

УДК 81

UDC 81

THE IMPACT OF FOREIGN LANGUAGE LEARNING ON THE DEVELOPMENT OF HUMAN BRAIN ORGANISATION*E. V. Murugova, A. F. Aitova*Don State Technical University, Rostov-on-Don,
Russian Federationmurugovaelena@yandex.ruAlina.aitova@bk.ru

The general purpose of the article is to investigate the learning foreign languages impact on the cognitive brain structures of bilinguals. The article is to demonstrate that people who speak foreign languages (bilinguals) have some parts of their brain more developed than monolingual ones. This is confirmed by numerous studies of the different brain areas activity of bilinguals by means of such medical imaging techniques as MRI and ultrasound scanning. The data analysis in this field proves that people competent in foreign languages learning perform better in tasks that require intellectual skills (ability to prioritize, to distinguish between minor tasks, to solve several problems simultaneously, etc.). In addition, learning foreign languages has a positive effect on mental abilities of elderly people as the brain stimulation for more intensive activities hinder the processes of brain aging. The results of these studies will further help in determining the correlation between the ability to learn foreign languages and individual characteristics of the human brain structure.

Key words: Foreign languages, learning technologies, cognitive linguistics, monolinguals, bilinguals, medical imaging, brain structures, hippocampus, memory functions.

ВЛИЯНИЕ ИЗУЧЕНИЯ ИНОСТРАННОГО ЯЗЫКА НА РАЗВИТИЕ ОРГАНИЗАЦИИ МОЗГА*E. В. Муругова, А. Ф. Аитова*Донской государственный технический
университет, Ростов-на-Дону, Российская
Федерацияmurugovaelena@yandex.ruAlina.aitova@bk.ru

Целью статьи является исследование влияния иностранных языков на когнитивные функции головного мозга билингвалов и монолингвов. Показано, что у людей, владеющих иностранными языками (билингвов), некоторые участки мозга развиты сильнее, чем у монолингвов. Это подтверждают многочисленные исследования активности различных участков головного мозга у людей, занимающихся дополнительными языками, с помощью таких методов медицинской визуализации, как магнитно-резонансная томография (МРТ) и ультразвуковое исследование (УЗИ). Анализ данных исследований показывает, что люди, владеющие иностранным языком, лучше выполняют задачи требующие интеллектуальных способностей (умение правильно расставлять приоритеты, различать второстепенные задания, решать одновременно несколько задач и т.п.). Помимо этого, изучение дополнительного языка благоприятно сказывается на умственных способностях людей в возрасте, поскольку происходит стимуляция мозга для более активной деятельности, что тормозит процессы старения мозга. Результаты исследований в дальнейшем помогут в определении взаимосвязи между способностью к изучению иностранных языков и индивидуальными особенностями строения мозга человека.

Ключевые слова: иностранные языки, технологии обучения, когнитивная лингвистика, монолингвы, билингвы, методы медицинской визуализации, структуры мозга, гиппокамп, функции памяти.

Introduction. Languages are gateways to new cultures that allow us to connect with people around the world more efficiently than before. But, among other advantages, learning a new language has physical health benefits too. Human brain can increase in the size through the process of learning a foreign language. There is a great amount of researches that use some brain imaging technologies to understand better the cognitive benefits of learning languages. Diagnostics like electrophysiology and magnetic resonance imaging (MRI), besides other, can now reveal what is happening in our brains when we understand, hear or produce second languages [1].

Literature review and data analysis. One of the MRI study showed that learning a second language has a discernible effect on the brain.[7] A group of young people with a talent for languages learned Russian or Arabic intensively, while a control group of participants also studied hard, although not languages as the first one. MRI scans showed that specific parts of the brains of the language students advanced in size while the brain structures of the second group remained unaffected[1]. No less interesting was that learners whose brains developed in the hippocampus and zones of the cerebral cortex related to language learning had better language skills than other learners for whom the motor region of the cerebral cortex developed more.

In other words, the parts of the brain that grew were associated with how easy the learners found languages [7]. As the researchers remarked, although it is not completely obvious what changes after three months of concentrated language study mean for the long term, brain development sounds auspicious.

Looking at functional MRI brain scans can also tell us what zones of brain are active during a particular learning task [7]. For instance, we will be able to see the reason why native adult speakers of language like Japanese can't easily distinguish between the English "r" and "l" sounds (it is difficult and almost impossible task for them to differentiate "river" and "liver" or "road" and "load", for example). In contrast with English, Japanese does not recognize the difference between "r" and "l" sounds [4]. Instead, a single sound unit known as a phoneme represents both sounds.

This is useful in discovering the reason why native speakers of certain languages find it difficult to vocalize certain sounds of other phonetic systems. Knowing the brain mechanics behind vocalization can aid educators in including useful visual tools to help, for example, a Japanese student say, "Rob Roy" without the "l" sound. In the experiments with English words that contain either of these sounds, brain imaging studies demonstrate that only a single part of a Japanese speaker's brain is triggered, while in English speakers, two different areas of activation show up, one for each unique sound.

For Japanese speakers, learning to hear and produce the differences between the two phonemes in English requires a rewiring of certain elements of the brain's circuitry [8].

This sort of study may eventually lead to progress in the use of technology for foreign languages learning. For instance, by means of ultrasound machines like the ones used to show future parents the features and activities of their babies in the womb, scientists in articulatory phonetics would be able to explain to language learners how to make sounds in a proper way by showing them the visual images of how their organs of the vocal apparatus and the airstream mechanisms should work [1].

Ian Wilson, a researcher working in Japan, has formed some early reports on studies of these technologies that are quite promising [6]. Of course, researchers aren't suggesting that ultrasound equipment can be used as part of regular language classes, but ingenious software engineers are beginning to invent the ways to take advantage of this new knowledge by including imaging into cutting edge language learning apps.

Furthermore, professors at the University of Illinois at Chicago use electrophysiology to examine the inner mechanisms of the brain. They taught foreign language learners to speak a non-natural, artificial language – a mini language created by linguists to test statements about abilities of learning languages in a controlled way.

In their experimentations, one group of students was taught through description and explanation of the main rules of the language, whereas the second group was taught by being dipped into the language, like people usually learn their native languages. When the experiment ended, that were the immersed learners whose brain processes looked like those of native speakers. Fascinatingly, six months later, when they hadn't received any more experience of the language at home as the language was artificial, these learners still executed well on tests, and their brain processes had become even more native-like [2].

In some supplement studies, the scientists discovered that the students who had demonstrated specific flairs at picking up sequences and patterns learned grammar particularly well through immersion. It's been said that the brain-based researches show us not only that some adults can learn through dipping, like the young ones, but might let us deduce optimal learning circumstances for individual adult learners.

The research based on the brain imaging might eventually help us adapt methods of foreign languages learning to our cognitive capabilities, showing whether we learn best from formal teaching that highlights rules, or from immersing ourselves in the sounds of a language, or perhaps from one followed by the other.

This recent brain-based researches tell us good news. It is known that people who speak more than one language fluently have better memories and are more mentally flexible and cognitively creative than monolinguals. In discussions of memory, the hippocampus is mentioned repeatedly because it is a major part of the brain involved in the declarative memory function (the function that is dedicated to the storage of information about facts and events, along with general concepts and knowledge) [3]. Some studies of Canadian researchers suggest that Alzheimer's disease and the beginning of dementia are diagnosed later for bilinguals than for monolinguals, that means that knowing a second language can help us to stay cognitively safe and sound into our later years.

Even more inspiring is that bilingual advantages still hold for those of us who didn't have a chance to learn second languages as children. Edinburgh University researchers call attention to the fact that "millions of people across the world acquire their second language later in life: in school, university, or work, or through migration or marriage to a member of another linguistic community" [5]. The study also raised many questions, such as whether learning more than one language could also have the same positive effect on cognitive ageing and whether actively speaking a second language is better than just knowing how to speak it. Their results, with 853 participants, clearly show that knowing another language is beneficial regardless of when you learn it [5].

Conclusion. The results of literature review and material study showed that people who are good at foreign language acquisition perform better in tasks that require intellectual skills, demonstrate mental abilities at elder age. Bilingualism leads to the brain stimulation for more intensive activities that hinder the processes of brain aging. The results of these studies will further help in determining the correlation between the ability to learn foreign languages and individual characteristics of the human brain structure.

The key question in the studies is whether learning a new language improves cognitive functions or whether individuals with better cognitive abilities are more likely to become bilinguals.

References:

1. Morgan-Short, K. (2014). Electrophysiological approaches to understanding second language acquisition: A field reaching its potential. *Annual Review of Applied Linguistics*, 34, 15-36. — Режим доступа:

https://www.researchgate.net/publication/270218269_Electrophysiological_Approaches_to_Understanding_Second_Language_Acquisition_A_Field_Reaching_its_Potential (дата обращения: 16.12.2016).

2. Morgan-Short, K., Steinhauer, K., Sanz, C., & Ullman, M. T. (2012). Explicit and implicit second language training differentially affect the achievement of native-like brain activation patterns. *Journal of Cognitive Neuroscience*, 24(4), 933-947. — Режим доступа:

https://www.researchgate.net/publication/51590337_Morgan-Short_K_Steinhauer_K_Sanz_C_and_Ullman_MT_2012_Explicit_and_implicit_second_language_training_differentially_affect_the_achievement_of_native-like_brain_activation_patterns_Journal_of_Cognitive (дата обращения: 16.12.2016).

3. Morgan-Short, K., Faretta-Stutenberg, M., Brill, K. A., Carpenter, H., & Wong, P. (2014). Declarative and procedural memory as individual differences in second language acquisition. *Bilingualism: Language and Cognition*, 17(1), 56-72. — Режим доступа: https://www.researchgate.net/publication/259349628_Declarative_and_procedural_memory_as_individual_differences_in_second_language_acquisition (дата обращения: 16.12.2016).

4. Wikipedia, Perception of English /r/ and /l/ by Japanese speakers — Режим доступа: https://en.wikipedia.org/wiki/Perception_of_English_/r/_and_/l/_by_Japanese_speakers (дата обращения: 16.12.2016).

5. Thomas H. Bak MD, Jack J. Nissan PhD, Michael M. Allerhand PhD, Ian J. Deary MD Does bilingualism influence cognitive aging? 2014. DOI: 10.1002/ana.24158 — Режим доступа: <http://onlinelibrary.wiley.com/doi/10.1002/ana.24158/full>.

6. The Guardian, What happens in the brain when you learn a language?, — Режим доступа: <https://www.theguardian.com/education/2014/sep/04/what-happens-to-the-brain-language-learning> (дата обращения: 16.12.2016).

7. Johan Mårtensson, Johan Eriksson, Nils Christian Bodammer, Magnus Lindgren, Mikael Johansson, Lars Nyberg, Martin Lövdén. Growth of language-related brain areas after foreign language learning. *NeuroImage*, 2012; 63 (1): 240 — Режим доступа: <http://www.sciencedirect.com/science/article/pii/S1053811912006581>: (дата обращения: 16.12.2016).