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# Limbic System and Second Language Acquisition: Reconsidering the Role of Emotion

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**ABSTRACT: Although the study of emotional brain has long been taken heed in second language acquisition (SLA), the current study makes an endeavour to reconsider the stance of emotional brain in SLA from neuroscientific perspectives. In so doing, inspired by Lamendella (1977) who holds that first language acquisition (FLA) is generally based on the limbic system, the present paper insists that SLA in a natural setting entail greater involvement on the part of limbic system. Henceforth, as to the present writers, investigating the function of learners' limbic system in SLA will contribute to our understanding of SLA.**

**Key words:** formal instruction, informal instruction, limbic system, empiricism, nativism

## INTRODUCTION

Emotion is embedded at the root of informal instruction. The seating of emotion, the limbic system, is inevitably involved in the formation of memory, and conclusively in second language acquisition (SLA) in informal contexts (Lamendella, 1977). The term *limbic* was earlier introduced by Willis (1664) to designate a cortical border encircling the brainstem. Schumann (1997, cited in Arnold & Fonseca, 2004, p. 121) asserts that "brain stem, limbic and front limbic areas, which comprise the stimulus appraisal system, emotionally modulate cognition such that, in the brain, emotion and cognition are distinguishable but inseparable. Therefore, from a neural perspective, affect is an integral part of cognition". Henceforth, though emotion and cognition are not neatly divided in the brain (Hendel-Giller, *et al.*, 2010), emotion exists at the heart of every cognitive theory. LeDoux (2000) also declares that virtually all mental activities involve both emotion and cognition. The present paper asserts that young educators suffer from a false dichotomy: genetics or experience. They probably have difficulty in deciding whether to follow empiricists' or nativists' implications. The present paper insists that it is time that specialists begin to re-describe the theories raised in SLA, and now test the key words in the given theories in order to corroborate the very hypotheses in order to pave the way toward their falsification. Raising new theories in the air is so much perilous that scholars reach nowhere. That Krashen (1981), for instance, claims informal environments are conducive to SLA is based on the truism that the amount of intake the acquirer can get is rich in informal contexts. In fact, according to Krashen, "the acquisition-rich classroom might be extremely efficient" (p.116) in SLA. Accordingly, what the present paper is of the thought is that the plausibility of the very efficiency can be justified neuropsychologically. In other words, when the content to be learned is associated with strong positive emotions, students are more likely to retain newly-learned information (Krashen, 1982). Seen from this stance, Krashen's input hypothesis can be in support of the function of limbic system involvement in SLA. Research in the field of educational psychology declares that affective variables might be the cause of lack of knowing. The affective variables that scholars (e.g., Krashen, 1981; Scovel 1969) refer to are related to the learners' emotions that emerge from the human limbic system. So much has been reported regarding the stance of emotion in SLA; however, less has been paid to the seating of emotion in the limbic system. Whether the limbic system has a qualitative effect on SLA is a matter of issue that the given paper makes an attempt to revitalize. In a sense, situating the stance of emotion in SLA, the present researchers assert that the overall effect of limbic system on SLA will be conceivable provided that it is held in a natural context. The same effect is respected not merely genetic- but also experience-based. The current paper, in this regard, is in an attempt to provide a critical view on situating the stance of the limbic system in SLA.

## REVIEW OF RELATED LITERATURE

There has always been a dichotomy in the definition of *learning*. As to Hinton, Miyamoto, and Della-Chiesa (2008), in SLA, there seems to be a dramatic sporting event between genetics (nature) and experience (nurture). The false dichotomy emanates from two absolutist perspectives in education. The first position, nativism, believes knowledge, per se, originates in nature. In other words, it is genetic. The idea goes back to Kant and Plato. Later, Chomsky (1957) revitalizes Plato's concept of mind in a new theory coined as Universal Grammar. Chomsky asserts that UG is an innate property of mind and cannot be learned. Nevertheless, Chomsky himself was harshly criticized by Campbell and Wales (1970) as "the man who, more than any other, has shown the shallowness, indeed the irrelevances of almost all behaviourist accounts of language acquisition" (p. 245).

The empiricism, in contrast, contends that knowledge originates from the environment. Behaviourism has its roots within positivism (Williams & Burden, 1997). The term positivism as a version of empiricism (Richards & Schmidt, 2002) was first coined by the French Philosopher Auguste Comte who believed reality can be observed. In modern times, empiricism is closely associated with the psychologist, Skinner (1957). Skinner asserts that there are no limits to what a human being can learn because both the time and opportunity are available. However, much of the research in neurolinguistics has been dedicated to proving Skinner wrong by showing that children can go beyond the given input, creating novel sentences (Bates, 1998).

Until now, the story goes on; there have been successive and often contradictory attempts in providing a solid definition for learning. Nevertheless, we are haunted in unanswered questions that need to be empirically investigated. Raising questions in the air is futile; the paper holds that the raised questions, up to now, need to be seriously corroborated and attempts should be made toward their falsifications.

Hendel-Giller *et al.* (2010) assert that learning is the defining feature of human beings. To Hendel-Giller et al. "learning is not just changing external behaviour, but changing the very wiring of the brain as it relates to those behaviours" (p. 5).

In sum, it is a truism that through learning, the structure of the brain will change. Hendel-Giller *et al.*, in the same line, go on to hold:

> Learning affects the brain in two different ways—either by altering existing connections or by creating brand new connections. New connections lead to an increase in overall synaptic density, while altering connections makes existing pathways more efficient or suitable. In both cases, the brain is remolded to take in new data and, if useful, retain it. (p. 6)

**Empiricism and nativism: Compromise or conflict?** Learning is conducive to structural changes of the brain. To Hendel-Giller *et al.* (2010), the hippocampus, a part of the limbic system in the brain, is responsible for encoding declarative and episodic memory. Manning (2007), also, asserts that if a person is exposed to high levels of stress, for instance, activation in hippocampus increases, and as a result, the encoding of declarative and spatial memory gets debilitated. In contrast, another part of limbic structure, the amygdale, becomes more active under stress, and therefore memory of emotionally relevant experiences enhances.

For three decades SLA has suffered from a false dichotomy between experience and genetics. Moreover, one reason for making SLA as a deep puzzle is the fact that what appear to be as SLA theories is "not in fact really theories, but rather either descriptive, non-explanatory frameworks for L2 researchers on the one hand, or else metaphors for organizing one's thoughts on the other" (Gregg, 1993, p. 289).

Chappell (2010), in harmony with Gregg (1993), asserts that SLA theories are compatible with "developing descriptive and explanatory power to account for how linguistic knowledge is instantiated in the brain and how L2 knowledge comes to be acquired in the brain" (p. 61). In fact, Gregg (1993) is keen on developing SLA as an endotropic theory, which is 'self-generating, self-fertilizing, self renewing' (Hasan, 2005, p. 51) "and whose object of study is kept free of contamination from its context, and reduced to its simplest elements, allowing for unequivocal claims" (Chappell, 2010, p. 61).

Parallel to the argument, Long (1993) argues that the rationale behind SLA theories should be oriented toward explaining how a second language becomes represented in the brain. In a sense, lack of a coherent general theory of SLA and also a coherent link to its empirical base (Gregg, 1993) ignite a flash fire among scholars to deeply investigate the role of brain in SLA. Henceforth, after two decades, the education community has started to realize that understanding the brain can help to open new pathways to improve educational research policy and practice. Nonetheless, nowadays, there appears to be a dynamic interplay between the two points of view—empiricism and nativism. Relativist inclination toward this dichotomy (i.e., genetics and experience) leads us to side Lantolf (1996), "the world has witnessed far fewer atrocities as a result of excessive tolerance than it has as a consequence of absolutism" (p. 722). What these absolutist camps—empericism and nativism— fear is relativism. In a sense, relativists (e.g., Schumann, 1984), as to Lantolf (1996), tend to be united in their belief that differences and heterogeneity are impediments to the mastery of truth.

What the present authors take advantage of the given interplay is that the progress in SLA might be dependent upon the degree of limbic system involvement, as well. Put differently, "a major contribution of neuroscience to education is the scientific confirmation that the brain develops through a dynamic and continuous interaction between biology and experience" (Hinton *et al.*, 2008, p. 88).

Although two thousand years ago Plato stated that all learning is embedded in emotion, only in the last two decades have several scholars (e.g., Le Doux, 2000; Schumann, 1998) shown that emotion changes the neural structural of the brain. That emotion plays an important role in the process of learning is undeniable. But how emotional regulation affects the process of learning is still at the core of heated debate in neurolinguistics. For decades, so much ink has been spilt trying to explain SLA processes. Research (e.g., Manuel-Dupont *et al.*, 1992) shows that formal and informal language learning have different neural representations in the brain. The quality of this representation probably depends on the degree of limbic system involvement.

In 1981, Krashen defines informal language learning or acquisition as that which is acquired in naturalistic communication settings where the user's attention is directed more to the content than the form of linguistic utterances. In contrast, formal language acquisition is characterized by the emphasis on the rule-governed system which makes the learners aware of the language. In a sense, Krashen makes a distinction between two types of knowledge: learning and acquiring. Learning, as a conscious process, takes place in artificial situations and is less permanent. Acquiring, in contrast, is a subconscious process and takes place in naturalistic situations and is more permanent. Krashen asserts that language acquisition is an incidental process that results in tacit linguistic knowledge, while language learning is an intentional process that results in conscious metalinguistic knowledge.

**On situating the stance of limbic system:** Lamendella (1977) contends that language acquisition and language learning have different neural representations with respect to the involvement of the limbic system. Similarly, Boeree (2009) maintains that the limbic system which lies on both sides of the thalamus is composed of a set of structures: the hypothalamus, hippocampus, amygdale, cingulated and other medial structures of the brain that form a ring about the inner border of the cortical mantle. As put by Boeree, the limbic system is highly responsible for the formation of memories and emotion. Regarding SLA, Lamendella (1997) puts forth that L1, in comparison with L2, is generally based on the limbic system.

Lamendella states when a second language is learned in a natural setting, it entails greater involvement on the part of limbic system. On the contrary, when the language is learned in a formal setting, like any other subject matter, it entails mainly neocortical structures. In this regard, Pavlenko (2005) makes a distinction between embodied languages and disembodied languages. Embodied languages are acquired within an emotional and contextual process, while disembodied languages are learned in a decontextualized process such as L2 classrooms. Pavlenko also asserts that SLA can also be considered as a contextualized process; thus, to her, emotional implication is not restricted to FLA. Henceforth, the limbic system is involved in L2 acquisition only if L2 appears as the linchpin of human beings' affective life (Kopke, 2007).

Paradis (1985, cited in Manuel-Dupont *et al.*, 1992), likewise, asserts that the limbic system is involved in the learning process. As to Paradis, limbic system is involved from fluent production of speech to the provision of empathy, and integrative attitudes. However, to Paradis, this involvement varies with the age of the learner, the degree of emotional involvement of the learner, the motivation to learn L2, and the relative prestige of the two languages in addition to the learning situation—formal versus informal (Manuel-Dupont *et al.*, 1992).

Regarding the involvement of limbic system in SLA, several other scholars including Kalbfleisch (2004) and LeDoux (2000) also share the same view. LeDoux (2000), for instance, maintains that the limbic system is highly connected with cortical areas involved in cognitive processing. The limbic system, known as the seat of emotion (MacLean, 1949), remains "a significant factor in the functioning of human speech" (Robinson, 1976, p. 769). In effect, the function of the limbic system is to generate emotion which is of great importance to learning and memory (Wolfe, 2001).

In sum, learning a new language has become a challenging journey where both experience and genetics are involved. On the journey, we experience a range of emotions along the ride. Emotional arousal usually results in the release of adrenaline (Huang, 2006). As to LeDoux (1996, cited in Huang, 2006), when adrenaline is released naturally, the related experience is remembered well. In fact, when a person feels angry, for instance, the amygdale in the limbic system will immediately downshift. As to Huang (2006), downshifting occurs when neocortex does not get sufficient glucose to function properly, causing the amygdale to prevent the brain from making rational decision. It is worth mentioning that emotions not only have their physical pathways in the brain, but also drive attention and create meaning (LeDoux, 1994, cited in Huang, 2006). Compatible with the notion of downshifting, Sylwester (2000, cited in Huang, 2006) asserts that the stronger the emotion associates with an experience, the greater is the assistance to cognitive learning. This does not mean that the emotion should be too strong, if so, downshifting occurs and learning decreases (Huang, 2006).

**Emotion and limbic system**: Regarding SLA, Schumann (1998) puts forth that affective appraisal of stimuli is embedded at the core of cognition, and it results in our decision-making processes. As to Schumann, it is through experiencing the world and conducting affective appraisal of these experiences that human beings develop their own preferences and aversions.

"Managing one's emotion is one of the key skills of being an effective learner" (OECD, 2007, p. 64). As to Reeve (2005) "emotions are short-lived, feeling-arousal-purposive-expressive phenomena that help us adapt to the opportunities and challenges we face during important life events" (p. 294). Regarding the importance of emotions in language learning, Bolitho et al. (2003) assert that language learning is enhanced when learners are "affectively engaged and when they willingly invest energy and attention in the learning process" (p.252). Along the same line, romantic humanists often claim that by touching the students' emotions and invoking their inner selves, they will encourage more successful language learning (Gadd, 1998). Inspired by the work of Rousseau, the romantic philosophy is based on the truism that the essence of being human is to be a member of a community engaging in debate and action. Allowing students to speak from their vantage points and letting students' emotion blossom facilitate the process of language learning. In other words, humanizing students through dialogue (Shakouri & Nazari, 2012) and creating a social band for them are at the heart of romantic humanism. Along the same vein, Schumann (1998) contends "emotional reactions influence the attention and effort devoted to learning, and...patterns of appraisal may underline what has been considered motivation in SLA" (p. 8).

The limbic system, according to Schumann (1998), involves innate homeostatic and sociostatic values; that is, innate dispositions related to survival and interaction with conspecifics. Schumann studying the biological aspect of motivation comes to hold that "through evolution, all human beings inherit two systems of motivation: homeostatic and sociostatic regulation" (p. 1). From one side, human beings are concerned with systems that allow to breathe, feed, stay warm and cool, and maintain an appropriate heart rate. In contrast, people are also driven by sociostates—the innate tendencies on the part of human being to seek out interaction with members of their community. These two systems foster human beings' motor activity in the environment.

Rolls (1990), also, maintains that emotion has its role in creating the need for interaction. Correspondingly, it can be hypothesized that due to the short pathway from the thalamus to the amygdale information is received approximately a quarter of a second sooner than the cortex (LeDoux, 2000). Thus, educators need to be aware of the efficient side of the learning by virtue of emotions. As LeDoux goes on to hold, emotion drives attention, and "the concept of attention is necessary in order to understand virtually every aspect of second language acquisitions" (Schmidt, 2001, p. 3).

**On the plausibility of informal instruction:** Human language springs forth from roots buried within the depths of the limbic lobes buried in the body of the brain (Joseph, 2000). The emotional brain, the limbic system, is susceptible to open or close access to learning.

Concern for SLA goes back to a burned generation, who, despite having spent years in formal classes, appear to be non-functioning (Gulmez & Shresta, 1993). In our classrooms, we see lots of learners whose intellectual energies are drained and their minds are paralyzed by negative emotional states.

On situating the stance of instruction, there appear several contradictory perspectives. For several scholars (e.g., Cook, 1991; Krashen, 1981) instruction makes no difference. They count the reasons as learners have access to Universal Grammar principles, and thus the learners do not need instruction. In fact, instruction takes place between UG principles and input. Pinemann (1998), though does not explicitly claim that formal instruction is unnecessary, recalls that formal instruction will not enable the learners to acquire any developmental features out of sequence because processability constrains acquisition. For another group of scholars, instruction is both beneficial (Schmidt, 1990) and necessary (Higgs & Clifford, 1982; VanPatten, 2003). Schmidt (1990) asserts that conscious attention to form is an inevitable condition for SLA. VanPatten (2003) also pinpoints that without formal instruction, learners' linguistic system is to be fossilized.

The inclination toward informal instruction has more or less been observed among scholars. Though they did not refer their inclination to the learners' seating of emotion—limbic system, the present paper insists that the root of their unwillingness toward formal instruction should be studied neuroscientifically.

The current study seems to throw some light of support to Krashen's input hypothesis that holds that SLA is the product of comprehensible input designed to convey messages in low anxiety situations. In fact, as to Gulmez and Shresta (1993), "the formal subjects' preoccupations with the form of the language at the expense of the meaning it conveyed not only hindered the smooth flow of their ESL speech but also disrupted the line of their communication" (p. 82).

In sum, whereas there is not a unanimous perspective among scholars on what SLA theory can be, the present paper holds raising headlong ideologies in SLA results in incoherence. Henceforth, re-describing the terminologies raised by scholars (e.g., Krashen, 1981), though have been widely criticized can lead to the assimilation and the integration of ideas.

Nevertheless, so far, the story goes on, and we come up with a variety of contradictory theories that have haunted us in unanswered questions. To end up, to the current work, delving on the vocabulary raised by scholars can contribute to the integrity and rectitude among SLA theories.

## CONCLUSION

Although the study of emotional brain has long been ignored in SLA, recent contributions of neuroscience are in attempts to remedy the deficiency by revealing the emotional dimension of learning. Our emotion about language affects our desires to learn a language. Although "emotion is too elusive and vague" and is not trusted in the laboratory (Damasio. 1999, p. 39), it can not only facilitate but debilitate the process of SLA. In sum, as to Bognar and Dubovicki (2012), "emotions in classes are present… as a sort of atmosphere we call emotional climate that can be favourable and unfavourable" (p. 136). However, Cozolino (2006) considers emotion as safe emergency for learning to take place. To increase learning effectiveness, teachers should allow their students' voice to be heard and their emotion to blossom.

In fact, the insights that the students have gleaned give them the chance and ability to construct their views of the world. In fact, it can be claimed that humanizing L2 learners influences their ability to draw material from the long-term memory (Stevick, 1999). In the long run, it goes without saying that limbic system structures, amygdale and hippocampus play important roles in memory storage.

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