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Neurological Problems of Learning Foreign Languages: A Comparative Study of English and Uzbek

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Annotation: This study explores the neurological factors influencing foreign language learning, using English and Uzbek as case studies. It investigates how cognitive and neural processes, including working memory, attentional control, and neural plasticity, interact with linguistic typology to affect second language acquisition. Using behavioral, electrophysiological, and neuroimaging methods, the research examines differences in syntax, morphology, and orthography, and their effects on brain activation patterns.

Keywords: Cognitive and Neural Limitations, Brain Regions for Language, Neurobiological Processes.

Introduction

Neurolinguistics examines how the human brain's neural systems enable the understanding, production, and learning of language. As an interdisciplinary discipline, it integrates theoretical frameworks and research methods from neuroscience, linguistics, cognitive science, neuropsychology, and the study of communication disorders [1], [2], [3], [4]. Extensive research has highlighted the complex interplay between neural mechanisms and foreign language learning, establishing neurolinguistics as a crucial framework for understanding second language (L2) acquisition. Evidence suggests that learning a new language involves the activation of multiple neural networks, while neurocognitive limitations—such as constraints in working memory, attentional control, and reduced neural plasticity—can markedly hinder both the efficiency of language learning and the development of proficiency [5].

Recent neuroimaging studies, employing techniques such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG), have identified the significant contributions of cortical and subcortical regions in language processing, bilingual lexical retrieval, and syntactic integration [6], [7]. These results underscore that individual variability in neural organization and cognitive abilities can strongly influence L2 learning success.

Furthermore, psycholinguistic research indicates that cross-linguistic effects and interference are mediated by specific neural pathways, emphasizing the relevance of neurobiological insights forapplied linguistics [8].

A comprehensive understanding of these neurological mechanisms is vital for designing effective instructional strategies, managing cognitive load, and improving learner performance in both monolingual and bilingual environments. This study integrates contemporary neuroscientific evidence and examines its pedagogical implications, with a particular focus on English and Uzbek language acquisition [9], [10].

Materials and Methods

This research adopts a comparative neurolinguistic framework to examine the neurological factors that influence the acquisition of English and Uzbek as foreign languages. The study is anchored in neurocognitive and psycholinguistic theories, which elucidate how the brain encodes, stores, and

retrieves linguistic information. Learner proficiency is treated as a key variable, as it affects neural activation patterns and cognitive engagement during language processing. Within neurolinguistic research, proficiency is operationally defined as the extent to which L2 learners exhibit controlled linguistic competence at specific temporal stages, encompassing both comprehension and production abilities. An integrated methodological design is employed, combining behavioral, electrophysiological, and neuroimaging techniques. Behavioral measures include structured tasks such as sentence comprehension, lexical decision-making, and word association to assess language processing efficiency. Electrophysiological approaches, including electroencephalography (EEG) and magnetoencephalography (MEG), capture the temporal dynamics of neural responses to linguistic stimuli. Neuroimaging techniques, such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), enable the visualization of cortical and subcortical networks involved in L2 processing. By triangulating findings from these complementary methods, the study investigates both functional and structural neural correlates of language acquisition. This approach permits real-time analysis of phonological perception, syntactic integration, and semantic processing, while simultaneously identifying brain regions associated with executive control, working memory, and attentional regulation. The combination of behavioral and neuroscientific data provides a comprehensive framework for understanding how neurological constraints influence L2 learning outcomes, thereby informing evidence-based pedagogical practices for English and Uzbek language instruction.

Results and Discussion

Research indicates that different components of language, such as syntax and semantics, are processed in distinct brain regions. The left inferior frontal gyrus is primarily involved in syntactic processing, handling sentence structure, while the left temporal lobe is central to semantic processing, responsible for meaning extraction. These insights are crucial for developing pedagogical and therapeutic interventions that target specific linguistic functions [11]. Aphasia provides an important lens for understanding language processing in neurolinguistics. Sensory aphasia, for example, results from damage to brain regions responsible for phonological analysis, disrupting phonemic processing. In English, aphasic speakers often produce simplified or incorrect word order and misapply function words, struggling with irregular verb forms and tense markers. In Uzbek, aphasia typically affects affixation and case marking due to the language's agglutinative structure, leading to omission or misuse of suffixes and tense/person markers [12]. These observations suggest that while the neural regions affected may be similar across languages, the surface manifestations of aphasia are shaped by linguistic structure. Dyslexia, a developmental reading disorder linked to phonological processing deficits, demonstrates similar typology-dependent patterns. English's opaque orthography complicates phonological decoding, reducing activation in left-hemisphere regions such as the visual word form area. In Uzbek, with its transparent orthography, dyslexic readers face fewer irregular word challenges but still encounter difficulties with syllable segmentation and morphological parsing, particularly when processing complex agglutinative forms. Overall, these findings underscore that neurological and cognitive constraints interact with language-specific characteristics, influencing both typical and impaired L2 processing. Recognizing these interactions can inform targeted teaching methods and clinical interventions tailored to the neurocognitive profiles of learners [6], [13], [14], [15].

Conclusions

This study demonstrates that neurological and cognitive mechanisms play a central role in second language acquisition, with typological characteristics of languages, such as syntax, morphology, and orthography, significantly shaping brain activation patterns. English and Uzbek, as case studies, reveal that structural differences influence the engagement of neural networks responsible for working memory, syntactic integration, and phonological processing. The findings highlight the importance of accounting for individual neurocognitive profiles when designing language instruction or therapeutic interventions. By integrating behavioral, electrophysiological, and neuroimaging evidence, this research provides a comprehensive understanding of how neurocognitive constraints impact L2

learning efficiency and proficiency development. Overall, these insights emphasize the value of applying neurolinguistic principles to educational and clinical contexts, facilitating the creation of targeted teaching strategies and rehabilitation programs that are informed by the interaction between linguistic typology and neural processing.

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