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Research Paper

Biological differences in language learners

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Abstract

The purpose of this study is to reinvestigate the issue of biological differences, i.e. age, gender and brain in language learning. In spite of the fact that study on the biological differences in language learning is not a very young field, there are a lot of controversies remained unanswered. For instance, it is unknown how exactly language is processed in the brain. There is not either a general consensus concerning the fine structure of different neuronal regions that makes them an appropriate habitat for the functions that are impaired after damage to those areas. Providing different perspectives and various reasons, this paper concludes that since everyone enjoys a unique brain with unique genetic structure, so the different components of language- phonology, morphology, syntax, lexicon, and pragmatics are acquired relatively independently of each other and different for everyone and their development might follow different timetables.

Keywords: Biological Differences; Language Learning; Brain

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Introduction

There are numerous factors affecting the rate and route of language development. The effects of biological factors, namely age, gender and brain have also been subjects to various researches. This paper is going to discuss three above mentioned factors: age, gender and brain but it will be conclusively considered mostly in the uniqueness of brain and genetic uniqueness. With regard to the effect of age on language learning, Lenneberg (1967) states that the acquisition of language is an innate process determined by biological factors which limit the critical period for acquisition of a language from roughly two years of age to puberty [1]. He goes on to say that the brain loses plasticity after lateralization. Therefore, it is concluded that children learn language better and faster than adults. The outcome of second language acquisition (L2A) among adults is demonstrably different in many respects from the outcome of first language acquisition (L1A) among children. Departing from this basic observation, researchers attempt to understand the various sources of age-related effects in L2A.

But there are some controversies based on different findings. For instance, researchers have debated the age at which lateralization actually occurs. While Lenneberg (1967) proposes lateralization by puberty [1], Krashen (1973) suggests it may be complete by age 5 and surprisingly [2], Kinsbourne (1975, cited in Johnson & Newport, 1991) proposes completion by birth [3].

There is even some challenging evidence to reject the critical hypothesis itself. According to Birdsong (1992), some older learners have been identified who achieve native-like competence in the second language [4]. Bialystok and Miller (1999) points to the behavioral evidence that fails to reveal a

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qualitative change in learning outcomes at the close of a critical period [5].

The relationship between age and language learning manifests itself well in Critical Period Hypothesis. This hypothesis states that there is "a biologically determined period of life when language can be acquired more easily and beyond which time language is increasingly difficult to acquire." [6]. Originally, this hypothesis only included first language acquisition, but later researchers have extended it to second language as well. Many aspects of first language acquisition were brought into the domain of second language acquisition, but the assumption that the two types of acquisition are similar is fundamentally flawed.

Genesee (1988) explains the research of linguists who tried to relate the CPH to second language acquisition, but whose results remained questionable or inconclusive [7]. Working independently, Penfield and Lenneberg cited in Genesee (1988) suggested two reasons why language acquisition is difficult after puberty [7]. Penfield cited in Genesee (1988) maintained that the plasticity of the brain is lost "at puberty, after which complete or native like mastery of languages, first or second, is difficult and unlikely" [7]. This plasticity assigns functions to different areas of the brain and cannot be changed. Penfield noted that children who suffered brain damage before 9 to 12 years of age could recover language skills completely, but children who had suffered brain damage after puberty could not. Lenneberg (1967) went on to say that language learning after puberty was more difficult, but argued that the completion of "lateralization of language functions in the left hemisphere" (98) was the cause [1]. Lenneberg (1967) studied children who suffered damage to the left hemisphere of the brain before and after the age of 12 [1]. The transfer of language function to the right hemisphere was found in children who suffered damage before age 12, but rarely in those who suffered damage after age 12. Regarding the influence of gender on language learning, there is a long list of studies. Although researchers have long agreed that girls have superior language abilities than boys, there are some debates here too. For example, using functional magnetic resonance imaging (fMRI), Burman et al., (2007) measured brain activity in 31 boys and in 31 girls aged 9 to 15 as they performed spelling and writing language tasks [8]. Using a complex statistical model, the researchers accounted for differences associated with age, gender, type of linguistic judgment, performance accuracy and the method -- written or spoken -- in which words were presented.

Burman et al., (2007) find that girls still showed significantly greater activation in language areas of the brain than boys [8]. The information in the tasks got through to girls' language areas of the brain -- areas associated with abstract thinking through language. And their performance accuracy correlated with the degree of activation in some of these language areas. To their astonishment, however, this was not at all the case for boys. In boys, accurate performance depended on how hard visual areas of the brain worked. In hearing words, boys' performance depended on how hard auditory areas of the brain worked.

Burman et al., (2007) conclude that given boys' sensory approach, boys might be more effectively evaluated on knowledge gained from lectures via oral tests and on knowledge gained by reading via written tests [8]. For girls, whose language processing appears more abstract in approach, these different testing methods would appear unnecessary comparison with women.

A good deal of studies has also been dedicated to the relationship between brain and language learning. There have been different attempts by both language specialists and neurologists for over a century to understand how the brain learns, stores, and processes language but it proved to be a demanding onerous task because there are no animals that have symbol systems as rich as language. Therefore, for a long time, information about how the brain processed language could only come from the study of the effects on language of neurological disease in pathologies caused by various forms of brain injury. The high complexity of the brain and its functions on one hand and the complexity of the language itself and its functions on the other hand have led to different views about the relation between brain and language. Ahlsen (2006) refers to five views on the relation between brain and language [9].

Localism; associationism; dynamic localization of function; holistic; Evolution-based: this refers to those theories that deal with language and brain evolution over time and consider the difference between children's and adults' performances on language functions. Localism: This view tires to locate different centers in the brain which are responsible for different language functions and claims that they are mostly located in the cortex which are either two or more equally important parts for a function or a part is super ordinate to other parts regarding a function [9]. Localists like Broca and Gall define aphasia as trauma to a language function center.

***Associationism*:** This view situates language functions in connections of different areas of the brain's cortex. Thus based on this view, Ahlsen (2006) defines aphasia as a broken connection between the centers needed for a language function [9]. Among the supporters of this view are Wernicke and Geschwind.

***Dynamic localization of function*:** it assumes that functional systems of localized subfunctions perform language functions. Such systems are dynamic, and thus they can be reorganized during language development or after brain damage.

***Holistic*:** it views language functions as handled by differing parts of the brain working together. According to Ahlsen (2006), holism is the opinion that the brain works as a whole, at least to accomplish higher functions [9]. The cortex is said to handle, for example, higher cognitive functions, symbolic thinking, intelligence or abstraction. To advocates of holism, who are also called cognitivists, aphasia is a sign of general cognitive loss, not a specific language loss.

***Evolution-based*:** this refers to those theories that deal with language and brain evolution over time and consider the difference between children's and adults' performances on language functions.

"Unitarism and Equipotentiality" is another view discussed by Jacyna (1999) [10]. According to Jacyna (1999), "unitarism" refers to one unitary function of the brain, the view that the soul is one and cannot be divided, and "equipotentiality", means that all parts of the cortex have the same functional potential and that the size of a brain lesion determines the extent of the aphasia [10].

The point here is that as Knudson (2004, cited in Dornyei, 2009) argues, language depends on a wide range of specialized sensory, motor, and cognitive skills that involve many neural networks and structures, and they are shaped differently by experience [11]. According to Joseph (1993), a multitude of neuronal structures and fiber pathways are involved in the formulation, expression, and comprehension of speech and verbal thought [12]. Several scholars have suggested that since the different components of language- phonology, morphology, syntax, lexicon, and pragmatics are acquired relatively independently of each other, their development might follow different timetables, pointing to the possible existence of multiple critical periods for a person. Tranel et al., (1988, cited in Locke, 1997) state that genetic factors seem to play an important role: the infant`s responsiveness to facial and vocal activity is presumed to be heavily influenced by genetic factors [13]. Specific neural preadaptations underlie such behavior: Clinical and electrophysiological research reveals that humans have mechanisms that are similarly dedicated to processing faces and facial activity and to voices and vocal activity.

Joseph (1993) asserts that the right and left half of the brain utilize different means of communication and sometimes rely on different language systems [12]. There is strong evidence that information processing is carried on differently in each hemispheres of the brain. In majority of humans, the left hemisphere, is efficient at processing spoken language but has great difficulty processing social or emotional sounds. The right hemisphere on the other hand is very efficient in social and emotional sounds, but is deficient in language skills. As the century continues, more brain research will bring about new and improved information that can be used to make education and learning better. Is it possible that we can even be able to pinpoint difficulties to the point of being able to fix them and see a decrease of disabilities in students? One cannot know the range of knowledge gained from studies and research but one would like to believe that it could be possible. All the researches above and different findings show that everyone enjoys a unique brain that functions differently from others.

2. Conclusion

Although studies on the biological differences in language learning is not a very young field and some wholly rudimentary agreement was made in the first place on the role of age, gender and brain, there are a lot of controversies remained unanswered. It seems that it is all because of two important factors: first, language and brain are too complex, in other words, according to Code (1997), there is so little known about the brain itself. We do not know how exactly language is processed in the brain [14]. All the knowledge we have about the language in relation to the physical brain, or vice versa, have been gained by merely assuming correlation based on evidences suggested by case studies of persons with certain brain lesions and certain speech disorder that follow that lesion. We still have very little idea concerning exactly what it is about the fine structure of different neuronal regions that makes them an appropriate habitat for the functions that are impaired after damage to those areas; second, in Ahlsen`s (2006) words, everyone enjoys a unique brain with unique genetic structure, so the different components of language- phonology, morphology, syntax, lexicon, and pragmatics are acquired relatively independently of each other and different for everyone and their development might follow different timetables [9].

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