

## CHAOS AND THE COMPLEXITY OF SECOND LANGUAGE ACQUISITION <sup>1</sup>

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Chaos in the world brings uneasiness, but it also allows the opportunity for creativity and growth. (Tom Barret)

The objective of this chapter is to discuss the role of identity, autonomy and agency in second language acquisition (SLA). I argue that science and myth have much in common and whatever theory we use to try to understand any phenomenon, in our case SLA, we will be offering a metaphor, a way of seeing something in terms of another. My metaphor will be Chaos Theory. Taking the assumption that SLA is a chaotic complex system, I will demonstrate that identity construction is in intimate relation with agency and that identity, autonomy and agency can move SLA chaotic systems to the edge of chaos, understood as an overwhelming experience that changes the learners' behaviors. Some examples taken from a corpus of language learning histories will be used to exemplify the theoretical assumptions.

### Myths and science

Human beings have tried to explain the universe and the different phenomena around them, first by way of myths and then by science. As Armstrong (2005:3) puts it, “[M]ythology and science both extend the scope of human beings.”

Among scientists, there is a dispute between those who defend the objectivity of science and those who deny it, positioning themselves in favour of subjectivity. Lakoff and Johnson (1980) claim that both objectivism and subjectivism are myths. They explain:

Myths provide ways of comprehending experience; they give order to our lives. Like metaphors, myths are necessary for making sense of what goes on around us. All cultures have myths, and people cannot function without myth any more than they can function without metaphor. (p.185-6)

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Lakoff and Johnson advocate the myth of 'Experientialism', which does not oppose external and internal aspects of understanding. For them, there is neither absolute truth nor totally unrestricted imagination.

The experientialist myth takes the perspective of man as part of the environment, not as separate from it. It focuses on constant interaction with the physical environment and with other people. It views this interaction with the environment as involving mutual change. You cannot function within the environment without changing it or being changed by it. (Lakoff and Johnson, 1980: 230-1)

The Experientialist perspective is coherent with the complexity paradigm, a new way of knowing that highlights the dynamic interrelations among the elements of a phenomenon nested in the physical environment. This new paradigm brings together a series of approaches to complexity, including Chaos Theory. Complexity approaches encompass all the theories which see the object of study as a dynamic system made up of interconnected components. Among these theories, we can mention the ecological approach which highlights the relationship between humans and their environment in terms of affordance (see van Lier, 2004a) and Chaos Theory (see Gleick, 1987) that emphasizes that there is order underlying disorder and that the systems are sensitive dependent on initial conditions. In the Applied Linguistics field, researchers usually do not make a distinction between chaos and complexity and refer to them as chaos/complexity (See Larsen-Freeman, 1997, van Lier, 2004a, Larsen-Freeman and Cameron 2008). Both Experientialism and Chaos Theory see their objects of study as inseparable from physical reality.

Curiously enough, Chaos Theory borrowed its name from Greek Mythology, offering a new metaphor which radically changes the way we view the world and everything in it. Chaos is a substitute for the Newtonian metaphor of clockwork predictability. Instead of explaining the world as a clock governed by simple rules, the Chaos Theory metaphor describes it as "a kaleidoscope: the world is a matter of patterns that change, that partly repeat, but never quite repeat, that are always new and different" Waldrop (1993: 330). Chaos Theory and its shifting kaleidoscope metaphor have been used to describe different phenomena in different research fields, including knowledge dynamics (see Massen and Weingart, 2000) and SLA (see Larsen-Freeman and Cameron, 2008). Researchers have attempted to explain SLA through many different theories, models and hypotheses, but no consensus has been reached so far. Could there be any similarity between creation myths and SLA theories?

Creation myths in different cultures often begin with an initial emptiness, or chaos, and opposing forces which give birth to the universe. So do SLA theories. As in the Jewish/Christian *Genesis* which tells us that the world was created from a formless state through the addition of elements, the structuralists, for example, defend that SLA develops from a formless state through the addition of structures in an ordered sequence. From that perspective, first language was considered an opposing force to the birth of the new language. On the other hand, in the Chinese creation myth, the universe is described as a black egg where Pangu, the creator of the universe, was mixed together with heaven and earth. Feeling suffocated, Pangu splits open the egg, holding the top and the bottom as the sky and earth. As in the Pangu myth, the mentalists in Applied Linguistics believe in the existence of a previous innate structure from which language develops. It seems that both structuralists and mentalists would agree that in the beginning there was chaos, not understood as disorder, but as described in the Oxford Dictionary of English Etymology as “the primordial formless void”.

In the creation myths, the universe comes into existence through the agency of the gods. In the Jewish/Christian *Genesis*, agency was exerted by means of language when God said “*Let there be light*”; and *there was light*. Linguistic agency is also crucial in SLA no matter what the concept of language is. Whether it is understood as a set of syntactic structures, as a social system of human communication or as a tool for thinking and acting, linguistic agency is the initial condition in all theories which try to explain SLA. If the concept of language is that of a set of syntactic structures, one believes that language is acquired if one repeats those structures *ad nauseum*; if language is conceived as a communication tool, it is acquired by means of meaningful communicative activities; and if it is considered as a tool for thinking and acting, it is acquired if the learner is engaged in authentic linguistic social practices which enable him or her to think and make decisions in order to act, to do things with the language in communities of practice.

One of the crucial debates in the SLA research field centres on the initial conditions of acquisition and two points of view – “language innateness” and “environmentalism” – divide researchers into opposing theory groups. This is also called the nature-nurture debate and involves those who believe that language is something innate, a genetic predisposition, and those who argue that language is learned from the environment.

Although both ideas are still very influential, a third perspective arose when some Applied Linguists started thinking of SLA as a chaotic/complex (Larsen-Freeman, 1997) or ecological system (van Lier, 1997). In her seminal article, Larsen-Freeman (1997:141) saw “many striking similarities between the new science of chaos/complexity and language and SLA” and some months later van Lier (1997:783), on the same track, advocated the replacement of body-mind dualism with “a conception of the learning environment as a complex adaptive system, of the mind as the totality of relationships between a developing person and the surrounding world, and of learning as the result of meaningful activity in an accessible environment.” Since then, there has been an increasing interest in this kind of study, evidenced by Kramsch (2002) who gathered a distinguished team of scholars around ecological perspectives, including Larsen-Freeman and van Lier; and by the special issues on Complexity Theory in *Applied Linguistics* (2006) and *The Modern Language Journal* (2008). In Brazil, Martins and Braga (2007) have reviewed work by Brazilian researchers, which includes research on SLA, on identity in SLA, and on online learning and interaction in the light of Chaos and Complexity theories. Two books – van Lier (2004a) and Larsen-Freeman and Cameron (2008) – present a thorough discussion of the main concepts in this new approach to second language learning theory. Van Lier offers a comprehensive overview of an ecological approach to language learning and Larsen-Freeman and Cameron translate their understanding of complexity and its main concepts into Applied Linguistics.

In the next section, the reader will find a brief review of Chaos Theory and its implications for SLA. In order to make the theory more palatable, I will illustrate some key concepts by referring to language learning histories (LLHs) from the AMFALE Project. (AMFALE is an acronym in Portuguese for the research project ‘Learning with the memories of speakers and learners of foreign languages’. The project has a *corpus* of narratives written by Brazilian, Japanese, Chinese and Finn students and can be seen at <http://www.veramenezes.com/amfale.htm>).

### **Chaos Theory and Second Language Acquisition**

The importance of Chaos Theory to SLA is in its potentiality to reconcile ‘nature’ and ‘nurture’ as the learner can be seen as an individual with his/her cognitive capacities and at the same time as an agent who is in interaction with the other elements

in his/her environment. The interacting components in a complex system can be human (e.g. teachers, relatives) and non-human (e.g. books, films, music). It is my contention that learning initial conditions are chaotic, and two opposing forces – first and second language – give birth to a third, the individual interlanguage .

In science, chaos is a technical term to name systems which are apparently disordered or, as Lorenz (2001:4) says, processes “whose variations are *not random but look random* [emphasis in the original].” This technical use of the word chaos blends the notions of initial conditions (as in Greek chaos) and of disorder or randomness, although the theory states that there is an underlying order beneath this apparent randomness.

Chaos Theory deals with chaotic deterministic systems. This kind of system is defined by Lorenz (2001:24) “as one that is sensitively dependent on interior changes in initial conditions”. Although those systems are deterministic, or predictable in the short term, their long term behaviour is aperiodic or chaotic and cannot be predicted. The unpredictable behaviour of deterministic systems is called chaos. As Lorenz (2001:157) explains “[W]e may believe that some phenomenon is governed by deterministic laws and that it responds in a regular manner, only to discover at some point that its behaviour is more irregular than suspected.” Lorenz attributed the unpredictability of the weather to a chaotic deterministic system; below I will explain why a similar argument can be made to explain the unpredictability of SLA within individual learners.

Brooks (2007) states that “while we cannot predict the weather in a particular place and on a particular day in 100 years’ time, we can be sure that on average it will be far warmer if greenhouse gases continue to rise”. Similarly, in formal traditional contexts we can predict that students will be able to memorize rules and vocabulary, but we cannot predict that they will all acquire the language, that is, if they will be able to engage themselves in linguistic social practices. While we cannot predict the amount of second language (SL) an individual learner will acquire during his or her life, we can be sure that on average he or she will be more proficient if they have the opportunity to use the language in authentic contexts. The rate of change, that is, of acquisition, is not predictable and varies according to the nature of the interactions among all the elements of the learner’s system.

In the deterministic perspective, one believes that every action is the result of a preceding action, but chaotic systems are unpredictable, they are non-linear, and effects are disproportionate to causes. Smith (2007:10) offers an interesting example to help us

understand what non-linearity is. He says that “the impact of adding a second straw to a camel’s back could be much bigger (or much smaller) than the impact of the first straw.” In the SLA context, which is also constrained by individual identities, agency and autonomy, similar linguistic experiences might cause different student reactions. In an EFL context, being exposed to a certain experience may help one learner but block another one. In our corpus of LLHs, for instance, some Brazilian learners praised their teachers for speaking English only and others stated that they felt blocked because they could not understand what teachers were saying. Some displayed more autonomy and agency than others, and identity construction also contributed to the acquisition processes. Identity, agency and autonomy are important elements in the SLA chaotic system and will be further discussed in the next section.

### **Identity, agency and autonomy**

We become what we are by means of our actions and our complex interactions with other agents in the world. Language is an essential element for agency, understood as control over life or as “socioculturally mediated capacity to act (Ahearn, 2001).” Our sense of self or identity construction is in intimate relation with agency. As argued by van Lier (2004b:108), “when we say something we do not only provide a piece of information about something or other, we also at the same time provide information about two other important matters: Who we are ourselves, and who we think our listeners or readers are.” Using a second language is thus acting in the world and simultaneously displaying fractals of our identity.

The concept of fractal was developed by Mandelbrot (1982) to represent shapes made up of similar patterns at different scales, due to having the property of self-similarity. An example of a fractal dimension can be found in trees. They do not exhibit exactly the same structure at all scales, but the same kind of structure appears on the branches and leaves. A good example of a set of fractals is the Babushka Russian doll – a set of nested dolls. Whatever the size of the doll is, one will identify the same characteristics found in the other dolls. I understand identity as a fractal set because we do not have one identity, but a set of fractalized identities. As Sade (2009) argues, no matter which identity fractal is foregrounded – learner, son, football player and so on – the other identities will also be there, in the background.

As explained by Sade (2008: 6-7)

The “self” is constructed via emergence of several other “selves”; therefore, we can say it’s a system once it is compounded by several parts. Each of these selves interacts with the others, influencing and being influenced by them. From this interaction unpredictable behavior emerges.

She adds that “no matter the number of internal fragmentations, the parts are interconnected into a whole which is self-similar to the parts” (p.15).

Some identities are pre-determined in the social groups (family, school, work, etc) we belong to. As described by Archer (2000:73 -4), “people are involuntaristically pre-grouped at birth in relation to the social distribution of scarce resources. For simplicity these are called the ‘privileged’ and the ‘non-privileged’ and the latter confront plenty of daily exigencies, given their poor life chances”. Identity and agency are two sides of the same coin, and the non-privileged often strive to acquire more privileged identities by learning English, which is seen as a bridge to a more successful life. As Norton (2001:166) puts it, “if learners invest in a second language, they do so with the understanding that they will acquire a wider range of symbolic and material resources, which will increase their value in the social world.” See, for instance, the case of the Brazilian Little Joy’s singer and guitarist Rodrigo Amarante (2009:125) who said that he started learning English when he was 12 in order to understand lyrics in the songs of the English popular music band, The Smiths. English is so important for his musical identity that he composed one of his first songs in English.

But not all learners have the same linguistic affordances. As Sade (2008) points out, “the social location of a particular individual enables him/her to have access to some linguistic and non-linguistic choices and not others (p.14).” Affordance is exemplified by van Lier (2000) as “demands and requirements, opportunities and limitations, rejections and invitations, enablement and constraints (p. 253)”, that is “the relationship between properties of the environment and the active learner (p. 257).” In a complex perspective, it can be explained as the dynamical interaction between a learner and the other agents in the SLA chaotic system which provides linguistic experiences. As ‘non-privileged’ students do not have the same affordances the ‘privileged’ do, they have to be more autonomous and rely more upon their agency, in order to “relate their self to the world” (van Lier, 2004a:147).

An agent is one who acts and whose actions can be motivated or constrained by other elements in the system and by other systems. One can be a self-governing agent and take control of one’s own acquisition system or follow instructions of a teacher. In

both cases the learner is acting upon his process of acquisition. However, in the view of complexity, learners' agency interacts with the environment and as such it may be influenced by affordances and constraints. Think for instance of learners who live in the Amazon forest without electricity: their affordances will be different from our own and no matter how much they act upon their process, their "socioculturally mediated capacity to act" will be restricted by their environment. Likewise, one can be extremely autonomous, but environmental constraints or a given context can limit one's acts or agency. Even so, the more autonomous learners will probably seek opportunities to read in English or to speak with foreign visitors.

I see autonomy as a complex ecological system, subject to internal and external constraints, which manifests itself in different degrees of interdependence, control of one's own learning process, and agency. It involves affordances, capacities, abilities, attitudes, willingness, decision making, choices, planning, and assessment either as a language learner or as a communicator inside or outside the classroom.

Agency changes the system, but we can never predict the impact of one's autonomous choices and actions. In spite of human agency, SLA systems self-organize and transform themselves beyond the conscious intentions of the learners due to one's innate capacity to learn. Larsen-Freeman and Cameron (2008:8) explain that "it is not contradictory to state that, at the same time that humans are operating in an agentful way, the resources of the language in the individual and in the speech community are being transformed beyond the conscious intentions of the speakers." In a SLA system, I would say that slight interferences in the system might trigger overwhelming experiences and change the learner's behaviors. That is what we call the edge of chaos.

### **The edge of chaos**

Waldrop (1993:147) explains that these chaotic systems are "always unfolding, always in transition. In fact, if the system ever does reach the equilibrium, it isn't just stable. It's dead." As argued by Larsen-Freeman and Cameron (2008:58), "[A] system at or near the edge of chaos changes adaptively to maintain stability, demonstrating a high level of flexibility and responsiveness."

According to Brooks (2007), "[T]he unpredictable character of chaotic systems arises from their sensitivity to any change in the conditions that control their development." This is known in chaos literature as sensitivity to initial conditions. According to Gleick (1987:8), "tiny differences in input could quickly become

overwhelming differences in output.” Gleick further explains that, in weather, the sensitive dependence is translated into “what is known as the Butterfly Effect – the notion that a butterfly stirring the air today in Peking can transform systems next month in New York (p. 8).” This hyperbolic metaphor has been used in many areas to explain how minor behaviours can cause huge effects. As Gleick (1987:23) reminds us, it is well known that “a chain of events can have a point of crisis that magnify small changes.” He says that this notion is not new and exemplifies with folklore:

For want of a nail, the shoe was lost;  
 For want of a shoe, the horse was lost;  
 For want of a horse, the rider was lost;  
 For want of a rider, the battle was lost;  
 For want of a battle, the Kingdom was lost.

The loss of a nail led to the winning of the battle by the enemy, which destabilized the kingdom and contributed to its loss. The same point of crisis can occur in the classroom which may also be considered a chaotic system and as such can result in unpredictable outcomes. Teachers’ choices, for instance, may help one student “win” the battle of language learning, and another one “lose”, no matter how similar the educational experiences are. In our *corpus* of LLHs, we can find narrators who felt extremely discouraged by teachers who did not believe in them and others who felt challenged by a similar attitude. While the former may have halted their attempts at learning, causing the death of the SLA system, the latter accepted their teachers’ demeaning attitude as a challenge and felt more motivated to overcome SLA obstacles. This shows that small perturbations in the classroom can lead to overwhelming results, to a point of crisis.

The point of crisis is also known as the critical point or as the edge of Chaos<sup>2</sup>. It is described by Waldrop (1993:12) as “the ability to bring order and chaos into a special kind of balance”. It is a phase of maximum creativity where the system operates between order and chaos or randomness. The edge of chaos is a phase transition where stability gives way to creativity and transformation. For Waldrop (1993:12), the edge of chaos is “the constantly shifting battle zone between stagnation and anarchy, the one place where a complex system can be spontaneous, adaptive, and alive.” In Ockerman’s words (1987),

[The] edge of chaos is a paradoxical state, a spiral chance between order and chaos, a humming oscillation between the two extremes, characterized by risk, exploration, experimentation. Here is where the

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<sup>2</sup> The phrase “edge of chaos, according to Waldrop (2003:230), was coined by Langton who also used the expressions “transition to chaos”, the “boundary of chaos” and the “onset of chaos”.

system operates at its highest level of functioning, where the information processing takes place, where risks are taken and new behavior is tried out. (p.222)

Learning systems move to the edge of chaos because the less desirable state of equilibrium would mean the death of the system. For example, for the learners described previously who felt discouraged by teachers, equilibrium would be gained by those learners ending their attempts to learn the language, but this would result in the collapse of the language learning process. In SLA, we can say that the edge of chaos is where acquisition suddenly shifts from one state to another and where the learner is faced with the greatest challenges and risks. A good example of this phenomenon can be found in two narratives by undergraduate students in a Brazilian University. In that university, prospective candidates for the position of English teacher are expected to have a basic level proficiency on the assumption that they have already studied English at high school. On the other hand, as Spanish is usually not part of every high school curriculum, students have the chance to attend classes for beginners and at the same time prepare themselves to be teachers of Spanish. Despite already having a basic level of proficiency, some students enrolled in the English Program feel challenged by its requirements and find themselves at the edge of chaos where new behaviours emerge. Some of them take risks in their search for language development and achieve good results. But, those challenges might also lead the SLA system to stagnation as shown in (1).

(1) Well, I started learning Spanish around eleven years ago and it was in a Letters course. The truth is that, at the beginning I thought that English would be an interesting language, because, historically, it is a world-wide communication language. But in the University, I soon realized that the aim of the course was not to teach the English language, but to develop English teaching skills. Then, naturally, as I had much difficulty, I changed to Spanish. At first, I did not have the intention to study Spanish, but it turned out as an alternative. And surprisingly enough, what was an alternative became a passion. I had a significant development with support of the teachers, colleagues, and other fellows. [The original Spanish text can be found at <http://www.veramenezes.com/audio17e.htm>.]

We can infer in narrative (1) that this student's acquisition system became stressed and unstable. The student did not run any risks to cope with the disturbance introduced by the challenges of the English program, and did not make the necessary adjustments to

cope with the acquisition instability. As Bloom (2000) explains “[I]f these adjustments fail to work and the system does not restabilize, the continued perturbation will propel movement toward “bifurcation” – a decision point, a critical choice, Robert Frost’s “two paths” diverging in a wood.”<sup>3</sup> This new stage is supposed to be a phase of maximum agency, autonomy, creativity and transformation. The narrator did not take the less travelled path, he chose Spanish which, as a native speaker of Portuguese, offered him fewer obstacles. His choices show agency and autonomy. He took control of his SLA and decided to learn another language.

A live acquisition system is always in movement and never reaches equilibrium, although it undergoes periods of greater or less stability. That is the case of the counter example in (2). The system of the first learner bifurcated towards the acquisition of another language, but the learner in (2) took the road “less travelled by”<sup>10</sup>, and faced the difficulties along her learning path.

(2) Entering university was not simple and easy as I thought. (...) it took me a while to adapt. I started with the famous “integrated skills” and I can’t say I have good memories of any of them. It might appear I am a bit too critical, and I am sorry for that, but my experience started quite awfully. The problem wasn’t only the teachers... it was mainly me and my English background.

(...) As you can imagine, my results on these tasks were never good and I started feeling highly discouraged by the course: what was I doing at FALE if I wasn’t able to speak?

Finally I finished “Oral Skills 3”, and I felt relieved: I started studying literature and linguistics, which were the things I really enjoyed! My demoralization towards English vanished away and I started feeling motivated again. [The role text is available at <http://www.veramenezes.com/multi2.htm>.]

In (2), we have an excerpt from a multimedia narrative written by a student who had a similar experience to the one reported in (1). Our narrator faced identity and learning problems. She was aware she did not belong to the new community and had to reconfigure her beliefs and build up a new identity. In addition, it was not easy for her to follow a course which demanded more oral skills than she had been used to. She did not give up though and managed to cope with “disorder” in her SLA system. “Disorder”

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<sup>3</sup> Robert Frost’s poem *The Road Not Taken* is well known worldwide, mainly because of its final verses: “Two roads diverged in a yellow wood, and I/I took the one less traveled by/And that has made all the difference”. For Brazilians, leaning Spanish is easier than learning English because Portuguese and Spanish are very similar languages. Learning Spanish can be compared to a road which offers fewer obstacles to the learner. For some students, learning English might be compared to traveling along a less traveled road, full of obstacles.

is represented in her text by the noun “demoralization” – “a state of disorder and confusion”, according to *Dictionary.com*. Confusion was caused by the emphasis on oral skills instead of grammar and reading and also by the consequent bad marks. Although it took her “a while to adapt”, she managed to attend the three levels of the “integrated skills” courses. She overcame the turbulence and reached a new acquisition phase, exhibiting a new linguistic behaviour or a new attractor.

### Attractors

Attractors are defined by Larsen-Freeman and Cameron (2008:49) as “states, or particular modes of behaviors, that the system ‘prefers’.” When the system moves into an ‘attractor basin’, it reaches a moment of stability. Learning histories told by learners from different countries reveal that grammar seems to operate as an attractor basin in a great deal of SLA experiences. Murphey, Jin and Li-Chin (2004: 93), for example, claim that most LLHs they examined often reported an overemphasis on grammar teaching as do the ones from Brazil, exemplified in LLH (2).

The SLA process described in (2), and represented in Figure 1, presents different acquisition phase spaces. A phase space is also called a state phase and it “represents the ‘landscape of possibilities’ of a system, and, as it changes and adapts over time, the system moves through this landscape”. (Larsen-Freeman and Cameron (2008:49). In Figure 1 three phase spaces are represented: high school, whose attractor was grammar and reading activities, then the three first semesters in the University with a shift to oral skills and, finally, the third phase represented by the final course years and another attractor: the use of the English language in Literature and Linguistics courses.



Figure 1 The trajectory of a SLA system across attractors in its acquisition phase spaces (inspired by Larsen-Freeman and Cameron, 2008: 51).

Other learners will be constrained by different attractors and exhibit different dynamical behaviors as each learner will follow his or her own route.

Narrator (1)’s English acquisition system, for instance, did not change nor adapt itself. Observe that I refer to the system and not to the learner. The latter is one of the elements in the acquisition system as we do not separate the learner from the other

human and non-human elements that make up the acquisition system. In that case, school rules and the teacher's attitudes did not contribute to the SLA development. If the initial conditions had been different, the learner would have probably felt more motivated to act and learn English. On the other hand, narrator (2)'s system had three moments of change and adaptation: from form to oral skills and then to literature and linguistic studies. Larsen-Freeman and Cameron (2008:57) explain that “[I]n a *cyclic or closed loop attractor*, the system moves periodically between different attractor states, as with the pendulum.” But the system can also be attracted to a strange attractor, as explained by Larsen-Freeman and Cameron (2008:57):

A *chaotic or strange attractor* is a region of state space in which the system's behavior becomes quite wild and unstable, as even the smallest perturbation causes it to move from one state to another. In visual terms, this would look like a large attractor basin that is full of hills and valleys of different shapes and sizes around which the system moves fast and unpredictably. This kind of behavior is called ‘chaos’ and the attractor is labeled a chaotic attractor. We should resist the poetic imagery of the label – ‘chaos’ as used here is a mathematical term to describe certain modes of behavior that are not predictable but are also not random

I will try to make this point clear by referring again to LLHs (1) and (2). If we focus on each of those two LLHs, we will understand that they are chaotic complex systems nested in another complex system – the school, which in turn is nested in an educational system, and so on. The SLA system described in (2) followed a somewhat predictable route, but the one described in (1), when disturbed, moved to a chaotic attractor inside the school system. In other words, the requirements of the English program caused a butterfly effect and the student was, unexpectedly, attracted by the Spanish program basin. This is a story of failure in terms of the acquisition of English, but a story of success if we take Spanish acquisition into account.

Several kinds of strange attractors can change the route of SLA systems leading the learners towards the path to success. One common strange attractor is travelling to English-speaking countries. Several examples of successful experiences can be found in our corpus and also in the Applied Linguistics literature. In some stories, the learners undergo painful experiences. See, for instance, the story of a Hong Kong student and her experience in England, in Chik and Benson (2008), and also the experiences abroad lived by MM and CS, in Block (2002). Chik and Benson (2008) tell the story of a student who wanted to become a *native speaker* and the impact of her experiences abroad on her identity as Hong Kong student. In spite of facing discrimination and

racism and not becoming a *native* speaker, she got the fluency she needed. Block (2002) also describes the turbulent experiences lived by MM and CS and shows how their identities were destabilized. In spite of that, he concludes that border crossings have been positive experiences for those students.

Joining specific communities where English is spoken is another example of a strange attractor. Murray (2008), for instance, tells the story of a Japanese student, Yuichi, who “got a job at an international hotel in Tokyo where he worked for six years” in order to improve his English. Menezes (2008) provides an example of a Brazilian student who started practicing capoeira, an African-Brazilian fight-dance and martial art, and had a chance to meet foreigners and speak in English. This learner said it was the first time he felt that he could communicate with native speakers in the target language. All these examples show us the relevance of several identities – traveler, hotel worker, sportsperson, etc. – which allow the SLA system develop.

We can find in our *corpus* examples of unexpected changes which were not under the students’ control (the student has to move to an English-speaking country; the student starts working in a place which affords them contact with English speakers) , but contributed to lead their SLA system towards the edge of chaos. Nevertheless, there is also enough evidence for me to say that autonomous learners are more aware of linguistic affordances which they do control to improve their SLA. Empowered by autonomy and agency, learners are powerful agents who lead their SLA systems to the edge of chaos, despite some obstacles such as teachers’ pedagogical choices, lack of opportunities to use the language and also lack of collaboration by more proficient peers in the classroom. Some narrators register in their LLHs complaints against classmates who refuse to help them, usually the ones from the ‘privileged group’. Those stories tell us that the classroom is not the idealized "collaborative paradise" teachers dream of, but an arena where some students must struggle to protect their needs and their identities against the impositions of their teachers and partners and sometimes, against the co-adaptive patterns created in the classroom. In spite of that, whole new behaviours can emerge when they reach their edge of chaos.

## **Conclusion**

It is my contention that the same way men have always strived to explain the origin of the universe, offering us different myths, so do SLA researchers strive to understand how languages are learned, offering us different theories and metaphors by

way of explanation. I am aware that Chaos Theory is one more metaphor for SLA, but one that I hope will enable us as researchers to shed some light on the dynamic nature of language learning, particularly with regard to the individual and the important notions of identity, agency and autonomy.

The learning histories in our *corpus* are all unique, and yet all of them reveal a turbulent, nonlinear dynamic process of transformation of order into disorder yielding the emergence of a new order, a new language. They are not identical because the elements or agents in each system are different and so are the dynamics of individual experiences.

In spite of the powerful unexpected uncontrolled changes in the individual SLA systems, most of the learning histories show that agency, identity and autonomy can move SLA chaotic systems to the edge of chaos. As we saw in LLHs (1) and (2), a learner “is capable of adapting itself to the sorts of new and diverse circumstances that an active agent is likely to encounter in a dynamic world (Davis and Sumara, 2006:14).” Our *corpus* of LLHs shows us that autonomous students always find a way to act, to overcome obstacles and to fulfill their willingness to construct their identity as a second language speaker. As we have already seen, they reach a state phase transition or edge of chaos by going abroad, by becoming members of specific communities (e.g. at work, through sports) and by engaging themselves in imagined communities (Yashima, Chapter 3) mediated by cultural productions such as music, cinema, and internet communities. The very richness of affordances allows the SLA system to go through spontaneous self-organization. Waldrop (1993:11) says that

complex, self-organizing systems are *adaptive*, in that they don't just passively respond to events the way a rock might roll around in an earthquake. They actively try to turn whatever happens to their advantage. Thus, the human brain constantly organizes and reorganizes its billions of neural connections so as to learn from experience (sometimes, anyway).

Successful learners are active agents who take risks, experiment and explore the environment. People trying to learn a second language unconsciously organize themselves into a linguistic ecological environment through a myriad of individual acts of language use. Most of the time, it happens without any conscious planning through evolution.

Inspired by the initial quotation, I would like to finish this chapter by saying that chaos in the SLA process brings uneasiness, but it also allows the opportunity for

individual language learners to become autonomous and aware of affordances, for creativity, for agency and for the construction of a second language speaker identity .

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