 46)

Figure 1 represents the "state space", also called "phase state" by some authors. It is a compilation of all possible states of a system. It implies that all the possible trajectories followed by a system are represented in this topological state space landscape.

Larsen-Freeman (1997) points out a few examples of complex systems: ecosystems, global climate, the universe, language, a living cell, and the acquisition of a second language. All these systems are dynamic, complex, nonlinear, chaotic, unpredictable, sensitive to initial conditions, open, self-organized, feedback sensitive and adaptative. In these examples, the context plays an

important role. In Second Language Acquisition (SLA), particularly, "each learner interacts with the environment in a unique way" (GARDNER; MILLER, 1999, p. 11).

SLA is a complex system. It is open due to the continued input to which students expose themselves. It is also nonlinear because learners do not fullfill their skills one by one consecutively. Besides, there is no ending point in this process. The target language is a continuous move that depends on many factors to determine its trajectory (LARSEN-FREEMAN, 1997). In consonance with Larsen-Freeman (1997), Fiorin (2013) alleges that seeing a language as a complex, dynamic and adaptative system means that there is no language staticity.

The butterfly effect

The butterfly effect is a phenomenon that can be observed in complex systems. It was first observed in Meteorology by Edward Lorenz. "The butterfly effect is the notion that a butterfly fluttering its wings in a distant part of the world today can transform the local weather pattern next month" (LARSEN-FREEMAN, 1997, p. 144).

According to Magno e Silva and Borges (2016, p. 26), this phenomenon shows that "small disturbances in a system can have great consequences". It means that the system depends on its initial conditions. Following the same line of thought, Larsen-Freeman (2017, p. 17) asserts that

> in a nonlinear system, a small change in one parameter can have huge implications downstream, when a "tipping point" is reached, so predictability is compromised [...]. As a result, one might have expectations about a future state or experience, based on the experience of past tendencies, but precise predictions are unreliable because nonlinear systems are sensitive and can change unexpectedly.

Even though small predictions can be made through pattern analysis, it is hard to predict the consequences of complex systems' behaviors. Reliable results are not assured when predictions about a system are made by analyzing the trajectory in a chronological manner. Different from a Cartesian system, coordinates do not always bring precise information. Considering the system is nonlinear, unexpected changes happen all the time. Hence, at any time, the insertion of energy affects the whole system.

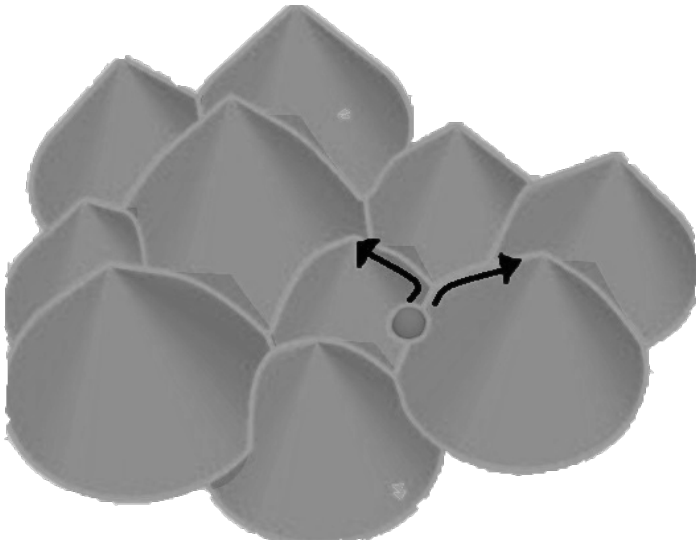
The edge of chaos

Complex systems can constantly face the edge of chaos. This metaphorical transition zone disturbs systems and prevents them from turning into stationary systems. "A system at or near the edge of chaos changes adaptively to maintain stability, demonstrating a high level of flexibility and responsiveness" (LARSEN-FREEMAN; CAMERON, 2008, p. 58).

In SLA, Paiva and Nascimento (2011, p. 194) assert that "the edge of chaos is the point where the acquisition undergoes sudden change from one state to another and when the learner is challenged and exposed to the risk of making mistakes and learning from them". Facing the edge of chaos is essential to complex systems, otherwise, they would become stagnant and would probably die (PAIVA; NASCIMENTO, 2011). In the same way, Menezes (2013, p. 66) says that "[...] slight interferences in the system might trigger overhelming experiences and change the learner's behaviors. That is what we call the edge of chaos".

An example of the edge of chaos in real life context is introduced in Menezes (2013). The author tells the story of an English learner who had an awful experience with the language. The system faced the edge of chaos when he realized that his English background was not enough to fullfill tasks at the university. Then, when the system reached this critical point, it found a decision point: bifurcation (Figure 2).

Figure 2. Bifurcation



Source: the author

In Figure 2, the system, which is identified by the ball, can follow two paths. Figure 2 shows a critical choice that will affect the system's trajectory. By relating it to the situation described in Menezes (2013), one of these paths could be reached by continuing studying English despite difficulties and the other, by giving up.

The role of elements and agents in complex systems

As stated before, in complex systems, many components are in interaction. These components can be divided in elements, agents and processes. Also, they may be complex systems themselves. In SLA, elements such as music and movies and agents such as family, friends, teacher and classmates are part of the systems.

"The complexity of a complex system arises from components and subsystems being interdependent and interacting with each other in a variety of different ways" (LARSEN-FREEMAN; CAMERON, 2008, p. 29). As assumed by Larsen-Freeman (1997), the behavior of the complex system is more than the sum of the behavior of its individual components.

Since these interdependent agents establish mutual interactions, the systems themselves self-organize spontaneously. This is explained due to the order that emerges by means of an apparent disorder. "Systems with self-organized criticality 'tune' themselves to a critical state on the edge of chaos, with power-law distribution of avalanche-type events" (LARSEN-FREEMAN; CAMERON, 2008, p. 62).

Aiming at surviving, complex systems always need to self-organize, otherwise they would reach a static stability and die. This self-organization and adaptation made through agents' interaction ensure the system's survival. In other words, a complex system is only alive due to the interrelations that emerge as a result of the interaction among its components (TATZL, 2016).

Advising in Language Learning

In this subsection, peculiarities of ALL are introduced. Inicially, aspects and definitions of ALL are mentioned, as well as agents involved in this practice are presented. Then, ALL Mynard's model is discussed.

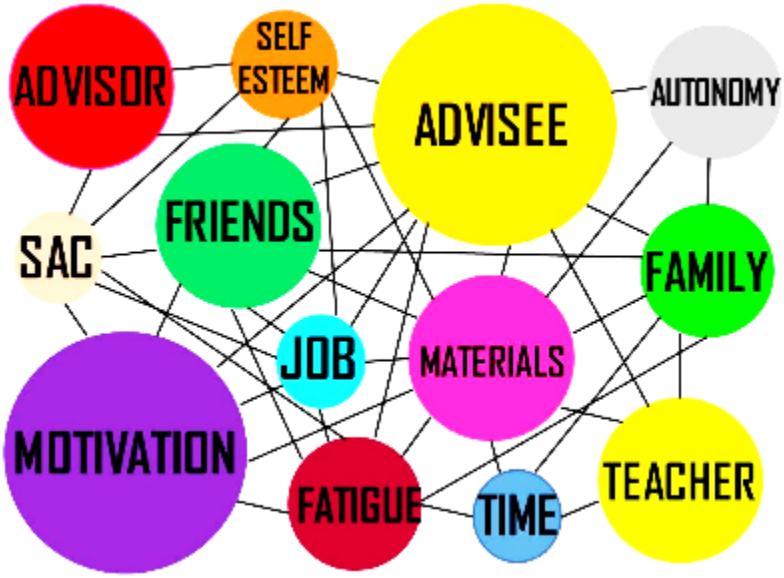
Definitions and aspects of advising in language learning

ALL is a practice which aims at providing the learner with meaningful and reflective learning.

Reinders (2008, p. 13) says that: "language advising (also called 'language counselling') is a form of language support. It consists of one or more meetings (online or face-to-face) between an advisor (a teacher or dedicated language support person) and a student". Following the same line of thought, Carson and Mynard (2012, p. 4) affirm that ALL "involves the process and practice of helping students to direct their own paths so as to become more effective and more autonomous language learners".

In this practice, there are two central agents: advisee and advisor. The advisee is a learner that finds barriers to learn a foreign language. The advisor is someone who helps the advisee. He/she listens to the advisees' problems and tries to solve them by fostering self-reflection. "The learner needs to act, and the advisor should not assume directional actions in his/her guidelines but proposes a menu of alternatives so that the advisee chooses his/her own path" (MAGNO E SILVA, 2016, p. 202). When ALL is linked to Complexity Theory, it is observable that many systems are connected. As exposed in figure 3, mutual interactions happen continually.

Figure 3. ALL as a complex system



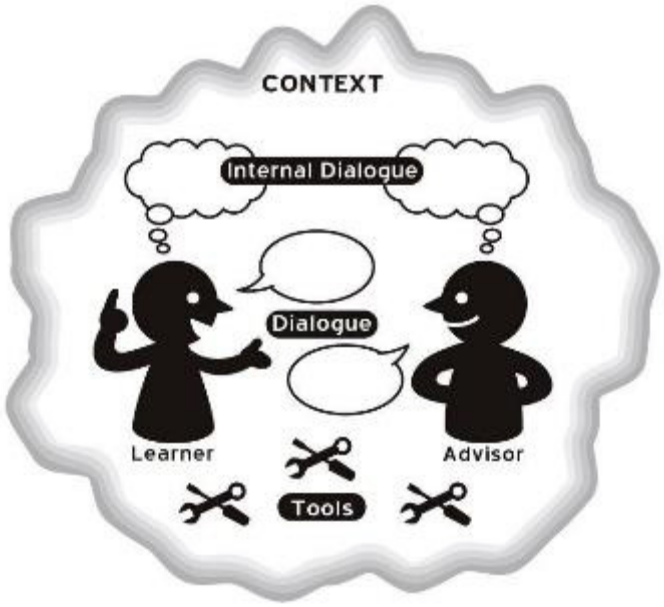
Source: the author

Figure 3 reflects the entanglement which complex systems experience and shows that ALL is a system composed by other systems. When ALL is analyzed through a complex prism, it becomes clear that one of the advisor's role is to identify which system is causing disorder to other systems. This disorder can be described as lack of motivation or self-confidence, for example. Thus, the advisor tries to show the advisee that he/she is not unable, and that the learning trajectory can be successful despite the obstacles.

Mynard's model for advising in language learning

There are many models to follow when ALL sessions are led. One of them was proposed by Mynard (2012). This model emphasizes three elements that are essential to ALL: dialogue, tools and context. These elements connect to each other in order to provide an effective ALL process that encourages a learner to reflect about his/her learning, as exposed in figure 4.

Figure 4. Mynard's model for advising in language learning



Source: MYNARD, 2012, p. 33.

In figure 4, it is possible to notice all the elements that are part of Mynard's model for ALL. Both the internal dialogue and the dialogue between advisor and advisee have important roles in this process since the whole process, which focuses on the advisee, depends on both.

In sociocultural theory, dialogue is seen as a psychological tool. It is through the dialogue that the main agents involved in ALL associate with each other. "Language learning is strongly connected with learners' life events, and all learners have stories to tell" (KATO, 2017, p. 287). The association of dialogue with other elements of Mynard's model can provide the learner with a profuse reflection about her/his learning process.

Tools help learners to achieve goals. They are part of learning and, if used in a right way, can be valuable to build a successful learning trajectory. According to Mynard (2012), ALL tools are divided in three groups: cognitive, theoretical and practical.

The first type of tool stimulates cognitive and metacognitive processes. They are considered tools that facilitate planning in language learning and can be used by the learner alone. Self-evaluation sheets, journals and learning plans are some examples of cognitive tools.

The second type is called theoretical tools. With a pedagogical feature, they relate to knowledge about learning processes, beliefs, and strategies. They are fundamental to advisors as their objective is to work effectively with a learner.

The last type, practical tools, point to record-keeping and reservation systems employed in an institution, for example. These tools help in the organization of advising sessions and provide both advisee and advisor with physical devices in order to bring sessions a better engagement.

The context, which is varied, can expand and redefine itself according to the learners' needs. Put differently, it is constantly expanding, shifting and being redefined according to new possibilities. This gives it a blurred and uneven aspect (MYNARD, 2012). The context can also be divided in three groups: the personal context, the physical context and the contextual practices.

The personal context deals with the learner perception about ALL and how the advisor approaches the session. Students' background and prior experiences with learning need to be considered. Some of these experiences may include factors such as expectations, motivation and willingness, for example.

The physical context has an impact on ALL either. Sessions can happen at a self-acess center (SAC) or in another conducive place, as a classroom or a library. ALL can also happen in an online environment.

Contextual practices involve two concepts: sites of engagement and communities of practice. Despite the different types of context, it is necessary to have in mind that ALL is a process focused on the advisee and on his/her reflection about learning process.

Methods

As stated before, the objectives of this research were: a) to identify evidences of aspects that are related to Complexity Theory in the ALL process; b) to expose the consequences of the butterfly effect and the edge of chaos experienced by complex systems; c) to analyze the influence of agents when the systems faced the butterfly effect and the chaotic situations aforementioned.

The research questions that oriented this research were: a) What Complexity Theory aspects are found in the ALL process? b) What are the consequences of the butterfly effect and the edge in complex systems? c) How agents influence the system when it faces the butterfly effect and the edge of chaos?

This empirical research was carried out in the perspective of the qualitative paradigm (SELIGER; SHOHAMY, 1989). One language learner that found barriers in learning English was analyzed. This learner is part of the English Language Teaching Undergraduate Program at UFPA. As an attempt to solve her language problems, she became an advisee in the ALL process. Since the author of this study was her advisor, it was possible to study her learning trajectory and to analyze her complex system according to the research objectives.

The Context

Place and period

Although a great deal of data was collected since the beginning of 2016, the research was carried out at UFPA during the first semester of 2018. The whole amount of data belongs to the period the participant has been an advisee.

The first scheduled meeting happened in March 2016 at the *Base de Apoio à Aprendizagem Autônoma* (BA[3]), the Foreign Modern Languages School SAC, which, according to Gardner and Miller, (1999) is defined as a space that provides learners with self-study language-learning materials. In other words, its objective is to supply learners with a greater learning independence in order to foster their autonomy and increase motivation. Hence, independent learners see a SAC as a way of satisfying their own learning needs and wants.

The participant

AC5CL22[1] is a young learner who has been in contact with advising since 2016. Three years ago, she was a freshman and had just started the first semester at the English Language Teaching Undergraduate Program at UFPA.

The participant is currently studying in the sixth semester. When she was a teenager, she studied English in a private language school, but in her opinion, her English proficiency level was not as good as she wanted. Twice a month, advisee and advisor met at the *Instituto de Letras e Comunicação* (ILC) for advising sessions. Some online sessions were also conducted.

Research instrument and procedures

Research instruments that were used included drawings, questionnaires, learning narratives, oral and written reports, voice recordings, table of learning goals, written self-assessments and the Index of Learning Styles Questionnaire (FELDER; SOLOMAN, 1994). Data were collected during the language advising sessions.

1 Code used in the research project Paradigma da complexidade na aprendizagem de línguas adicionais em espaços ampliados: autonomia, motivação e aconselhamento in order to keep the data anonymous.

The findings were analyzed through interpretive and comparative moves. The advisee's learning trajectory was described and analyzed according to evidences of the butterfly effect and the edge of chaos found in her trajectory. Agents were also decisive in investigating this trajectory since they are part of learning complex systems. Also, some attention was dedicated to the agents that emerged as important ones in her trajectory.

Data analysis and discussion

In the following subsections, the learner's complex system will be analyzed, and its results, presented based on the literature review of this article. In the first subsection, AC5CL22's learning trajectory is described. Later, relevant points to the learner's trajectory are interpreted and linked to the edge of chaos. In the last section, the same is done, but the focus moves to the butterfly effect.

The learner's trajectory

When AC5CL22 was younger, she studied English in a private school. Through a learning narrative, the advisee reported how her interest for the English language emerged:

> [1] AC5CL22: When I was twelve years old my step-father talked with my parents about the possibility that I join Aslan[2] scholarship contest. They explained to me the importance about know another language. I did the test and got a partial scholarship. At Aslan, I had more contact with English and it's interested me. And I started to pay attention to the lyrics and search the meaning of the songs and just not listen the sounds - like I used to do. I improved my English grade at school (Learning narrative)[3].

She finished the advanced course successfully, but her proficiency level was not as good as she wanted. Besides, she used to avoid talking in public because she was shy. Thus, in 2016, she decided to start the ALL process. In some advising sessions, she established a few goals to help her being an autonomous learner.

In the graduation course, AC5CL22 presented a few seminars, even though she did not feel confident. In order to overcome barriers related to speaking abilities, she watched videos, movies and cartoons in English. AC5CL22 was also engaged in a project called Ícone[4].

A few months later, UFPA received three English Teaching Assistants (ETAs). ETAs are American youngsters with a Bachelor of Arts (BA) degree that accepted a scholarship to teach aspects of American language and culture within Brazilian universities. They provided the community with workshops in order to improve Brazilian students' proficiency in English. AC5CL22 usually attended their workshops. Therefore, with the ETAs' help, she constantly practiced listening and speaking.

Trying to become a more autonomous learner, the advisee assumed that she had frequently visited BA[3]. She borrowed some English books from BA[3] and this decision contributed to her reading skills improvement. As stated by her, the SAC was a cozy place to learn a foreign language. Moreover, she could rest and learn in a terrific environment.

A SAC can bring many benefits to a language learner. Tatzl (2016, p. 45) explains that: "there are environments that restrict the autonomy of learners and others which promote it through their particular constellation of ideological, methodological, administrative and manegerial influences". Considering environments that promote autonomy, it is stated by Gardner and Miller (1999) that

2 A language course in Belém.

3 The excerpts here mentioned were not edited.

4 This project aims at establishing a cultural and linguistic connection between students of Portuguese as a foreign language at Duke University and English students from UFPA. For this reason, conversation sessions via Skype in which students from both universities exchange experiences and learning are held.

a SAC prepares learners to independent learning. It focuses on individual strategies development and reflection.

The learner also got a student scholarship in an Anthropologhy outreach project at UFPA. She had to offer the community of a poor city in Pará a workshop related to English language.

AC5CL22 did not stop improving her English skills. The learner used to talk in English to a friend through Skype. The advisee also applied to a project called Tandem. This project aims at pairing Brazilian tutors to foreign students enrolled at UFPA. It is considered a type of learning support that provides interaction in both the mother and the foreign languages.

Differently from the beginning, problems related to shyness had almost disappeared. It means that the advisee had exposed herself to many situations that required her to talk in public. Hence, the contact with people while talking was not a trouble but an escape valve that allowed her to reduce shyness. Another evidence in her trajectory that she had overcame shyness was that, together with some classmates, she would be one of the presenters of a conversation workshop called Sit In. It was offered by BA[3] and its main objective was to help foreign people with Portuguese conversation practice and language tips.

Adicionally, AC5CL22 decided to go back to school to practice the target language. She joined a scholarship contest, and, at the end, she won a partial scholarship in a conversation course in a private language school ran by one of her UFPA classmates. Along the course, her impressions were the best. There, she always felt confident in speaking English. The environment played an important role in this process because it was flexible since her colleagues did not judge her when she made mistakes, as it usually happened at UFPA.

Despite many successful actions towards learning, AC5CL22 was not able to participate in Tandem because her partner droped out of the project. Consequently, she felt sad and disappointed. However, whenever possible, the advisee also talked in English to one of her friends. Their interaction provided her with valuable possibilities to speak the target language.

In the second semester of 2017, AC5CL22 was upset and worried about her performance in two academic subjects: Anglophone Prose and Applied Linguistics. She thought she would not pass these subjects because she was overloaded and her investment in the graduation course was not positive enough.

In this context, AC5CL22 assumed that her health was not good. She was physically and mentally oveloaded. The main issue related to her learning was procrastination and lack of motivation, which disturbed not only her studies but also her life.

In the end of 2017, the advisee's system had already overcome that unstable period. Then, she had started the fifth semester and, so far, all her assignments had been completed before the deadline.

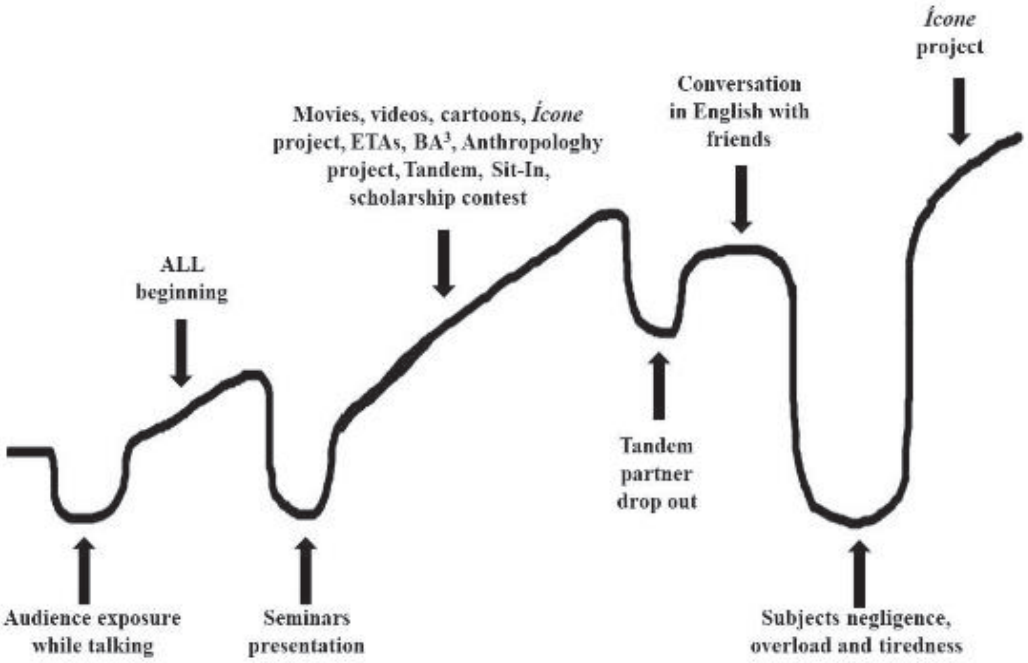
In the beginning of 2018, AC5CL22 had the opportunity to engage in Ícone project again. This time, her proficiency level was higher, and the communication flowed better. It increased her motivation. Therefore, while speaking English, she felt proud of herself and happier than before.

ALL was essential to provide AC5CL22 with learning strategies and to foment her successful learning trajectory, as it can be observed in the following comment taken from a questionnaire answered by the advisee:

> [2] AC5CL22: ALL was very important. Through tips, I could improve my listening, speaking and motivation. Besides, I could see my progress, which I would hardly have noticed if I were alone. (Questionnaire)

The episodes aforementioned are part of the learner's complex system trajectory. They can be seen in the timeline below, whose objective is to expose the positive and negative moments found in the AC5CL22's learning trajectory (Figure 5):

Figure 5. AC5CL22's learning trajectory



Source: the author

As observed, the system is unstable and unpredictable. The depressions and mountains emphasize that a complex system is nonlinear. It means that the learner's behaviors give direction to the trajectory. Hence, people never surely predict what is about to happen.

The edge of chaos

During the period in which AC5CL22 had been an advisee, her system faced the edge of chaos many times. Each chaotic situation had been overcome by a continuous self-organization behavior that brought the system to a new stage. Larsen-Freeman and Cameron (2008, p. 43) argue that: "because of their non-linearity, complex systems evolve and adapt in several different ways, internally and through external connections to their environment". This adaptation is what conducts the system to a new stage.

The first evidence of the edge of chaos is seen in the beginning of the trajectory description. Whenever the advisee needed to talk to an audience, she faced the edge of chaos. It implies that her system faced an unstable and "stressed" moment in which the system had to decide which path it would follow. Therefore, the learner could face the fear by talking to the audience or to give up and leave the difficult situation by speaking Portuguese or even not saying anything, for example.

Fiorin (2013) says that the edge of chaos is more than an equilibrium point. It is an emergent point of new and unpredictable system behaviors. As the advisee decided to speak English in some of those situations, AC5CL22 "overcame the turbulence and reached a new acquisition phase" (MENEZES, 2013, p. 70).

In this case, the agents involved (listeners) affected the learner's confidence while she spoke in English. Although to disturb and to provide AC5CL22 with a tense situation was not the listeners purpose, whenever she talked, AC5CL22 imagined them as challenging beings. It blocked the opportunity she had to enjoy speaking English and led her to a condition composed by fears and concerns.

Another evidence is related to one of the subjects from the first semester: Production and

Comprehension of Academic Texts. In this subject, AC5CL22 presented a seminar. According to her reports, she was confident, but seconds before the beginning of the presentation, she noticed that the classmate presenting with her was not comfortable enough. Therefore, the advisee also became afraid and apprehensive while presenting. At the end, she reflected about her performance and noticed that she did not conduct a good presentation. Everything happened totally different from what she expected.

In the paragraph above, it is seen that one agent (AC5CL22's seminar copresenter) had influenced the whole system. It led the system to find two paths established by a bifurcation after the system faced the edge of chaos. "Learning systems move to the edge of chaos because the less desirable state of equilibrium would mean the death of the system" (MENEZES, 2013, p. 68). This way, due to the interdependent character seen among complex subsystems stated by Larsen-Freeman and Cameron (2008), a unique agent caused a complete disturbance and a consequent reorganization in AC5CL22's system.

In order to avoid difficult situations as the one exposed, the advisee established strategies to increase her self-confidence while talking in public. In the Production and Comprehension of Academic Texts seminar presentation, the edge of chaos faced by the learner's system was induced by her partner. In this instance, the consequences were negative to the overcoming of fears since AC5CL22 felt troubled. On the other hand, after establishing a few strategies in ALL, such as talking in front of the mirror and having a conversation with a close friend or family member, and accomplishing them, the system reached a stage which produced positive consequences to the learner.

Besides that, in the workshops AC5CL22 attended, ETAs always expected students to talk and express their opinion in English. In all meetings, AC5CL22 had to decide: to discuss in English or to keep silence when she was asked to talk. Again, this situation emphasizes the role agents play in the dynamic system. They did not let the learner's system die and always tried to encourage students to speak English, even if they were afraid. When the system looks for an equilibrium point between the complete disorder (also called chaos) and the static order, it means that they are living at the edge of chaos (FIORIN, 2013).

In relation to the order which is aspired by systems at the edge of chaos, Larsen-Freeman (2017, p. 16) assumes that systems: "can undergo periods of relative stability, but even during these periods there is no stasis, and the system has the potencial to undergo radical change at any time".

In a complex viewpoint, the contact with agents caused a system phase shift which led the trajectory to emergent behavior. Therefore, "in complex systems, each component or agent finds itself in an environment produced by its interactions with the other agents in the system. It is constantly acting and reacting to what the other agents are doing" (LARSEN-FREEMAN, 1997, p. 143).

As a requirement to an academic subject called Syntax, the advisee had to present another seminar in English. It focused on abbreviations on cell phone messages. To do so, she looked for foreign people on social media and asked them a few questions. This action increased her self-confidence and provided her with a great deal of new vocabulary. She also felt fearless to present the seminar. Due to the large amount of seminars and exposure to English, her self-confidence considerably increased. Thus, talking to an audience was not a problem anymore.

The advisee seemed to have a nice engagement in learning English. She tried to have more contact with the language and to make use of strategies that would increase motivation and foster autonomy. The last term is seen as an emergent result of interactions among the learner's system and others which could be possibly nested within a bigger system (TATZL, 2016).

Differently from the seminar presentation in Production and Comprehension of Academic Texts, when AC5CL22 presented the seminar in Syntax, her system did not face the edge of chaos. The learner was not challenged and exposed to the risk of making mistakes anymore and the system did not face a sudden change. In Syntax seminar presentation, talking to an audience was no longer a problem.

In the case of figure 5, the valleys represent a difficult period in which the system faced itself. This period brought negative consequences to it. In Complexity Theory, the edge of chaos does not always result in negative consequences. Some positive consequences described in AC5CL22's

trajectory had, as starting point, the existence of chaotic situations, such as having a conversation with the ETAs (the rising mountain in figure 5). Also, different agents (seminar copresenter, friend and ETAs) influenced the system in different levels, even though the situation lived by them were similar and the context, the same.

The Butterfly Effect

The butterfly effect was a metaphor observed in the learner's system for repeated times. In this phenomenon, small actions done by AC5CL22 resulted in significant changes which led the system to a meaningful learning. At the same time, great motions toward learning led to minimal shifts in the trajectory.

The learner seemed to be interested in ALL, a practice in which she saw an opportunity to develop her abilities. One of the ALL instruments is the learner goals table. By establishing her personal learning goals, it helped AC5CL22 to overcome difficulties. In every session thesee goals were checked. The first one established by her was to watch a movie or TV series episode and understand the audio in English (Table 1).

Table 1. Learner goals table

Ficha de Aconselhamento Linguageiro		
METAS PESSOAIS O que gostaria de...	SUGESTÕES/COMPROMETIMENTO O que devo fazer...	PROGRESSO Como foi meu desempenho no período
Assistir a um filme (ou episódio de série) e entender o áudio em inglês.	Treinar o listening para poder compreender o áudio.	----1----2----3----4----(5)
Descobrir como algumas palavras do dia-a-dia são ditas em inglês	Utilizar o dicionário com maior frequência.	----1----2----3----(4)----5
Ler um livro completo em inglês. (Little woman)	Gastar menos tempo nas redes sociais e ver menos notícias na internet.	----1----2----3----(4)----5
Escutar o áudio do livro O Homem Elefante	Dedicar um tempo no final de semana para cumprir a tarefa e escutar menos música	----1----2----3----(4)----5
Traduzir um livro para o português.	Pegar emprestado um livro na escola onde faz um curso de conversação.	----1----2----(3)----4----5
Transcrever uma música em inglês.	Escolher a canção e prestar atenção na letra ao escutá-la	----1----(2)----3----4----5
Criar um caderno de aprendizagem com tópicos que já sabe ou que precisa melhorar em inglês.	Refletir acerca de aprendizagem e escrever.	----1----2----3----4----5

Source: the author

As exposed in figure 1, the first goal settled by AC5CL22 would be achieved by practicing listening skills to improve this ability. At the end, a few weeks after, she achieved this goal successfully. She graded her development during these weeks, and as noticeable, she reached the maximum progress point.

One month after the beginning of advising sessions, AC5CL22 expressed that she had been using great learning strategies. Then, she observed a small but meaningful change in her listening and speaking skills. In her free time, she was still watching movies in English and videos on the internet.

Choosing the first goal was a simple and common attitude in the beginning of ALL process that could be performed or not by the learner. In the advisee's case, the accomplishment implied in huge effects to the trajectory. This is the so-called butterfly effect mentioned by Larsen-Freeman (1997).

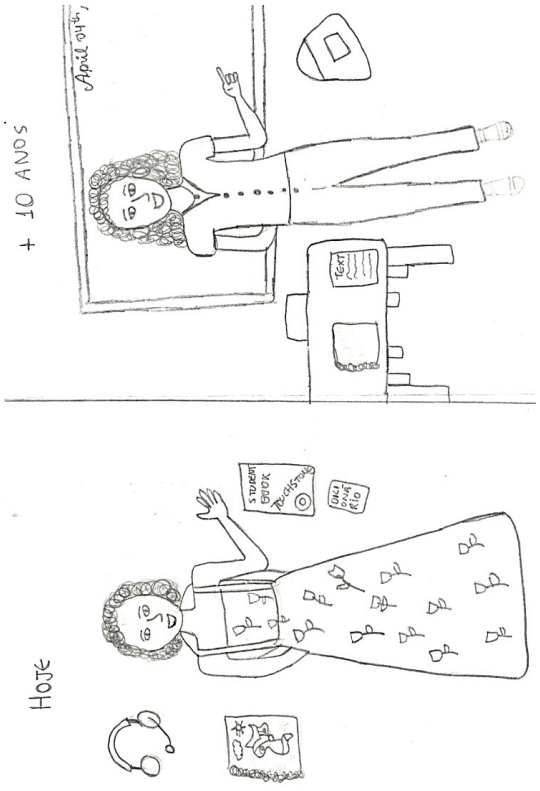
By accomplishing one goal successufully, the advisee understood the action of watching movies as an efficient strategy to develop her English level. During the whole advising process, movies were one of the main AC5CL22's sources of learning. Due to the repeated action of watching movies, her listening skill level increased considerably. It also contributed to heighthen her motivation level.

In this case, at this moment, the only agent involved in the process was the advisor, who contributed positively by encouraging the advisee. Consequently, this encouragement caused the goal achievement, which led the learner to watch movies as part of her routine. Sometimes, huge behaviors can cause minor effects, "small perturbations [...] can lead to overwhelming results" (MENEZES, 2013, p. 67). These small disturbances can be associated to the advisor encouragement, and the overwhelming results, to the action of watching movies continuously to improve language skills.

In one of the advising sessions, the advisor asked AC5CL22 to draw her ideal L2 Self and Ought-to L2 Self (Figure 6). These drawings reflect the advisee's professional and personal lives since they "establish a clearer self-image, connect insights and bridge the past, present, and future" (KATO, 2017, p. 284). It means, she drew the perception she had about herself in the present and her expectation to the future as an English language a teacher.

As stated by Kato (2017, p. 285), the L2 Self and Ought-to L2 Self drawings are "effective in prompting reflection on the past sessions, but also in considering a new future". The author also mentions that "a drawing is used as an effective approach to promote the dialogue between a storyteller and a listener, to explore the storyteller's unconscious mental state" (KATO, 2017, p. 276).

Figure 6. ideal L2 Self and Ought-to L2 Self drawing



Source: AC5CL22 original drawing

ACL5CL22 drew herself in two stages of life. In the first, she is an undergraduate student of the English Language Teaching Program at UFPA. She recognizes herself as a student that uses tools such as textbook, notebook and dictionary to boost learning. Headphones are also important in her learning since listening to music in English is one of her biggest motivations to learn the language. They represent Ícone project either, which provided her with a great experience in talking to foreigners.

In the other drawing, she evidenced her role as a teacher ten years projected in the future. According to her reports, she would like to look serious and committed to her students' learning. Through this drawing, the advisee reflected about her learning process and established personal goals to be the teacher she drew. In this regard, Kato (2017, p. 276) assumes that "advisors have advantages to be a good life story interviewer as their job is to listen to learners attentively".

Through figure 6, it is possible to notice that the agents involved in the AC5CL22's concept she has about her ideal L2 Self are implicit. They are friends, family, teacher, ETAs and foreigners she met at Ícone. In a socio-interactionist viewpoint, these agents' role is to mediate and facilitate learning. In few situations, this role was played positively, but in others, they disturbed the learner, for example, when the advisee neglected some tasks in Anglophone Prose and Applied Linguistics. According to her, this neglection was a consequence of her group members disinterest on the tasks. It meant that she would not complete the task alone and let the whole group be congratulated for something they had not done. As the advisee stated, the biggest problem is that the group members are her best friends and she does not know how to disconnect friendship from group work. She said that her friends' lack of motivation affected her, nonetheless she did not want to feel unmotivated.

The consequence brought to her system by some group work problems was unpredictable: she felt sad, discouraged and frustrated with her friends and her learning. Despite that, a few weeks later, she continued experiencing new ways of learning through the interaction with her friends. According to her reports, while working in groups, she always acquired new knowledge. In this situation, the butterfly effect is evident. The system is unpredictable and sensitive to initial conditions. The butterfly effect "underscores the interdependence of all the components in the system" (LARSEN-FREEMAN, 1997, p. 144).

Another evidence of the butterfly effect is seen when AC5CL22 won a scholarship contest made through social medias by a private language school ran by one of her UFPA classmates and she started to practice the target language in a conversation course. In this school, the environment was always pleasant due to her classmates, that were generous and friendly. Therefore, she never felt frightened when she made a grammar mistake in the classroom. Maybe, if she had not applied to the contest, she would not have increased her language level and motivation the way she did. Larsen-Freeman (1997, p. 159) asserts that "it can be the small things that matter the most. They must not be overlooked".

According to Menezes (2013), several factors can change the SLA system route. This change can lead the learner towards success or failure. In the situation above, two essential agents (teacher and classmates) led the learner towards success.

The butterfly effect is a neutral phenomenon, but its consequences are not. In this regard, agents were fundamental to identify the consequences of the butterfly effect as negative or positive to the advisee's learning. In other words, agents in ALL influenced the complex system and contributed to the appearance of this sensitive dependence on initial conditions as well as to its consequences.

Conclusion

The contact between advisee and advisor through ALL sessions enabled the development of this research. Two years of data collecting were enough to provide information to describe the learner's trajectory and to observe aspects related to the edge of chaos and the butterfly effect in her system.

In AC5CL22's system, many evidences of these complex phenomena were found. Even

though the system faced the edge of chaos and the butterfly effect in several situations, their consequences were different.

It was also possible to notice that ALL practice is surrounded by complexity. It means that many systems such as: advisee, advisor, friends, teacher, family and others are interconnected. This aspect shows that ALL is a complex system composed by small nested systems that are complex either. Agents were also crucial to the advancement of the advisee's trajectory since most of the time they contributed to the emergence of the edge of chaos and the butterfly effect.

Along the learner trajectory, the edge of chaos led the system to a tension point in which it was decisive to choose which path the system would follow. While a few decisions brought negative consequences to AC5CL22's learning (lack of self-confidence, discouragement and melancholy), others brought positive effects (self-esteem, autonomy and motivation increase).

The butterfly effect, a neutral phenomenon, evidenced the dependence on initial conditions. The advisor and AC5CL22's friends were the major agents that contributed to this phenomenon arisal. Then, a small action led to great consequences. This way, it was clear that a system cannot be fully predicted.

Therefore, it was possible to notice that two events were constant in AC5CL22's system. The characteristics were similar, however the consequences brought to the system were totally different.

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