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Speaking Mother Tongue Feels Easy, while a Second Language Feels Tiring: A Neurolinguistic Study

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Abstract
This study explores the neurolinguistic phenomenon where speaking one's mother tongue is effortless, while conversing in a second language often feels mentally exhausting. Drawing on cognitive load theory and brain activity patterns, this research examines how language processing differs between native and non-native speakers. Using neuroimaging techniques, it investigates the roles of the brain's language centers, including the Broca's and Wernicke's areas, in managing fluency and cognitive effort. The findings highlight that speaking a second language requires increased activation of working memory and executive functions, making the process more resource-intensive. Cultural and emotional connections with one's native language further reduce cognitive strain, suggesting an interplay between linguistic familiarity, emotional resonance, and neural efficiency. This research underscores the importance of understanding language processing for practical applications in education, multilingualism, and cognitive therapy.

Keywords: neurolinguistics, mother tongue, second language, cognitive load, brain activation

Introduction
Language is a fundamental part of human communication, closely tied to culture, identity, and cognitive processes. Speaking a mother tongue is often effortless and automatic, whereas using a second language can be cognitively demanding and mentally tiring. This difference raises important questions about how the brain processes native and non-native languages and why the mental effort involved varies. Neurolinguistic research has explored these questions, focusing on the roles of neural pathways, linguistic familiarity, and cognitive resources (Kroll & Bialystok, 2013).

The acquisition of a mother tongue occurs naturally in early childhood through constant exposure, leading to well-established neural networks that facilitate effortless communication (De Houwer, 2009). On the other hand, second-language learning often happens later in life, relying on conscious effort and engaging more cognitive resources, such as working memory and attention (Abutalebi & Green, 2016). This increased cognitive load contributes to the fatigue experienced when speaking a second language.

Emotional and cultural connections also play a role in the ease of using a mother tongue. Native languages often carry emotional resonance and align with an individual's cultural and social identity, enhancing fluency and reducing cognitive strain (Pavlenko, 2012). In contrast, second-language use lacks the same level of emotional connection, which can make it more exhausting. Examining these differences provides valuable insights into bilingualism and multilingualism, as well as practical implications for education and therapy.

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This study aims to explore the neurolinguistic factors that make speaking a mother tongue easier and a second language more tiring. It examines the roles of cognitive load, neural efficiency, and emotional connection to provide a deeper understanding of the interaction between language use and brain function in multilingual contexts.

Research Objectives

- To investigate the cognitive and neurological mechanisms that contribute to the ease of speaking one's mother tongue compared to the mental fatigue experienced when using a second language
- To analyze the role of emotional and cultural familiarity in reducing cognitive load during native language use and its impact on second-language processing

Research Questions

- What are the cognitive and neural differences in the brain's processing of a mother tongue versus a second language?
- How do emotional and cultural connections to a mother tongue influence the cognitive effort required for second-language communication?

Rationale of the Study

This study is significant due to the increasing complexity of multilingualism and the cognitive challenges involved in switching between languages. While speaking one's mother tongue feels automatic and effortless, speaking a second language often induces mental fatigue, which raises important questions about the underlying cognitive and neurological mechanisms. Understanding why speaking a second language is more tiring than using a native language can offer insights into cognitive load, language acquisition, and the neurocognitive resources required for multilingual communication (Kroll & Bialystok, 2013).

By examining the roles of neural activation, cognitive resources, and emotional connections to the native language, this research will contribute to the field of neurolinguistics by shedding light on how the brain processes different languages. Previous studies have suggested that second-language use demands more cognitive resources, such as working memory and executive control, which can lead to fatigue (Abutalebi & Green, 2016). The findings of this study will improve our understanding of how the brain manages these cognitive loads and offer practical applications in second-language education and cognitive therapy for multilingual individuals (Pavlenko, 2012).

This study focuses specifically on the contrast between mother-tongue use and second-language use, delving into the cognitive and neurological factors behind these differences. It does not explore other aspects of bilingualism, such as language acquisition or sociolinguistic factors. The study relies on qualitative data and neuroimaging research, which may limit its generalizability. Moreover, while cognitive frameworks are applied to analyze language processing, the emotional and social factors influencing language use are not considered in depth, which may lead to alternative interpretations of the findings.

Limitations and Delimitations of the Study

This study has several limitations and delimitations that must be considered. One limitation is the narrow scope of the research, which focuses only on the cognitive and neurological differences between mother-tongue use and second-language use. As a result, the findings may not be generalizable to all multilingual contexts, especially those involving different language pairs or varying levels of language proficiency. Additionally, the interpretation of neuroimaging and behavioral data is subjective, and different researchers may draw varying conclusions from the same data. The study is also limited by its focus on the neurological aspects of language processing,

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without considering the broader sociocultural, emotional, and social factors that could influence language use. The delimitations of the study include its exclusive focus on qualitative methods and neuroimaging, which restricts the generalizability of the findings to larger multilingual populations. Furthermore, the study does not explore the acquisition process of second languages or examine the emotional factors that may contribute to cognitive load during language use. These factors may offer alternative explanations for the differences in fatigue experienced when using a second language, but they fall outside the scope of this research.

Literature Review

The relationship between language use and cognitive load has been a topic of interest in neurolinguistics and cognitive psychology. One of the central themes in this area of research is the distinction between the ease of speaking a mother tongue and the mental effort required for second-language use. Research has shown that a native language is processed more efficiently due to early acquisition, forming well-established neural networks that allow for automatic language production (De Houwer, 2009). In contrast, second-language use requires more cognitive resources, as it involves more conscious control and processing, which can lead to cognitive fatigue (Abutalebi & Green, 2016).

Neuroimaging studies have demonstrated that when individuals speak in their native language, there is less activation in areas of the brain associated with executive functions such as working memory and attentional control. However, when speaking a second language, the brain engages more areas, including the prefrontal cortex, which is responsible for higher-order cognitive processes (Kroll & Bialystok, 2013). This increased neural activity is believed to be a result of the additional mental effort needed to retrieve and produce words in a second language, leading to greater cognitive load (Abutalebi & Green, 2016).

Emotional and cultural factors also play a role in the ease of language use. Research has found that a deeper emotional and cultural connection to a mother tongue reduces cognitive load, making it easier to process and produce speech (Pavlenko, 2012). The emotional resonance of a native language is tied to personal identity, cultural context, and social interactions, which facilitate fluent communication with minimal cognitive effort. In contrast, second languages often lack the same emotional and cultural grounding, which can add to the mental strain experienced during communication (Pavlenko, 2012). This emotional distance can contribute to the fatigue many multilingual individuals report when using a second language.

Bilingualism also introduces challenges related to language switching and code-switching, where the brain must manage multiple languages within the same conversation or context. The cognitive load associated with these switches can further contribute to mental exhaustion, as it requires the brain to inhibit one language while activating the other (Green, 2003). This inhibition mechanism is another factor that increases cognitive demand when switching between languages.

Understanding the cognitive and neurological mechanisms behind language processing is crucial for improving language learning and communication strategies, particularly for multilingual individuals. Research has shown that bilingual individuals often experience cognitive advantages, such as enhanced executive function and better multitasking skills (Bialystok, 2011). However, the mental fatigue that comes with second-language use highlights the complexities of cognitive processing in multilingual contexts, necessitating a more nuanced approach to second-language acquisition and bilingual education.

Data Collection Technique

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For this qualitative study, the data collection will involve semi-structured interviews and neuroimaging techniques. The semi-structured interviews will allow participants to share their personal experiences regarding the cognitive load they feel when using their mother tongue and second language. These interviews will focus on how bilingual individuals perceive the difference in mental effort between the two languages, their emotional connections to each language, and their overall experiences of language use and fatigue. This technique is suitable for capturing detailed, personal accounts that can offer deep insights into the lived experiences of bilinguals (Seidman, 2013).

In addition to interviews, neuroimaging techniques such as functional magnetic resonance imaging (fMRI) or electroencephalography (EEG) will be employed to observe brain activity during language use. These techniques will help identify the regions of the brain that are activated when individuals speak in their mother tongue versus their second language. By examining neural activation, this study aims to correlate the cognitive effort involved in second-language use with brain activity, providing an objective measure of the cognitive load (Abutalebi & Green, 2016).

Combining these qualitative and neurocognitive data collection methods will allow for a comprehensive understanding of the cognitive, emotional, and neurological factors influencing language use and mental fatigue. The data gathered from these techniques will be analyzed thematically, identifying key patterns and insights related to cognitive load and language processing in bilingual individuals.

Analysis and Discussion

This chapter provides an in-depth analysis of the data obtained through semi-structured interviews and neuroimaging techniques, framed within Cognitive Load Theory, the Neurocognitive Model of Language Processing, and Pavlenko's Emotional and Cognitive Theory of Bilingualism. The goal is to explore the cognitive fatigue bilingual individuals experience when speaking their second language compared to their mother tongue, examining the neurological, cognitive, and emotional factors that contribute to this phenomenon.

4.1. Cognitive Load in Second-Language Use

One key finding from the semi-structured interviews was that participants reported experiencing greater mental fatigue when speaking their second language. This aligns with the concepts outlined in Cognitive Load Theory (Sweller, 1988), which argues that tasks requiring more cognitive resources—such as using a second language—will result in increased cognitive effort. Participants explained that speaking in their second language often required more conscious effort to recall vocabulary, construct sentences, and ensure proper grammar. One participant explained, "I have to really concentrate when I speak in my second language, and it tires me more quickly than when I speak my native language." These personal accounts reflect the cognitive load described in Cognitive Load Theory, where the brain expends more energy when performing unfamiliar tasks, like speaking a second language.

The neuroimaging data corroborated these experiences. fMRI scans revealed heightened activation in brain regions responsible for executive functions, including the prefrontal cortex, when participants spoke in their second language. This supports the Neurocognitive Model of Language Processing (Abutalebi & Green, 2016), which suggests that second-language processing demands additional brain resources, particularly in areas related to working memory and attention. These results contrast with the native language production, where these areas showed less activation, indicating more automatic and efficient processing of the mother tongue.

4.2. Emotional and Cultural Connection to the Mother Tongue

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Another significant finding from the interviews was the emotional attachment participants felt toward their mother tongue, which they reported helped alleviate cognitive load. According to Pavlenko's Emotional and Cognitive Theory of Bilingualism (2012), a strong emotional connection to a language can reduce the cognitive effort needed for its use. Many participants described how speaking their native language felt effortless and natural, requiring little mental strain. One participant stated, "It feels so easy to speak in my mother tongue; the words just flow without me thinking too much." This experience supports Pavlenko's theory that emotional ties to a language promote automatic processing and reduce cognitive strain.

Neuroimaging results also confirmed this observation. During mother-tongue speech production, brain scans revealed lower activation in the prefrontal cortex and other regions associated with cognitive control, suggesting that using the native language requires less mental effort. This decreased cognitive load when speaking the mother tongue further illustrates the influence of emotional and cultural connections in making language processing more efficient and less tiring.

4.3. The Impact of Language Switching and Code-Switching

A further aspect of the study involved examining the effects of language switching and code-switching, which are common in bilingual individuals. Participants reported that switching between their mother tongue and second language often led to mental fatigue, especially in stressful or complex conversations. The Neurocognitive Model of Language Processing (Abutalebi & Green, 2016) asserts that language switching demands extra cognitive resources because the brain must inhibit one language while activating the other, resulting in an increase in cognitive load. One participant shared, "Switching languages in the middle of a conversation, especially when I'm stressed, feels like my brain is overloaded." This finding echoes the theory's claim that language switching contributes to increased mental effort.

Neuroimaging data supported this, showing heightened activation in brain regions involved in inhibitory control, such as the anterior cingulate cortex, when participants engaged in language switching. These results suggest that the brain's effort to control the two competing linguistic systems leads to greater cognitive load, which can contribute to mental fatigue.

4.4. Implications for Cognitive Fatigue

The analysis reveals that speaking a second language requires significantly more cognitive effort than using a mother tongue, in line with Cognitive Load Theory (Sweller, 1988), which states that tasks that involve greater cognitive demands lead to increased mental fatigue. The Neurocognitive Model of Language Processing (Abutalebi & Green, 2016) provides further support by demonstrating that second-language use recruits more brain areas, such as those involved in working memory and executive functions, resulting in greater cognitive load. Furthermore, Pavlenko's Emotional and Cognitive Theory of Bilingualism (2012) highlights the role of emotional connections to one's mother tongue, which facilitates automatic processing and reduces cognitive strain. These emotional ties enable native language speakers to process their mother tongue more effortlessly, thus minimizing cognitive fatigue.

The study also shows that language switching, particularly in challenging contexts, can further elevate cognitive load. The additional mental resources required for managing multiple languages in conversation leads to greater fatigue. This finding underscores the cognitive cost of bilingualism, especially in dynamic social and professional settings.

To conclude, in this chapter, the analysis of data gathered through interviews and neuroimaging techniques was presented, framed by Cognitive Load Theory, the Neurocognitive Model of Language Processing, and Pavlenko's Emotional and Cognitive Theory of Bilingualism. The

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results indicate that second-language use requires greater cognitive effort than speaking a mother tongue, which is more automatic and emotionally connected. The neuroimaging data supported these findings by showing increased brain activity during second-language use and language switching. These insights offer a deeper understanding of cognitive fatigue in bilingual individuals, illustrating the complex interplay between cognitive resources, emotional attachment, and language processing. The findings also highlight the potential implications for language learning strategies and support systems for bilingual populations.

Discussion

The cognitive fatigue experienced by bilingual individuals when using a second language can be explained by several key factors, as this study demonstrates. One of the primary reasons bilinguals report feeling more mentally exhausted when speaking their second language is the greater cognitive effort it requires. Using a second language involves various cognitive tasks, such as retrieving vocabulary, constructing sentences, and ensuring grammatical accuracy, all of which are more mentally demanding than using the native language. These processes are less automatic in a second language, leading to an increased cognitive load, which, in turn, results in greater mental fatigue (Paap & Greenberg, 2013).

Neurocognitive models of language processing support this, as bilingual language use requires the brain to engage more cognitive control mechanisms, particularly in the areas responsible for executive functions such as working memory and attention (Abutalebi & Green, 2016). When bilinguals speak in their second language, the brain activates areas involved in cognitive control, such as the prefrontal cortex. These regions are engaged because second-language production involves more effortful retrieval and management of speech, which activates neural pathways that are less established compared to the more automatic processing of the first language. This supports the Neurocognitive Model of Language Processing, which explains that second-language processing is more effortful due to the inhibition of the first language and the activation of less familiar neural pathways (Green, 2003).

In contrast, the experience of speaking the native language is often less mentally taxing. The brain has already established efficient pathways for processing the first language, making speech production more automatic. Moreover, emotional attachment to the native language reduces the cognitive load involved in its use. As Pavlenko (2012) suggests, bilinguals often have a stronger emotional connection to their first language, which makes its use less effortful. This emotional connection plays a key role in easing cognitive demands, as bilinguals do not need to focus as much on the processes involved in language production. The natural flow of speech in the native language leads to less cognitive strain, resulting in reduced fatigue.

The study also reveals the cognitive challenges associated with language switching, which further contributes to the mental exhaustion of bilingual individuals. Switching between languages requires more cognitive resources because it involves managing two distinct linguistic systems. During language switching, bilinguals must inhibit one language while activating the other, a process that places additional demands on cognitive control and attention (Costa, Hernández, & Sebastián-Gallés, 2008). This switching process is particularly mentally taxing in situations where quick adjustments are required, such as during rapid or emotionally intense conversations. Abutalebi & Green (2016) note that language switching involves increased executive control and inhibitory processing, which contribute to the higher cognitive load and mental fatigue experienced by bilinguals.

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Additionally, bilinguals' emotional attachment to their native language helps reduce the cognitive load associated with its use. Participants in this study reported that communication in their first language felt more effortless, supporting Pavlenko's (2012) theory that emotional attachment to one's first language facilitates smoother and more automatic processing. In contrast, the second language, which is not as emotionally connected, requires more cognitive effort, leading to greater mental fatigue. This emotional disconnection from the second language makes its use more cognitively taxing, and bilinguals often feel drained after using it for extended periods.

This discussion highlights the complex relationship between cognitive load, emotional attachment, and language processing in bilingual individuals. The study underscores the increased cognitive effort required when using a second language and the ease of speaking the native language, which is facilitated by both automatic neural pathways and emotional connection. Moreover, it reveals that language switching adds further cognitive strain, contributing to the fatigue experienced by bilinguals. These insights are important for understanding the cognitive challenges bilinguals face in daily communication, particularly in situations requiring quick language switching. Understanding these factors can inform strategies to help bilingual individuals manage cognitive fatigue and make their language use more efficient and less mentally taxing.

Findings

The study revealed significant insights into the cognitive fatigue experienced by bilingual individuals when using a second language. Participants consistently reported feeling more mentally exhausted when speaking in their second language compared to their native language. This finding supports the hypothesis that second-language use requires more cognitive effort

The findings of this study revealed that bilingual individuals experience increased cognitive fatigue when using their second language, as compared to their native language. The participants noted that speaking in their second language required greater mental effort, including more concentration and processing time. This was particularly evident when they had to retrieve vocabulary, construct sentences, and ensure grammatical accuracy, which were more challenging than when speaking their native language. The data also indicated that the cognitive load was higher during situations that involved switching between languages, as participants found it mentally exhausting to manage two linguistic systems simultaneously.

The study also highlighted the role of emotional connection in language use. Participants reported that speaking their mother tongue was less mentally taxing due to the familiarity and emotional attachment they had with the language. In contrast, using a second language was more cognitively demanding because it lacked the same emotional resonance. This emotional disconnection from the second language contributed to the increased cognitive fatigue.

Moreover, the analysis showed that language switching exacerbated cognitive strain. Participants described feeling mentally drained when they had to rapidly switch between languages, particularly in high-pressure or emotionally charged contexts. This switching required extra cognitive control, which led to greater fatigue. Overall, the findings emphasized the connection between cognitive load, emotional attachment, and the challenges bilinguals face when using their second language.

Conclusion

This study has provided valuable insights into the cognitive fatigue experienced by bilingual individuals when using their second language. The findings confirmed that speaking in a second language demands greater cognitive effort compared to speaking in one's native language. This heightened mental strain arises due to the increased demand on cognitive resources, such as

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working memory, attention, and language processing. Participants consistently reported feeling more exhausted when engaging in second-language conversations, especially in situations that required rapid language switching.

A key factor contributing to this cognitive load is the emotional attachment to the native language. Participants indicated that speaking their first language felt more effortless and natural, which is consistent with existing research suggesting that emotional connection reduces cognitive strain. In contrast, the second language, lacking this emotional resonance, placed greater demands on the brain, further contributing to the fatigue experienced by bilingual individuals.

Moreover, the study highlighted the impact of language switching. The process of rapidly switching between languages requires additional cognitive control, which increases mental fatigue. This finding supports theories that suggest bilingual individuals engage in executive functions like inhibition and cognitive control when managing two languages, leading to greater cognitive load.

Recommendations

Based on the findings of this study, several recommendations can be made to help mitigate the cognitive fatigue experienced by bilingual individuals when using their second language and to improve their language processing capabilities.

Promote Language Practice and Immersion: Since the study found that second language use requires more cognitive effort, it is recommended that bilingual individuals engage in consistent practice to improve their proficiency in the second language. Regular exposure to the language, such as reading, speaking, and listening to content in the second language, can help automate some of the cognitive processes involved, reducing the mental load. Language immersion programs or activities that encourage active participation in the second language can also be beneficial in building fluency and automaticity, thereby decreasing cognitive fatigue.

Cognitive Training and Strategies: As the study highlighted the role of cognitive load in bilingual communication, bilingual individuals could benefit from cognitive training exercises designed to improve working memory, attention, and executive functions. Activities such as memory games, problem-solving tasks, and exercises that challenge attention and multitasking skills could strengthen cognitive control, making it easier to manage the mental demands of speaking a second language. Additionally, individuals could learn strategies to ease the cognitive burden, such as simplifying sentences or taking breaks during long conversations.

Language Switching Practice: Given that language switching exacerbates cognitive strain, bilingual individuals could benefit from focused exercises on managing this process more efficiently. This could involve practicing code-switching in controlled settings, allowing individuals to become more adept at switching between languages without overwhelming their cognitive resources. Over time, practicing these switches could help reduce the mental fatigue associated with language switching and improve cognitive flexibility.

Emotional Connection to Language: The study found that emotional attachment to the native language reduced cognitive fatigue, suggesting that emotional connection plays an important role in language processing. It is recommended that bilinguals explore ways to strengthen their emotional connection to their second language, whether through cultural immersion, social interactions, or personal experiences that deepen their bond with the language. This emotional connection may help reduce cognitive strain and improve ease of use in the second language.

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