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Bilingual Switch Cost Effect on Language Processing

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BILINGUAL SWITCH COST EFFECT ON LANGUAGE PROCESSING

BY

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ABSTRACT

Recent reports suggest that over half of the world's population regularly uses two or more languages (or dialects) in their daily lives. The U.S. Census Bureau reports 21.6% of the population communicates in a language other than English within their homes. Thus, it is essential to methodically investigate how language processing and learning vary between monolingual and bilingual individuals. To date, research on the effects of bilingualism on language processing has been inconsistent or conflicting. The present study was designed to empirically examine if bilingual speakers differ in language processing and comprehension compared to their monolingual counterparts. It was hypothesized that the bilingual switching process would impact language processing as measured by accuracy and reaction time (RT). A sample of 60 participants was used and consisted of 15 monolingual English speakers and 45 bilingual Spanish, French, and Arabic speakers.

All participants completed a series of language decision tasks consisting of 44 congruent and incongruent sentences presented randomly and sequentially. Results showed that participants were more accurate in detecting incongruent than congruent sentences. Similarly, participants also responded faster to incongruent than congruent sentences. In addition, results also showed that participants had higher accuracy scores when the sentences were presented sequentially than randomly and responded faster when sentences were presented randomly than sequentially. Interestingly, results also showed a significant interaction between congruency and presentation mode on participants' accuracy scores. Tests of simple effects indicated that for the sequentially presented sentences, there was a significant difference between congruent and incongruent sentences.

Similarly, for the congruent sentences, there was a significant difference between the sequentially and randomly presented sentences. Furthermore, our results also showed a significant interaction between congruency and presentation mode on participants' reaction time scores. Tests of simple effects indicated that participants had faster reaction time scores in the congruent sentences when they were presented randomly than sequentially. A series of General Linear Models (GLM) was conducted to examine the effects of language tested, congruency, and presentation mode on participants' accuracy scores. Results also showed a marginally significant interaction between congruency and language tested on accuracy and reaction time scores. Tests of simple effects indicated that only the Arabic speakers had significantly higher accuracy scores on concurrent than incongruent sentences. None of the other language groups had significant differences between congruent and incongruent accuracy scores for the other language groups. Finally, there was a significant interaction between congruency and language tested on participants' reaction time scores. Results showed that for the congruent sentences, French speakers had significantly faster reaction times than Spanish speakers and English speakers had significantly faster reaction times than Spanish speakers. However, English speakers had significantly faster reaction time scores for incongruent sentences than Arabic speakers. Both theoretical and practical implications are discussed, and future research directions are presented.

Keywords: bilingualism, switch cost effect, language processing, syntactic congruency, cognitive performance, sentence comprehension accuracy.

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CHAPTER ONE: INTRODUCTION

In today's era of rapid globalization, there is an increasing trend of individuals crossing national, cultural, and linguistic borders for employment, education, or personal pursuits. Bilingualism and multilingualism have increased significantly as a result of this. Bilingualism, the capacity to converse effectively in two languages, is an important phenomenon that is spreading around the world. It has developed into a crucial component of many people's daily lives, making its study and comprehension an essential element of contemporary sociolinguistic research.

According to recent studies, individuals proficient in communicating in two or more languages or dialects are estimated to represent over half of the world's population (Grosjean, 2010). This astounding number demonstrates the widespread adoption of bilingualism around the world.

The number of individuals in the United States who speak a language other than English at home has seen a significant increase, almost tripling from 23.1 million in 1980 (about 1 in 10) to 67.8 million in 2019 (almost 1 in 5), according to the U.S. Census Bureau (2022).

United Nations Educational, Scientific and Cultural Organization supports this finding, stating that on a global scale, bilingualism and multilingualism outpace monolingualism (Education in a Multilingual World, 2003, p. 12). Our linguistic panorama is in constant flux, with an astonishing array of approximately 6,000 to 7,000 existing languages (Asher & Moseley, 2018, p.3). Languages possess an inherent potential to evolve, sometimes morphing into distinct dialects or even facing extinction (Nettle & Romaine, 2000, p.153). Despite this diversity, a bias persists, particularly in governmental bodies, to consider monolingualism as the norm, often fueled by explicit or implicit language policies James (2011). Of approximately 200 worldwide nations, less than a quarter officially recognize more than one language, with exceptions like India,

Luxembourg, and Nigeria acknowledging more than two (Alatis & Tan, 2001, p. 332). However, the widespread nature of bilingualism does not eliminate its unique cognitive challenges. A case in point is the bilingual switch cost, which refers to the temporary cognitive decline and delay in processing time experienced by bilinguals when alternating between languages, which is one of the most notable declines in performance (Costa & Santesteban, 2004; Abutalebi & Green, 2007). By investigating the effects of the switch cost effect on y aspects of language processing, such as semantic processing and sentence comprehension, this study aims to clarify and further explore the cognitive mechanisms active during the usage of two languages. It also focuses on the effects of bilingual switch cost on congruent and incongruent sentences, an area not thoroughly investigated in earlier studies (Bialystok, 2009; Costa & Sebastián-Gallés, 2014). In addition to this unique focus, the study provides important insights into how presentation mode can impact the speed and accuracy of language comprehension in bilingual individuals (Prior & MacWhinney, 2010).

Gender

Cognitive differences between gender abilities and language processing have been a subject of interest for researchers for many years. Studies have shown that women may generally have better verbal skills than men in language comprehension. For instance, women have been found to have larger vocabularies, better reading comprehension, and superior verbal fluency (Halpern, 2000; Wallentin, 2009). According to a theory put forth by Baker and Jones (1998), women's improved verbal abilities may help them learn a second language more quickly, potentially improving their fluency in both languages. In terms of bilingual language processing specifically, Baker and Jones's (1998) studies suggest that females may exhibit more efficient

language switching, potentially due to their superior verbal abilities. For example, females might have a lower switch cost when alternating between languages, allowing for more seamless transitions in bilingual communication.

Moreover, females may be better at phonetic perception and pronunciation than males, which are essential skills for learning a second language and can assist them in producing a more native-like language in bilingual settings (Piske et al., 2001). However, It is essential to remember that not all research has uncovered gender differences in multilingual processing. For instance, Paap et al. (2015)'s research did not find conclusive evidence in favor of the presence of multilingual benefits in executive processing, a concept that would incorporate the switch costs phenomenon. Their findings indicate that factors other than gender, such as individual differences in cognitive control or language ability, may significantly impact the efficiency of bilingual processing and switch costs. Interestingly, these individual variations in cognitive control may have their origins in variances in neuroanatomical structure. A study by (Yücel et al., 2001) revealed gender-based differences in the brain structures associated with cognitive control. However, similar to the findings of Paap et al. (2015), these neuroanatomical variations do not always correspond to gender differences in bilingual processing. Therefore, exploring individual cognitive and neuroanatomical variations might be beneficial, instead of gender alone, in understanding and predicting bilingual switch costs. It is also relevant to consider how gender and societal issues interact complexly with bilingualism. Gender disparities in bilingualism may be complicated by societal expectations and gender roles, which can impact language usage and learning. For example, due to their social roles in some cultures, females may have greater

opportunities to acquire and use a language, which may impact their ability to speak two languages (Ehrman & Oxford, 1989).

The research is not definitive, despite some data that suggests gender variations in bilingual language processing. Any reported variations are most likely the result of a complex interaction of biological, cognitive, and social variables. To completely comprehend the possible impact of gender on bilingualism and language switch costs, more research is therefore required.

Age of Acquisition

The age of acquisition is an important aspect of bilingualism, as it significantly impacts several language proficiency and cognitive outcomes. The degree to which each language becomes proficient, accent development, grammatical usage, fluency, and cognitive consequences, including attention control and cognitive flexibility, are all impacted by this component. In terms of the age at which a second language is acquired, bilinguals can be roughly categorized into two groups: early and late bilinguals (Hernández et al., 2012). Early bilinguals, often known as simultaneous bilinguals, typically acquire both languages during their early years, frequently before reaching the age of three. They may be able to acquire native-like ability in both languages, master accents, and successfully understand idiomatic usage attributed to this dual language exposure throughout the crucial era of language development (Meisel, 2009). Early bilinguals have significant cognitive consequences in addition to their language abilities. Inhibitory control and cognitive flexibility may emerge more readily as a result of the continual need to coordinate two functioning language systems (Carlson & Meltzoff, 2008). Due to extensive expertise in managing and sustaining two languages, early bilinguals frequently exhibit a

decreased switch cost, indicating more effective management of cognitive demands during language switching (Yow & Li, 2015).

By contrast, late bilinguals, also referred to as sequential bilinguals, start learning their second language after the critical period of language development, often during adolescence or adulthood. Even though they may reach high skill levels in their second language, these people are expected to have an accent still and use more grammatical errors than early bilinguals (Flege et al., 1999). In addition, late bilinguals frequently have distinctive cognitive effects. Although some studies point to potential cognitive advantages, such as improved attentional control, these advantages are often weaker and less dependable than those seen in early bilinguals (Bialystok, 2009). Additionally, late bilinguals frequently display a higher switch cost. This tendency is most likely caused by their limited time handling two languages, which causes them to exert more cognitive effort when switching between the two (Meuter & Allport, 1999). In summary, bilingualism's linguistic and cognitive characteristics are greatly influenced by the age a second language is attained, with early and late bilinguals showing different patterns in language processing and cognitive impacts.

Culture

The cultural context can significantly influence the multilingual experience. As a result, the culture may influence language proficiency and use as well as the cognitive components of bilingualism, such as switch costs (Treffers-Daller & Silva-Corvalán, 2016). Consider a bilingual person from Canada who speaks English and Punjabi as an example. Because of the cultural customs and familial ties, Punjabi may be the primary language spoken in this person's household and community. However, English is frequently the predominant language in Canadian society as

a whole. As a result, it may be spoken in places like workplaces, schools, and other public areas. Depending on the cultural and situational context, the multilingual person would utilize either Punjabi or English in this instance. This may lead to varying proficiency levels in each language, with greater fluency in English reading and writing due to education but more nuanced Punjabi conversational skills due to regular familial use.

Another example could be Spanish - English speakers in the United States. Due to cultural ties within the family, they may speak Spanish at home, yet because English is the language most spoken, they use it more often in formal or public situations. Due to increased usage and exposure, this trend may lead to stronger English skills, whereas their use in Spanish, despite maybe being more emotionally deep and contextually rich, may be less academically polished. Depending on the frequency and context of language switching, these individuals could also face a range of switch costs. For instance, individuals can encounter lower switch cost when switching from Spanish to English, as is common when going from the house to a place of employment or education. In contrast, switching from English to Spanish can have a higher switch cost because it happens less frequently and possibly in less predictable circumstances.

In the Ubang community in Nigeria, an intriguing example of cultural influence on bilingualism emerges, marked by an unusual linguistic phenomenon where men and women speak two distinct languages (Krauss, 1992). The Ubang people of Nigeria are known for their unique linguistic phenomenon. Men and women speak distinct languages in the Ubang community (Chari & Akpojivi, 2023). This custom has been carried down through centuries, with children growing up learning both languages but beginning to speak the one assigned to their gender around the age of ten. Men and the boy-child speak two languages, Ofre and Arasere, but women and the girl-

child speak only Arasere, even though they understand Ofre (Mgbeadichie, 2023). The Ubang languages are quite distinct, with different words, sounds, and lexical items for men and women. For example, the term for "clothing" in Ubang is "nki" for males and "ariga" for women (Chari & Akpojivi, 2023). This phenomenon is so deeply embedded in their culture that even when a man and a woman converse in their separate languages. Despite this linguistic divide, both genders can understand one other's language with no trouble.

The exact origins of this practice remain unknown, though various theories exist, one of which suggests that this dual language system was established to avoid direct confrontation or argument between men and women (Chari & Akpojivi, 2023). However, increased urbanization and the influence of English and other dominant languages endanger these distinct linguistic traditions (Krauss, 1992). Efforts to document and preserve the Ubang languages emphasize the significance of maintaining unique linguistic and cultural heritages despite global linguistic uniformity (Harrison, 2007).

As a result, culture is crucial to bilingualism, as it shapes the language and cognitive experiences of bilingual people in complex and context-specific ways.

Socioeconomic Status

Socioeconomic status can significantly impact the course and outcomes of bilingualism. Those from higher socioeconomic backgrounds often have access to resources that facilitate language learning, such as high-quality education, private tutoring, study abroad opportunities, and exposure to diverse linguistic environments (Callahan & Gándara, 2004). This increased access to resources may lead to higher proficiency levels in the secondary language.

Alternatively, people with lower socioeconomic status might have limited access to these resources. They may still become bilingual, especially if they grow up in a multilingual setting or community, but how well-versed they are in each language is contingent on a variety of circumstances, including the level of their education and their exposure to each language (Hakuta, 1986). For instance, children from lower socioeconomic origins may acquire a second language (typically the nation's official language) at school but use a different language at home in many developing nations. Due to the deficiency in premium educational resources, these kids may struggle with academic literacy in the second language despite their bilingualism (Brock-Utne, 2007).

Moreover, socioeconomic status can also influence the societal perception of a bilingual individual's language skills. For instance, languages associated with high socioeconomic status may be given more prestige and value, which in turn can affect a bilingual individual's motivation to use and maintain a language (Corsaro, 1992).

Motivation and Attitude

Motivation and attitude serve as an essential components in successful bilingual language acquisition. With a focus on motivational factors, Gardner and Lambert (1972) proposed a socio-educational model emphasizing learner differences' importance in second language acquisition. They hypothesized that learners with integrative motivation—the aspiration to acquire the language with the purpose of becoming assimilated into the culture of its speakers—tend to have higher success in their language-learning endeavors than learners with instrumental motivation. Dörnyei and Csizér (2005) also highlight the role of motivation in language learning. They believe that a learner's desire to excel in a second language could substantially affect their proficiency

level. As a result of personal pleasure or delight in language education development, a student who is intrinsically motivated to study will probably achieve a higher degree of proficiency than someone who is less motivated. Another important consideration is how one feels about the speakers of the intended language. Learning a language is more appealing and can enhance motivation when one has a good attitude toward the language and culture (Gardner, 1985).

In contrast, negative attitudes can impede language development and limit language proficiency. For example, having a positive outlook on both languages could encourage balanced bilingualism in a bilingual setting. In contrast, a child's motivation to use or keep one of their languages may decrease if they feel that their community undervalues it, which could have an impact on their bilingual development (Baker, 2001).

Emotional Resonance

Emotional Resonance in relation to the language of bilingual individuals describes the idea that one's first language (L1) frequently carries a greater emotional weight than one's second language (L2) or any thereafter learned languages. This phenomenon has been studied extensively and is thought to be caused by the fact that our first language is typically used to learn about, express, and experience our emotions in childhood. For example, a Pavlenko (2012) study found that bilingual individuals reported experiencing more emotional resonance when using their first language. Participants also claimed that slurs, praying, or expressing feelings of love or rage in their first language proved more emotionally intense than in their second. According to Pavlenko, these findings can be taken as demonstrating an elevated degree of emotional resonance with one's original language. Anooshian and Hertel (1994) conducted an additional study on memory recall in bilingual people. Their findings revealed that when individuals were asked in their original

language rather than their second, they were more likely to recall emotionally charged situations. It demonstrates that emotional experiences in one's original language may be more profoundly imprinted.

Furthermore, a study by Dewaele (2004) on self-reported language choice for expressing emotions in bilinguals discovered that participants frequently chose to express negative emotions in their first language, indicating that the emotional bond or attachment to a language may affect the selection of language utilized in different circumstances. The concept of emotional resonance regarding language is important because it emphasizes the necessity of taking emotional variables into account while researching bilingualism, language learning, and language use. It also has ramifications for disciplines such as psychotherapy, where the selection of language can exert a significant influence on emotional reactions and results in therapy (Costa & Dewaele, 2012).

Cognitive Abilities

Cognitive abilities, including working memory, phonological awareness, and metalinguistic skills, play an essential role in bilingualism. Short-term memory, or the capacity to retain and manage information temporarily, has been positively correlated with second language proficiency (Baddeley, 2003; Loewen and Sato (2017). This may be because comprehending a sentence in a second language frequently necessitates remembering the first portions of the sentence while processing the latter parts. A multilingual person learning a language with a different sentence structure from their original tongue, for instance, may extensively rely on working memory to reorganize the words in the sentence in their head.

Phonological Awareness

Phonological awareness is the knowledge that phonemes, or discrete sounds, make up words. According to research by Durgunoğlu et al. (1993), awareness of sound structure in a first language can aid learners of a second language in enhancing their reading and spelling skills. For instance, a bilingual child who understands how sounds correspond to written letters in their original language may discover it more effortless to become literate in their second language.

The ability to reflect on and analyze language in an abstract way is referred to as metalinguistic ability. In tasks involving metalinguistic abilities, bilingual people frequently do better than monolinguals (Bialystok, 2001). By increasing people's awareness of language usage and structure, these abilities may facilitate the learning of a second language. Due to their increased metalinguistic awareness, a bilingual person, for instance, might more easily comprehend that a statement like "Apples, John ate" and "John ate apples" can both indicate the same thing.

Language Similarity

Similarities between languages have a major impact on bilingualism. The speed and simplicity of learning a secondary language can be greatly influenced by how closely related the first and second languages are to one another. Languages that are more similar to one another than others in terms of vocabulary, grammar, or phonological systems can be acquired more quickly and effortlessly (Ringbom, 2001). For example, a person whose first language is Spanish is probable to study Italian, a closely related Romance language, more easily than Japanese, a language from a completely different language family. This is due to the substantial overlap between Spanish and Italian in terms of cognates (words with a shared etymological origin), grammatical structures, and phonological systems (Odlin, 1989). This factor can also affect the

nature of transfer errors. The term "transfer" describes the phenomenon where habits from the first language are carried over into the second language. If the languages are similar, these habits may be helpful, but if they are not, they may result in mistakes. Because the word order of questions differs between German and English, German speakers learning English may initially struggle with it (Kellerman, 1979).

Language similarities can affect the cognitive advantages of bilingualism, according to research. According to studies, bilinguals who communicate two closely related languages are less capable of maintaining their cognitive control when switching between the two languages than bilinguals who speak more different languages (Prior and Kotz, 2009).

Education and Formal Instruction

Bilingual people's language skills are developed and improved through formal education and training. The kind, quantity, and quality of training a bilingual person obtains can significantly impact their competency level in both languages.

Quality instruction, regardless of the language, usually involves well-trained teachers who employ effective teaching strategies and instructional methods. The syntax, vocabulary, and sociolinguistic complexities of the language they are teaching are well understood by these teachers, and they are able to effectively communicate this understanding to their pupils (Cummins, 2000). Furthermore, quality instruction also creates an inclusive and supportive learning environment that encourages learners to actively utilize the language across diverse settings (Baker, 2011).

The quantity of instruction is also important. Simply put, a person is more likely to learn more the longer they spend learning a language. Research shows a direct correlation between instructional time and language proficiency results (Carreira & Kagan, 2011). For instance, immersion

programs—where students spend a significant amount of time learning academic material in a second language—have been found to be particularly effective at promoting high levels of bilingual competency August et al. (2009).

The type of instruction is also important. Bilingual teaching structures, such as bilingual education techniques or bidirectional immersion approaches, can foster elevated proficiency in both languages and promote cross-cultural understanding (Howard et al., 2003). Alternatively, foreign language classes that meet only a few times per week may not give learners enough exposure and practice chances to develop strong language abilities (Lightbown & Spada, 2013).

An example of the contribution of formal education to bilingualism is seen in the Canadian French engagement programs. Anglophone students in these curriculums get most of their education in French, resulting in high levels of French language proficiency (Genesee, 2008). This demonstrates the importance of education and structured teaching in ensuring effective bilingual development.

Family Language Policy (FLP)

Family Language Policy (FLP) refers to families' explicit and implicit strategies to encourage bilingualism and biliteracy in their homes. It frequently entails deciding which language(s) to use in specific settings and contexts, which language(s) to teach children, and how to balance the usage and growth of both languages (Spolsky, 2004).

For example, some families implement a "one parent-one language" strategy, in which each parent regularly communicates with the child in a separate language. This approach aims to facilitate the child's acquisition of both languages. Other families may choose to implement a "minority language at home" practice of maintaining a minority language within the family environment to

offset the dominant language's effect in society (De Houwer, 2007). These choices can greatly impact a child's language competency and use patterns. An example of this can be seen in immigrant families, who often face decisions concerning balancing the heritage language and the tongue of their newfound homeland. According to research, keeping the legacy language at home can benefit children's cognitive development and cultural identification. It can also strengthen family cohesion by allowing greater contact with extended family members who may not be fluent in the prevalent language of the new nation (Tseng & Fuligni, 2000).

However, other elements, such as community perceptions of the minority language, the accessibility of materials in that language (such as books or media), and the perceived value of the language for the child's future opportunities, can all contribute to the FLP's success (Curdt-Christiansen, 2009).

Language Attrition

Language attrition is the gradual decline of a language as a result of lack of use or exposure. It is a common tendency among bilingual and multilingual individuals who stop using one of their languages on a daily basis (Köpke & Schmid, 2004). Language attrition can occur in both primary and second languages. In the instance of first language attrition, this can be seen in immigrant communities who move to utilize the language of their new nation more frequently, at the expense of their native tongue. For example, a person who migrates from France to the United States and uses only English may undergo French language attrition (Schmid, 2011).

Second language attrition, in contrast, occurs when a person learns a language in a formal setting, such as school, but then has little opportunity to use that language in everyday life. Many people study a foreign language in school, but if they do not use it consistently after graduation, they may

suffer from language attrition (Bahrick, 1984). It's important to note that language attrition does not always result in total language loss. Instead, the individual may struggle with fluency, vocabulary recall, and grammatical precision (Köpke & Genevska-Hanke, 2018). Numerous factors, including the degree of proficiency in the language previous to inactivity volume and standard of engagement with the language, along with the individual's age, may all affect the extent of language decline (Köpke & Schmid, 2004; Schmid, 2011; Schmid & Köpke, 2017).

Benefits and Challenges

Due to its intricate nature, bilingualism overlaps with and advances many academic disciplines, such as, but not restricted to, psychological linguistics, cognitive psychology, neurology, and education. The nature of linguistic encoding in the brain can be revealed by comprehending the cognitive processes behind bilingual language processing. This will allow researchers to determine whether two languages are stored in separate or shared neural regions and how they interact at different processing levels, such as lexical, syntactic, and semantic levels (Kroll et al., 2012).

Equally intriguing is the "bilingual advantage" theory, which suggests that navigating two languages enhances certain cognitive functions, including attentional control and cognitive flexibility. The viability of this idea and the possible mechanisms underlying these cognitive advantages can be clarified by empirical research on bilingual people (Bialystok, 2009). The dual language has advantages and disadvantages. In addition to having access to two linguistic and cultural resources, bilingual people frequently have cognitive advantages, such as enhanced creativity, enhanced executive abilities, and reduced age-related cognitive decline (Bialystok et al., 2007; Bialystok, 2009; Kharkhurin, 2010). However, they also have to cope with difficulties like

the cognitive load brought on by switch cost, potential linguistic disruption, social pressure, or stigma associated with particular languages, and the added effort needed to understand and produce accented speech (Grosjean, 2010; Floccia et al., 2009). The manner in which bilinguals acquire accents might make processing languages even more difficult. Accented speech sometimes requires more cognitive resources for comprehension and production since it has irregular pronunciation or intonation patterns (Floccia et al., 2006). According to studies, bilinguals may experience a higher switch cost when switching to a language with a more noticeable accent (Bice & Kroll, 2015). However, as it is a new area of study, the impact of accent on switch cost needs more investigation. A further key component of bilingualism is the practice of "code-switching," which involves switching throughout a single conversation between two or more languages or sentences. This new area of research has the potential to improve our comprehension of the neurological and cognitive processes that govern language choice and suppression, adding to our comprehension of how the human cognitive system operates (Green & Abutalebi, 2013).

CHAPTER TWO: LITERATURE REVIEW

Bilingual Switch Cost Effect Theories

It is essential to consider related bilingualism and language processing theories and models better to understand the bilingual switch cost effect on language processing.

The Additive Model is one of the main theories in the study of bilingualism, suggesting that bilingual individuals exhibit unique mental representations for each language which combine to offer additive benefits, such as enhanced cognitive flexibility and executive control (Ianco-Worrall, 1972). This model suggests that bilinguals maintain two separate language systems

processed independently but can interact to enhance overall cognitive capacities, encompassing cognitive adaptability, executive functioning, and working memory. According to this model, bilinguals have two distinct language systems that are processed independently but can interact to improve overall cognitive abilities, such as thinking flexibility, executive control, and short-term memory. The Subtractive Model challenges that being bilingual results in lower proficiency in both languages than those who only speak one language. Studies highlighting the cognitive benefits of bilingualism provide empirical support for the Additive Model. Bialystok and colleagues (2004) found that bilingual children performed better than their monolingual classmates on executive control tasks like task switching and inhibitory control. According to other research, bilinguals perform better than monolinguals on tasks that require mental flexibility, such as problem-solving and creativity. (Bialystok et al., 2006).

The Subtractive Model, first proposed by Peal and Lambert (1962), is a bilingualism theory that holds that bilingual individuals have a single mental representation for both languages, resulting in constant competition and, as a result, reduced language proficiency in comparison to monolingual counterparts (Peal & Lambert, 1962). The Additive Model, on the other hand, proposes that bilinguals have two independent language systems that can interact to improve overall cognitive abilities. Despite its popularity in the early stages of bilingualism research, recent studies have provided limited empirical support. Instead, research has shown that bilinguals do not perform inferior in either language compared with monolinguals (Bialystok et al., 2010; Kroll & Bialystok, 2013). Bialystok, Luk, Peets, and Yang (2010) revealed that bilingual children had language proficiency levels comparable to their monolingual counterparts. Bilinguals can maintain high proficiency in both languages without significant interference, according to Kroll and

Bialystok (2013). As a result, the Subtractive Model has fallen out of favor in bilingualism research, with more sophisticated theories, such as the Additive Model and the Bilingual Interactive Activation Mode taking its place.

The Code-Switching Model proposes that bilingual individuals can switch between languages fluidly when appropriate demands arise. This ability is critical to their overall language processing abilities. Code-switching is a linguistic phenomenon that enables bilinguals to navigate their linguistic repertoire seamlessly, selecting the most appropriate language or combining words from both languages to achieve effective communication in diverse social and cultural settings (Grosjean, 1982). The Code-Switching Model highlights the adaptive and flexible aspects of multilingual speakers' cognitive processes, emphasizing the dynamic nature of bilingualism.

The Dynamic Model of Multilingualism (DMM) model was proposed by Herdina and Jessner in 2002 as a way to understand and explain the complex nature of bilingualism. This signifies a significant advancement in the domain of linguistics and bilingual studies, shifting from a static to a dynamic view of language ability. The DMM is based on dynamic systems theory, which holds that systems are not static but change over time due to various factors. These elements can include the usage of language, the social context where language is used, individual attitudes toward different languages, and many others in the setting of multilingualism. Each of these elements can affect a person's communication ability, leading it to evolve and change over time (Herdina & Jessner, 2002). An example of the DMM model can be seen in a study by De Bot et al. (2007), where they followed a Dutch-English bilingual over a 17-year period. According to the study, the participant's language skills altered throughout time, indicating changes in her language use and social context. Her English skills increased, yet her Dutch skills deteriorated during

periods when she predominantly utilized English. Her Dutch skills improved once she returned to a Dutch-speaking setting. This demonstrates how dynamic and adaptable multilingual competence can be, therefore validating the DMM's main concepts. The DMM further claims that bilingual or multilingual speakers can easily transition between languages, the model presented earlier known as code-switching. Numerous studies, including one by Grosjean (1998), show that bilinguals frequently switch languages in conversation to suit the circumstances, illustrating the fluid and dynamic nature of multilingual ability.

The DMM provides a valuable framework for understanding multilingual competence's complex and ever-changing nature. It emphasizes the importance of considering the various elements that can influence a person's linguistic proficiency and the flexibility with which multilingual speakers use their languages.

The Input Processing Theory, proposed by VanPatten (2004), is mainly concerned with second language acquisition and the methods by which learners interpret (or process) language input. The hypothesis is based on two principles:

a. Students prioritize understanding the meaning of the content before analyzing its structure. This indicates that while acquiring a new language, people prioritize understanding the message's substance overpaying attention to the grammatical structures used. When learners hear the statement "The cat is chasing the mouse," they immediately understand the concept of a cat chasing a mouse before recognizing the verb tense or the article employed.

b. Learners have a natural order for processing different types of grammatical structures, frequently based on their inherent salience and semantic value. This notion argues that

learning and understanding some grammatical patterns is simpler than others, owing to their prominence in speech or writing and semantic contribution to the overall message. For example, learners may grasp the concept of plurality (cats vs. cat) before grasping advanced grammatical ideas such as perfect tense (has chased vs. is chasing).

The Input Processing Theory provides useful insights into effective second language teaching approaches. It emphasizes the necessity of delivering relevant input that learners can grasp and evaluate semantically, guiding them to detect and absorb new grammatical forms (VanPatten, 2004). It also implies that instruction should consider the natural order of processing specific linguistic structures and adjust accordingly. It may be more effective, for example, to add tense agreement once learners have a good understanding of basic sentence structure. However, this theory has been challenged by research emphasizing the potential of explicit grammar instruction for promoting language learning (Norris & Ortega, 2000), indicating the need for a balance between meaning-focused input and form-focused instruction.

Interdependence Hypothesis was proposed by James Cummins, often known as Cummins' Interdependence Theory, in 1981. According to this hypothesis, the learner's abilities in their first language substantially impact second language learning. Essentially, the skills, comprehension, and knowledge that learners build in their first language do not need to be relearned when they study a second language; rather, these skills are transferred to the second language. This paradigm places a strong emphasis on the necessity of mastering one's native language in order to support the learning of a second language successfully. For example, if a child has proficient reading skills in their first language, they can use these talents when learning to read in a second language. The

time and effort required to learn to read in a second language can be greatly reduced as a result. (Cummins, 1981).

Furthermore, Skutnabb-Kangas and Toukomaa (1976) noticed that Finnish immigrant children in Sweden with high proficiency in Finnish (their first language) also had advanced skills in Swedish, the second language they were studying. This provides support to the Interdependence Hypothesis. However, Cummins (1981) also noted that this transfer of skills is more effective when the educational environment acknowledges and respects the student's first language, suggesting that the context and approach to bilingual education can drastically impact the effectiveness of this transfer process.

Although numerous models attempt to explain bilingualism, only a few of them addressed the impacts of the bilingual switch cost effect on various domains, such as language production, perception, and memory. However, the specific cognitive mechanisms underlying the bilingual switch cost effect, particularly as they relate to language processing, semantic processing, and sentence comprehension, remain largely unknown. In studies, language switching has increased cognitive load, resulting in slower processing and increased errors, particularly when dealing with semantically or syntactically complex content (Costa & Santesteban, 2004; Meuter & Allport, 1999). This switch cost effect represents the cognitive effort required to deactivate one language system and activate another, and it appears only in bilingual individuals during semantic processing and sentence comprehension tasks (Costa & Santesteban, 2004; Meuter & Allport, 1999). The temporary cognitive load experienced during language switching may impact bilingual individuals' performance during these tasks.

The cognitive advantages of bilingualism, include improved executive function and task-switching abilities, are well-established (Bialystok et al., 2012; Costa et al., 2009; Garbin et al., 2010). However, the bilingual switch cost effect, a temporary decline in performance when bilinguals alternate between languages, presents a unique set of challenges. One such benefit is enhanced executive control, encompassing attention control, inhibitory control, and cognitive flexibility. For instance, Bialystok et al. (2004) discovered that in a Simon task, bilinguals outperformed monolinguals, a classic executive control measure. These findings suggest that simultaneously managing two languages may strengthen these executive skills in bilingual individuals.

Further, the frequent need for bilinguals to switch languages might enhance their task-switching abilities. Supporting this, Prior and MacWhinney (2010) observed that bilinguals demonstrated quicker and more accurate responses than monolinguals in a task-switching experiment. This implies that bilingualism could facilitate the development of efficient task-switching skills. However, it is crucial to acknowledge that these benefits do not invariably occur and are contingent on several factors, such as an individual's language proficiency, the task's particular requirements as well as the language used, and the context (Bialystok, E. 2009). Therefore, it is of paramount importance to methodically investigate the variations in language processing and acquisition between monolingual and bilingual speakers. Current research has uncertain or conflicting findings regarding the effect of bilingualism on language processing. This study's goal was to empirically investigate whether bilingual people experience differences in language processing and understanding from their monolingual peers.

CHAPTER THREE: STATEMENT, RESEARCH QUESTION AND HYPOTHESES

Thesis Statement

This study investigates the influence of bilingual switch cost on semantic processing, sentence comprehension, and reaction time. By highlighting the distinctions in accuracy and processing speed between monolinguals and bilinguals, it employs experimental design and data analysis methods focusing on language-switching phenomena. The intention is to explain the cognitive and neural mechanisms underpinning bilingualism and the complexities bilingual individuals encounter during daily linguistic interactions. Ultimately, this study aims to illuminate the cognitive challenges and opportunities inherent in bilingual language processing, contributing to a more nuanced scientific understanding of bilingualism. The insights could potentially enhance language instruction methods and cognitive training interventions tailored to the bilingual population.

Research Question

How does the bilingual switch cost effect impact language processing in terms of speed and response accuracy in bilingual individuals when processing congruent and incongruent sentences?

The proposed research question is multidimensional, investigating how bilingualism interacts with cognitive processing, specifically language processing speed and response accuracy. "*How does the bilingual switch cost effect impact language processing in terms of speed and response accuracy in bilingual individuals*?" refers to the 'bilingual switch cost effect,' the cognitive

phenomenon observed while a bilingual person alternates between two languages. This switch often leads to a temporary decrease in performance or 'cost,' including slower processing speed and decreased response accuracy. This research aims to explore deeper into this effect by investigating how it explicitly influences the reaction time and precision of language processing in bilingual individuals. Next, *"...when processing congruent and incongruent sentences..."* adds another layer to the investigation. It implies the study will examine language processing broadly and precisely in the processing of 'congruent' and 'incongruent' sentences. Congruent sentences are those where the structure and semantics align with the expected language norms. In contrast, incongruent sentences may contain unexpected or unusual syntax or semantics, adding an extra layer of cognitive complexity. The research question suggests the study will compare how the bilingual switch cost effect varies between these two types of sentences.

Hypothesis

H1*: Sentence congruency will have an effect on language processing.*

H1.a *Congruency would affect participants' accuracy scores.*

H1.b *Congruency will affect reaction time scores.*

The first hypothesis assumes a direct relationship between higher switch costs and lower accuracy when processing syntactic irregularities, also known as incongruent sentences. The term "switch costs" refers to the cognitive challenges and performance declines that bilingual individuals face when switching languages. In this context, "accuracy" corresponds to how accurately participants in each language can identify and understand syntactic incongruent sentences. As a result, this hypothesis suggests that as switch costs increase, bilingual people's ability to process and understand syntactically irregular sentences declines.

H2*: Sentence presentation mode will have an effect on language processing.*

H2.a *Presentation mode would affect participants' accuracy scores.*

H2.b *Presentation mode will affect reaction time scores.*

The second hypothesis suggests an association between higher switch costs and longer reaction times, particularly among sentences with syntactic irregularities. Reaction times are typically defined as the length of time it takes a participant to react to a specific stimulus. The stimulus in this study would be syntactically incongruent sentences. This hypothesis proposes that bilingual individuals' time to process and respond to these sentences increases as switch costs rise.

H3*: There will be an interaction between congruency and sentence processing on accuracy and reaction time.*

H3.a *The effect of congruency on sentence processing will depend on the level of presentation mode.*

H3.b *The effect of presentation mode on sentence processing will depend on the level of congruency.*

The third hypothesis proposes a relationship between sentence congruency and presentation sequence, which affects accuracy and reaction time scores. The grammatical consistency within sentences is referred to as sentence congruency, and the order in which these sentences are presented to the participants is referred to as presentation sequence. According to this hypothesis, the relationship between congruency and sentence presentation sequence influences the accuracy of language comprehension and the speed with which individuals can respond to language tasks. This means that the effects of sentence congruency on accuracy and reaction times may vary depending on the order of the sentences.

CHAPTER FOUR: METHODOLOGY

Participants:

A sample of 60 participants was randomly retrieved from secondary data, 40% (24/60) males and 60% (36/60) females, ranging in age from 18 to 45 years of age (M = 19, SD = 3.8). All participants were recruited through the University SONA System and received course credits for their participation. Participants were required to be either monolingual English speakers or bilingual speakers with English as a secondary language and French, Spanish, or Arabic as their primary language. All participants were treated according to the American Psychological Association (APA) ethical and research guidelines.

Design and Procedures

A 4x2x2 mixed-factorial design involving language group (English monolingual, Spanish, French, and Arabic bilingual) speakers as a between-subjects variable, and congruency condition (congruent versus incongruent), and presentation mode (sequential and random) as withing subjects variables was used. The dependent variables were the language decision task's accuracy and reaction time scores. This study used the same procedure as a previous study conducted by Mouloua et al. (2019).

Task and Materials

Participants in the study were given a language-processing task involving a series of sentences. These sentences were presented on a computer screen in congruent and incongruent pairs, either in sequential or random order. The task included a total of 44 sentence pairs, with 22 being congruent and 22 incongruent.

To carry out the experiment, the researchers used E-Prime 2.0 software from Psychology Software Tools in Pittsburgh, PA. The experimental procedure began with participants focusing on a fixation point (ITI), followed by another fixation lasting 250 milliseconds. Afterward, a congruent sentence was presented for 500 milliseconds, and then an incongruent sentence appeared and remained on the screen until the participant responded.

Participants' responses to the incongruent sentences were measured for both accuracy and response time (RT). The participants used a serial response box equipped with four numerical response keys to provide their answers. They were instructed to press "1" if the sentence was correct and "2" if it was incorrect. The researchers recorded these responses from all the participants throughout the study.

As a part of the experiment, participants were also required to rate the emotional resonance they felt with the sentences presented. The Emotional Resonance Evaluation scale was used, in which participants rated their emotional resonance on a scale of 1 to 10 after each sentence pair, with 1 being 'no emotional connection' and 10 being 'strong emotional connection.' The emotional resonance ratings were taken into consideration alongside accuracy and reaction time to evaluate the impact of emotional resonance on bilingual language processing (Pavlenko, 2012).

The total time for this study is about 2 hours. Here is what they will do during that time:

1. Receive an explanation of the study and read this consent form (10 minutes)
2. Complete 4 questionnaires: Demographics, Proficiency, Vocabulary Size (VS), Depth of Vocabulary Knowledge (DVK), Edinburgh Inventory questionnaires, and the Emotional Resonance Evaluation (60 minutes)

3. Complete the Psychophysical (mouse clicking/hand dominance) task using E-Prime software (5 minutes)
4. Complete experimental sessions assessing language processing (cognates, associative, categorical, homophones, and sentences) (45 minutes)

Undergraduate students will be recruited using the psychology department's SONA research recruitment system. Participants will be awarded 2 SONA credits for their participation in this study.

Sentences used in the study. The below figure displays examples of sentences provided to participants during the experiment.

Images 1 - 3 present sample sentences in Arabic that were provided to the bilingual participants.

Image 1

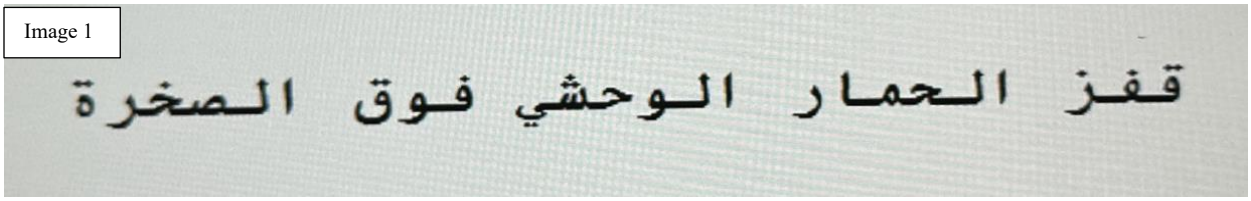


Image 2

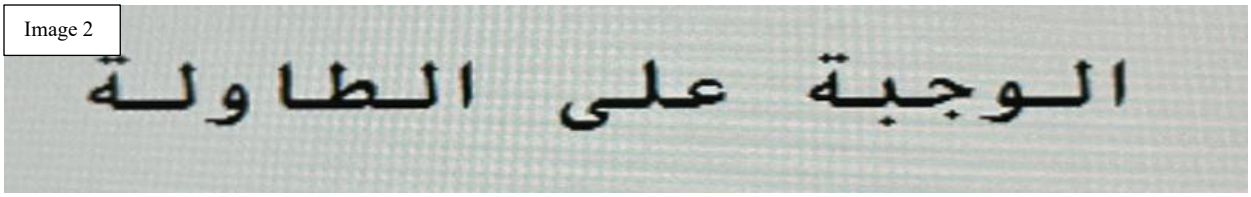
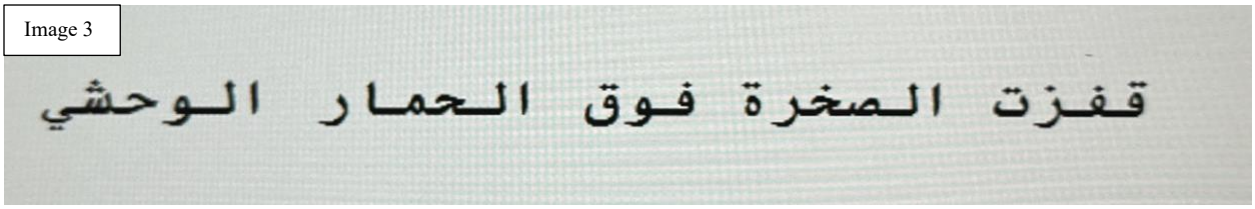


Image 3



Images 4 – 6 present sample French sentences provided to the bilingual participants.

Image 4

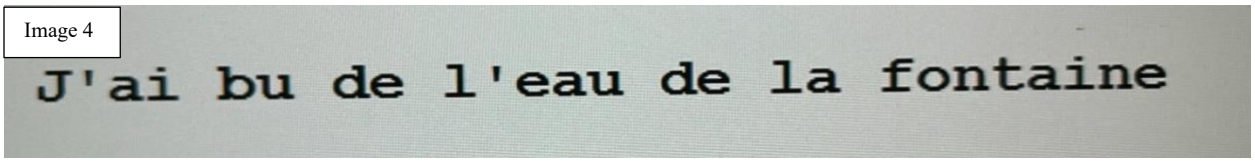


Image 5

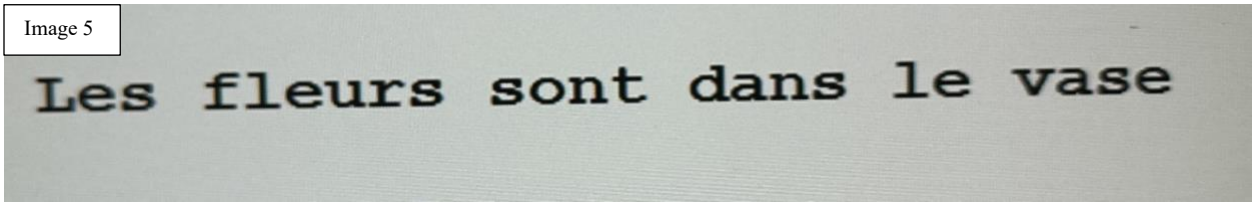
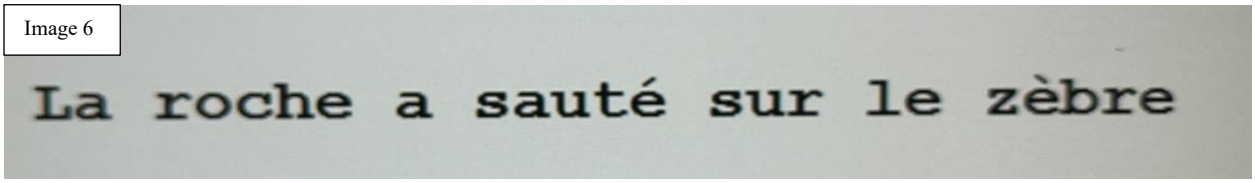


Image 6



Images 7 – 9 present sample sentences in Spanish that were provided to the bilingual participants.

Image 7

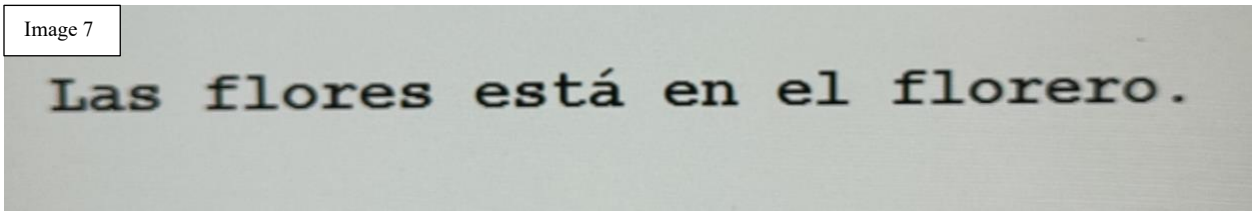


Image 8

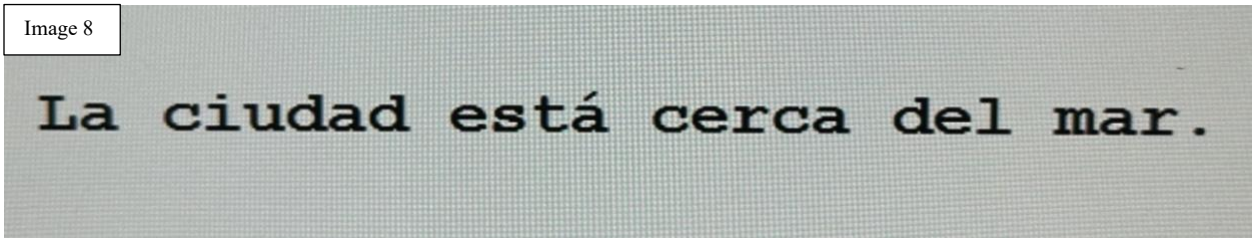
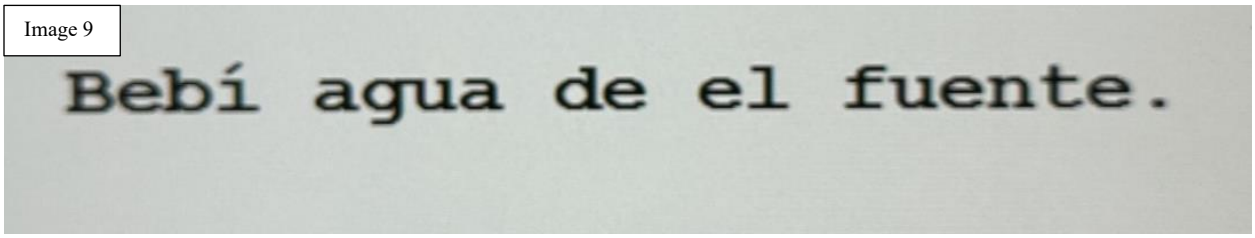


Image 9



Images 10 – 12 present sample sentences in English provided to the monolingual participants.

Image 10

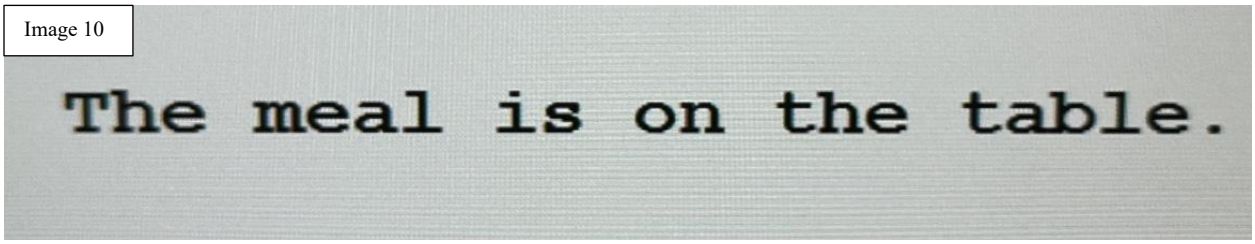


Image 11

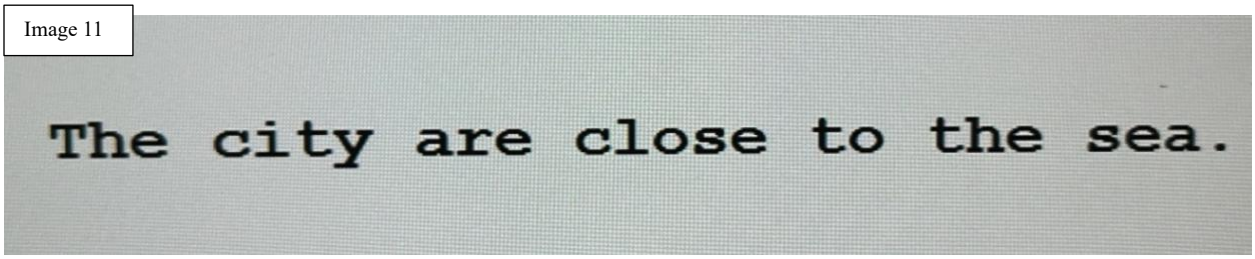
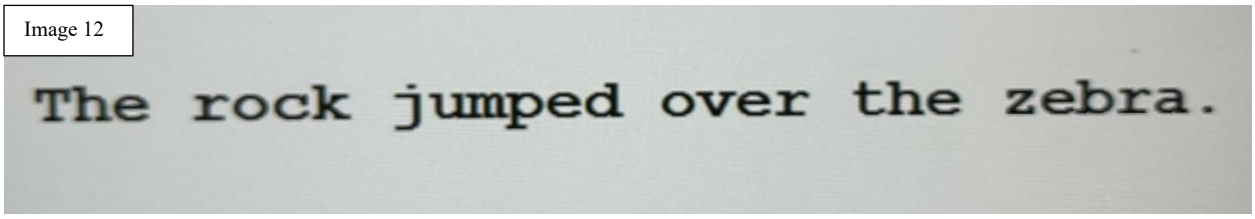


Image 12



CHAPTER FIVE: DATA ANALYSIS

The data collected in this study were subjected to statistical analysis using SPSS (Statistical Package for the Social Sciences) software version 24 to determine the effects of bilingual switch cost on language processing. Two dependent variables were considered: accuracy and response time scores on a language decision task. The analysis involved a two-step process due to the nature

of the experimental design. The design incorporated variables between subjects (language group) and within-subjects (sentence congruency and presentation mode).

Firstly, a univariate analysis of variance (ANOVA) was performed for each dependent variable to examine the effect of the between-subjects variable, language group (monolingual vs. bilingual Spanish, French, and Arabic speakers). Following the univariate ANOVA, a repeated measures ANOVA was conducted for each dependent variable to examine the effects of the within-subjects variables: sentence congruency (congruent vs. incongruent) and presentation mode (sequential vs. random) and their interaction. Before conducting these analyses, data were checked for the assumptions of normality, homogeneity of variance, and sphericity.

Post-hoc tests were also performed in the event of significant main effects or interactions to explore further and interpret these effects. All statistical tests were two-tailed, and a p-value less than 0.05 was considered statistically significant.

Finally, effect sizes were calculated to indicate the magnitude of observed effects, which is essential for understanding the practical significance of the results. The interpretation of the data was grounded in the context of the specific research questions and hypotheses.

Power Analysis

A power analysis was conducted using G-Power 3.1, a statistical software, to calculate the required sample size (Faul et al., 2009). The analysis suggested that a sample size of n = 51 would be sufficient, assuming an anticipated medium effect size of .25, a statistical power of .95, and a significance level of .05. However, for this study, we opted to use a slightly larger sample of 60 participants.

CHAPTER SIX: RESULTS

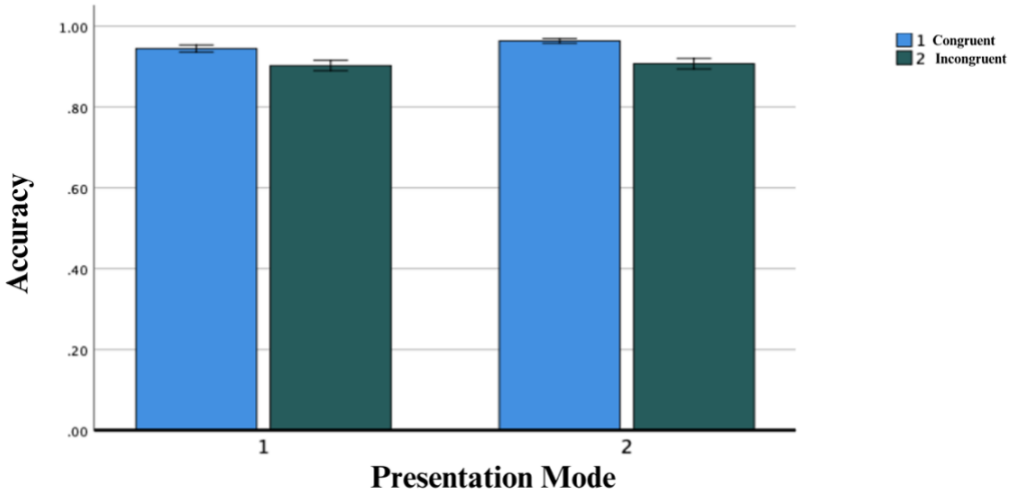
Accuracy Measure

The study demonstrated a significant congruency effect ($F(1,523) = 11.338$, $p < .001$, $\eta p2 = .02$) on participants' accuracy in the language decision task. When detecting incongruent "incorrect" sentences, participants were more accurate ($M = .935$, $SE = .004$) than congruent "correct" ones ($M = .923$, $SE = .004$). Additionally, a significant effect of presentation mode was found ($F(1,523) = 62.368$, $p < .001$, $\eta p2 = .10$) on participants' accuracy scores. Higher accuracy was observed when sentences were presented sequentially ($M = .945$, $SE = .003$) compared to when presented randomly ($M = .904$, $SE = .006$).

Additionally, there was a marginally significant interaction between language tested and congruency ($F(3, 56) = 2.521$, $p = .05$, $\eta p2 = .12$). Tests of simple effects indicated that there was a significant difference in accuracy scores between congruent and incongruent sentences ($M = .12$; $SE = .037$, $p < .005$) only for the Arabic bilingual speakers.

Furthermore, a significant interaction was found between congruency and presentation mode ($F(1,523) = 4.972$, $p < .05$, $\eta p2 = .00$) on participants' accuracy scores. Tests of simple effects indicated a significant difference between congruent and incongruent sentences in sequentially presented sentences (Mean Difference = .019, $SE = .004$, $p < .001$), but no significant difference when sentences were presented randomly ($p > .05$). For both congruent and incongruent sentences there was a significant difference between the sequentially and randomly presented sentences (Mean Difference for congruent = .042, $SE = .007$, $p < .001$; Mean Difference for incongruent = .057, $SE = .007$, $p < .01$). These results are visually presented In Figure 1.

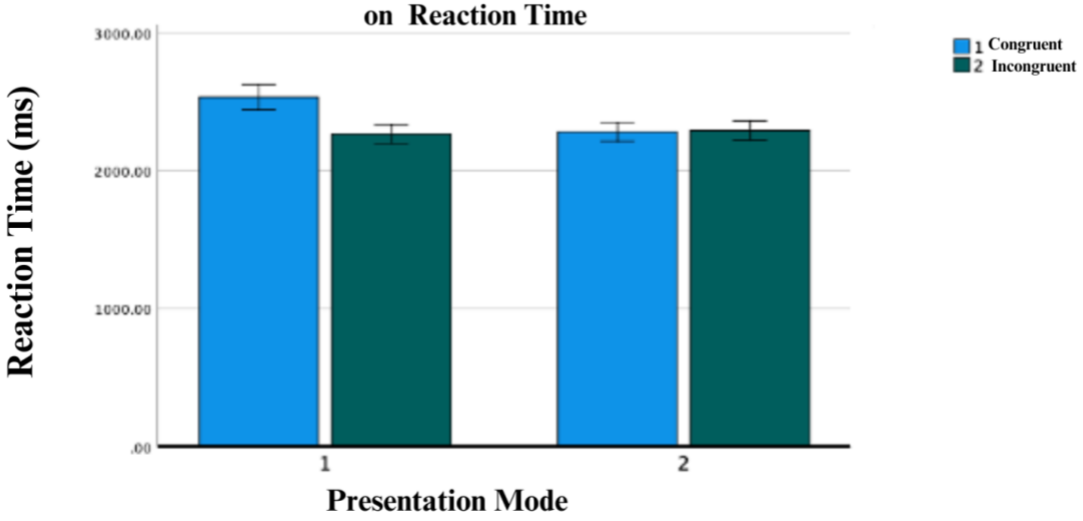
Figure 1:
Effects of Congruency and Presentation Mode on Accuracy



Reaction Time Measure

The study also found a significant effect of congruency ($F(1,523) = 18.635$, $p<.001$, $\eta p2=.03$) on participants' reaction time scores of the language decision task, meaning that participants responded faster to incongruent "incorrect" sentences (Mean=2283msecs; SE=33.611) than congruent "correct" sentences (Mean=2397.77msecs; SE=36.828).

Figure 2:
Effects of Congruency and Presentation Sequence on Reaction Time



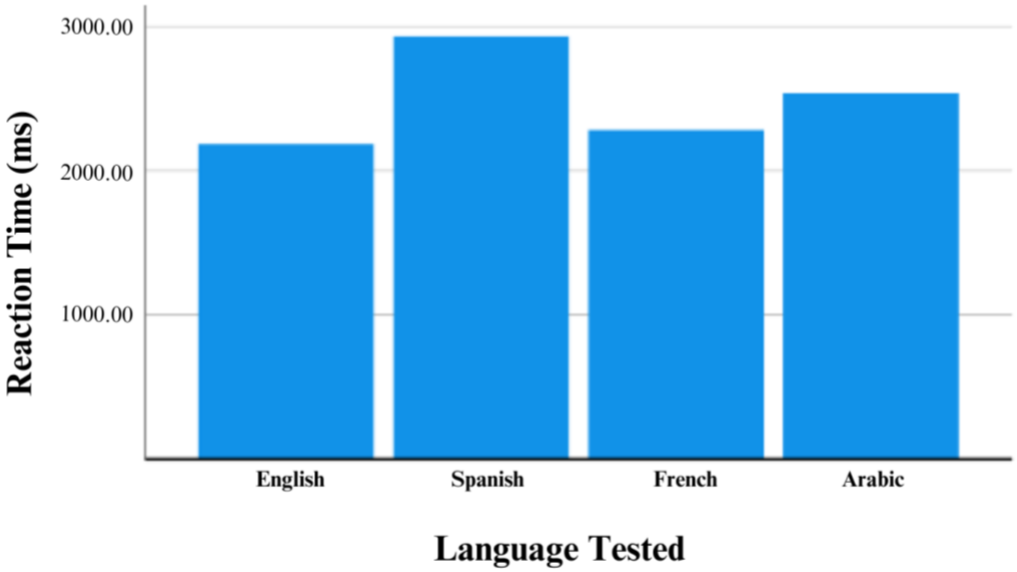
A significant effect of presentation mode was found (F (1,523) =41.291, p<.001, ηp2 =.07) on participants' reaction time scores on the language decision task. This means participants responded faster when sentences were presented randomly.

In terms of the reaction time scores, the study found a significant effect of the language tested on participants' reaction time scores (F (3,56) = 2.874, p < .05, ηp2 = .14). Post hoc comparison indicated that it was a significant difference between French and Spanish bilingual speakers (Mean difference = 649.597 ms; SE = 277.963, p<.001), as well as between Spanish and English speakers (Mean difference = 746.642 ms; SE = 277.963, p<.001).

The effect of language tested on participants' reaction time is depicted in Figure 3

Figure 3

Effects of Language Tested on Participants' Reaction Time



Furthermore, General Linear Models (GLM) were applied to assess how the language tested, congruency, and presentation mode influenced the accuracy scores of the participants. Adding the language group into the analysis, the study did not show a significant congruency effect ($p > .05$). Additionally, there was a significant interaction between congruency scores and the language tested ($F (3, 56) = 3.445$, $p < .05$, $\eta p2 = .16$) on participants' reaction time scores.

Tests of simple effects indicated that for the sequentially presented sentences, a significant difference in reaction times between bilingual French speakers and bilingual Spanish speakers ($M= 856.743$; $SE = 314.42$, $p < .01$), for congruent sentences ($p < .01$), as well as between Spanish speakers and monolingual English speakers ($M =541.873$; $SE = 314.41$, $p <.05$). However, for the randomly presented sentences there was a significant difference between bilingual Spanish and monolingual speakers, ($M =851.410$; $SE =258.584$, $p <.005$), as well as English and Arabic

bilingual speakers (M = 636.430; SE =258.584, p <.05). Similarly, there was significant difference between sequential and randomly presented sentenced only for the English speakers (M =426.360 SE =160. 892, p <.05). None of the other simple effect where significant between other languages testes.

Lastly, a significant interaction between congruency and presentation mode was observed (F (1,523) = 63.713, p<.001, ηp2=.10) on participants' reaction time scores on the language decision task. Tests of simple effects indicated that for the sequentially presented sentences, there was a significant difference between congruent and incongruent sentences. Equally, no significant difference was noted when the sentences were presented randomly. This suggests that the presentation mode can influence how quickly participants respond to correct versus incorrect sentences.

The interaction effects are visualized in Figures 4 and 5.

Figure 4

Effect of Tested Language on Participants' Reaction Time Scores

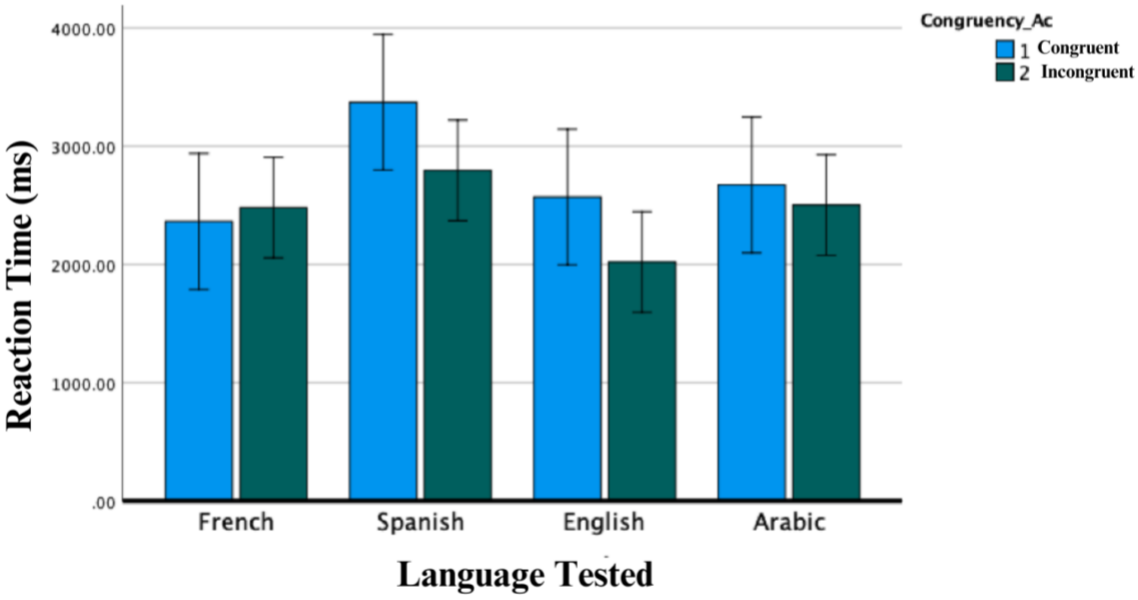
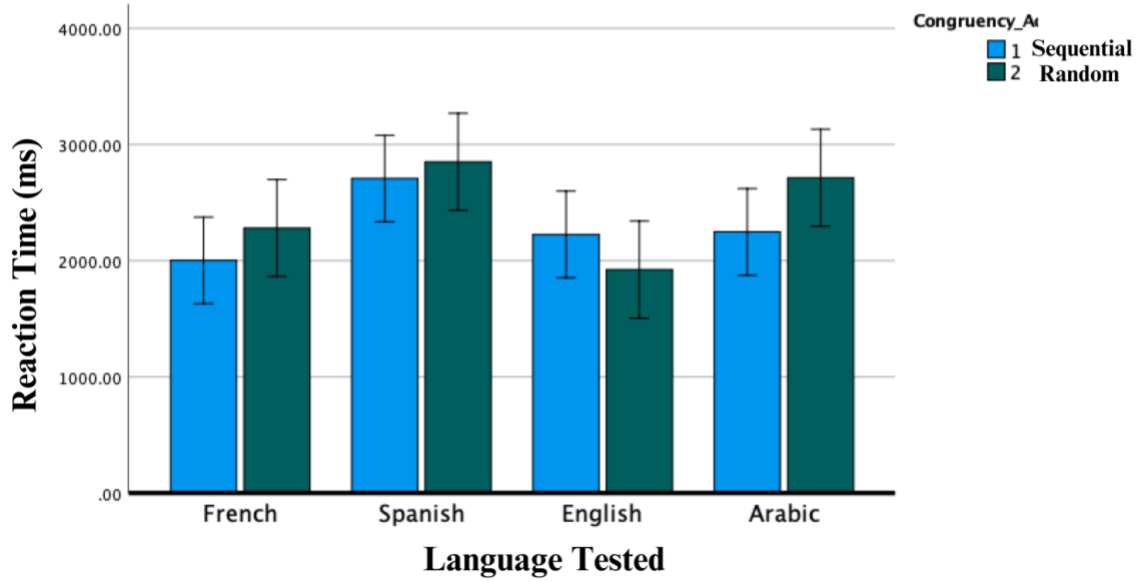


Figure 5

Effects of Congruency and Presentation Mode on Reaction Time



While the main hypotheses were significantly supported, we found that the direction regarding switch cost was only partially supported. In terms of accuracy scores, participants responded more accurately to incongruent sentences when sequentially presented. However, for reaction time scores, participants responded more quickly to incongruent sentences when randomly presented. The study's main findings have been included in Table 1, along with their interpretations and how they connect to or support the suggested hypotheses. Focus was primarily on the effects of multilingual switch cost effect on language processing time and response accuracy. The impact of switch costs on processing syntactically irregular sentences, the connection between switch costs and reaction times, and the interaction between sentence congruency and presentation sequence on accuracy and reaction time scores are just a few of the specific hypotheses covered in more detail. For a detailed summary of these results and their consequences, please see Table 1.

Table 1: Summary of findings in relation to the research question and hypotheses

Research Question Hypothesis	Findings	Support
H1: Sentence congruency will have an effect on language processing. H1.1 Congruency would affect participants' accuracy scores. H1.2 Congruency will affect reaction time scores.	H1.a Participants were more accurate in detecting incongruent sentences than congruent ones, indicating that higher switch costs can result in reduced accuracy for incongruent sentences. H1.b Participants responded faster to incongruent "incorrect" sentences than congruent "correct" sentences	H1: Partially Supported H1.a: No Supported H1.b Supported
H2: Sentence presentation mode will have an effect on language processing. H2.a Presentation mode would affect participants' accuracy scores. H2.b Presentation mode will affect reaction time scores.	H2.a Participants responded with higher accuracy when sentences were presented sequentially compared to when presented randomly. H2.b Participants responded faster when sentences were presented randomly then sequentially.	H2: Supported H2.a: Not Supported H2.b Supported
H3: There will be an interaction between congruency and sentence processing on accuracy and reaction time. H3.a The effect of congruency on sentence processing will depend on the level of presentation mode. H3.b The effect of presentation mode on sentence processing will depend on the level of congruency.	H.3.a Participants responded more accurately to incongruent sentences when sequentially presented. H.3.b Participants responded more quickly to incongruent sentences when randomly presented.	H3: Supported H3.a: Supported H3.b: Supported

CHAPTER SEVEN: DISCUSSION

The study has begun an important exploration into the multidimensional bilingual switch cost effect, focusing on the differences between congruent and incongruent sentences in language processing. The research conducted investigated the complexity of the cognitive mechanisms activated, and the findings have revealed some remarkable patterns and insights that support our comprehension of the bilingual switch cost effect's impact on language processing.

In the first hypothesis, the investigation addressed sentence congruency and its potential influence on language processing, especially in terms of accuracy and reaction time. While the initial hypothesis anticipated that higher switch costs would be linked to lower accuracy in processing syntactic irregularities (incongruent sentences), the study found the opposite. Specifically, the results showed no statistically significant effect of congruency on accuracy, demonstrating that switch costs might not affect how accurately sentences are processed, regardless of sentence congruency.

The second hypothesis focused on sentence presentation mode and its impact on language processing, with an emphasis on the effect of switch costs on reaction times. Here, the study partially aligned with the initial prediction. Though the main effect of congruency on reaction time was not statistically significant, there was evidence of an interaction between congruency and the language being tested. This suggests a complex relationship where the influence of sentence congruency on reaction time can depend on the language under scrutiny.

The third hypothesis explored the interaction effects of congruency, particularly concerning the level of presentation mode. This included both accuracy and reaction time. The findings were compelling and supported this hypothesis, revealing a significant interaction between congruency and presentation mode. This indicates a nuanced impact of these factors on the measures of language processing, regardless of the language being tested. Moreover, the primary effect of the presentation mode was statistically significant, highlighting the significant role of how sentences were presented to the participants.

Theoretical Implications

The results of this study align with previous research on the bilingual switch cost effect (Meuter & Allport, 1999), highlighting that bilinguals' response accuracy and reaction times could be significantly impacted by switch costs. Additionally, it demonstrated that sentence congruency and the manner of presentation could impact these effects, correlating with Prior and Gollan's (2011) findings that the consequences of multilingual switch costs are complex and subject to a variety of influences.

Contrary to the Inhibitory Control (IC) Model (Green, 1998), this study found no significant effect on either accuracy or reaction time as a function of the language being tested. This suggests new insights requiring reconsideration of the generalizability of the IC model, as suggested by studies like Costa et al. (2009). The conclusion reached by Philipp, Gade, and Koch (2007) that stimulus presentation can affect language processing in bilingual individuals is supported, emphasizing the role presentation mode plays in both response accuracy and reaction times.

The implications of this study contribute to the growing body of knowledge surrounding bilingualism's impacts on cognitive processing (Bialystok, 2009; Costa & Sebastian-Galles, 2009), including practical implications for shaping bilingual education policies, language instruction methods, and cognitive training programs.

Limitations

While the study provides valuable insights into the bilingual switch cost effect and its implications, some limitations that may have affected the findings and explanation of the results can be acknowledged.

Firstly, the sample size was relatively small; thus, some findings were marginally significant or lacked statistical significance. This could potentially lead to challenges in the representation of definitive conclusions. Moreover, the majority of participants being University of Central Florida students, the findings might have restricted generalizability, making it challenging to apply them to a broader context or diverse population to broader and more diverse populations.

Furthermore, the inclusion of only four language groups: monolingual English, bilingual Spanish-English, French-English, and Arabic-English, might not fully summarize the complexity of bilingual language processing. The varying linguistic distances, writing differences, and cultural settings between these language pairs could lead to unique switch costs (Costa, Santesteban, & Ivanova, 2006).

Finally, the study did not consider other potential factors that could have an impact on the results of the bilingual switch cost, such as language competency level, vocabulary size, cultural background, etc. These unexamined variables may introduce additional complexity and nuance to understanding the bilingual switch cost effect and language processing (Cummins, 2000; Genesee & Jared, 2008). Despite these limitations, the study's value remains uncompromised, and it also highlights areas where more comprehensive research can be conducted in the future. They highlight the need for further studies that are more comprehensive and tailored to fully understand the complexities of bilingual language processing.

Directions for Future Research

The information presented opens several avenues for future research. Expanding the sample size and including a wider variety of languages (Costa et al., 2006; Fink & Goldrick, 2014) can deepen the understanding of bilingual language processing. Examining individual differences, conducting

longitudinal studies, applying different cognitive models, incorporating neuroimaging techniques like fMRI or EEG (Abutalebi & Green, 2008; Kaushanskaya & Prior, 2014), and experimenting with variations in presentation mode could provide further insights.

In particular, future studies could focus on understanding how factors like age, language proficiency, context, and age at second language acquisition (Kroll et al., 2006; Calvo & Bialystok, 2014) significantly influence bilingual switch cost. By exploring these and other directions, researchers can deepen the understanding of bilingual language processing and its complexities, thereby informing bilingual education policymakers, language instruction methods, and cognitive training programs to optimize language-switching abilities in bilingual individuals (Bialystok et al., 2012; Cummins, 2009; Crago et al., 2021; August & Shanahan, 2010).

CHAPTER 8: CONCLUSION

This study set out to advance understanding of the bilingual switch cost effect and its influence on cognitive complexity, accuracy in sentence comprehension, and reaction times during language transition. We focused on exploring how the transition between languages affects processing speed and response accuracy in individuals fluent in English, Spanish, French, and Arabic.

As we worked with the data, outliers became apparent. However, we decided to retain these as they may offer meaningful insights for the broader project of which this research is part. This thesis has centered primarily on the impacts of sentence congruency and presentation mode on both accuracy and reaction time. While we collected additional data, such as gender differences and age of acquisition, vocabulary size, and word association, these were not used in this study. We believe

that these factors offer promising areas for future research and could enrich our understanding of the language decision task and the cognitive mechanisms at play.

Our findings hold significant implications. They emphasize the intricate complexity of bilingual language processing and suggest that elements like presentation mode can have a notable impact on performance in language tasks. Despite our initial hypotheses, the influence of sentence congruency on accuracy and reaction time did not present significant variations across the languages. Furthermore, we did not observe a significant interaction between sentence congruency, presentation mode, and language when it came to accuracy. This indicates that the subtleties of language switching and processing may not be as heavily influenced by specific language pairs as previously thought. This divergence from prior research necessitates further investigation.

By focusing on the bilingual switch cost, this research addresses a significant gap in the current body of knowledge, offering fresh perspectives on the roles of sentence congruency and presentation mode. Even with the study's limitations, such as the small sample size and the focus on a specific set of languages, this research pushes our understanding of the cognitive complexities of bilingual language processing forward.

In conclusion, this thesis provides further insight into the intricate complexity of bilingual language processing. It presents a more thorough understanding of how presentation mode and sentence congruency impact language transition in bilingual individuals. While the findings challenge some established theories, they offer valuable additions to the field, opening the pathway for more comprehensive and inclusive research into bilingual language processing. The potential outcomes of this research could be far-reaching, leading to improved educational strategies,

enhanced cognitive interventions, and a more in-depth comprehension of the cognitive processes underlying bilingualism.

Appendix

Appendix A: Demographics Questionnaire

Start of Block: 1. Demographics Questionnaire

Please type your participant number here:

_____

Q1.0 Researcher Question: Please enter the assigned language.

_____

Q1.1 Age (numerical answer only)

_____

Q1.2 Gender

- ○ Male
- ○ Female
- ○ Other _____

Q1.3 Where are you from? (Country)

_____

Q1.4 What is your first language?

_____

Q1.5
What is your second language?

_____

Q1.6 What is the level of knowledge of your second language?

- ○ Basic (read/write)
- ○ Intermediate (read/write/speak)
- ○ Advanced (read/write/speak fluently)

Q1.7
How long have you been in the United States? (numerical answer only: i.e., 10 instead of 10 years)

_____

Q1.8 How long have you been learning the language for which you are being tested? (numerical answer only: i.e., 10 instead of 10 years)

_____

Q1.9
How many total languages do you know, if applicable? (numerical answer only)

_____

Q1.10 What language do your parents speak at home?

_____

Q1.12 Which hand is your dominant one?

- ○ Left
- ○ Right
- ○ Ambidextrous

Q1.13 What is your class standing?

- ○ Freshman
- ○ Sophomore
- ○ Junior
- ○ Senior
- ○ Graduate
- ○ Non-degree seeking.

Q1.14 What is your major?

_____

Q1.15 What is your minor?

_____

Q1.16 What is your career field of interest?

_____

Q1.17 What is your GPA?

_____

Q1.18 If applicable, what was your total SAT score?

_____

Q1.19 For what year are your SAT scores?

_____

Q1.20 If applicable, what was your composite (average) ACT score?

_____

Q1.21 For what year are your ACT scores?

REFERENCES

Abutalebi, J., & Green, D. (2007). Bilingual language production: The neurocognition of language representation and control. Journal of Neurolinguistics, 20(3), 242-275. https://doi.org/10.1016/j.jneuroling.2006.10.003

Abutalebi, J., & Green, D. W. (2008). Control mechanisms in bilingual language production: Neural evidence from language switching studies. *Language and Cognitive Processes*, *23*(4), 557–582. https://doi.org/10.1080/01690960801920602

Alatis, J. E., & Tan, A. (2001). *Georgetown University Round Table on Languages and Linguistics (GURT) 1999: Language in Our Time: Bilingual Education and Official English, Ebonics and Standard English, Immigration, and the Unz Initiative*. Georgetown University Press.

Anooshian, L. J., & Hertel, P. T. (1994). Emotionality in free recall: Language specificity in bilingual memory. *Cognition & Emotion*, *8*(6), 503–514. https://doi.org/10.1080/02699939408408956

Asher, R., & Moseley, C. (2018). *Atlas of the World's Languages*. Routledge.

August, D., & Shanahan, T. (2010). *Developing Reading and Writing in Second-language Learners: Lessons from the Report of the National Literacy Panel on Language-Minority Children and Youth*. Taylor & Francis. https://doi.org/10.1080/1086296X.2010.503745

August, D., Shanahan, T., & Escamilla, K. (2009). English Language Learners: Developing Literacy in Second-Language Learners—Report of the National Literacy Panel on

Language-Minority Children and Youth. *Journal of Literacy Research*, *41*(4), 432–452. https://doi.org/10.1080/10862960903340165

Baddeley, A. D. (2003). Working memory and language: an overview. *Journal of Communication Disorders*, *36*(3), 189–208. https://doi.org/10.1016/s0021-9924(03)00019-4

Bahrick, H. P. (1984). Semantic memory content in permastore: Fifty years of memory for Spanish learned in school. *Journal of Experimental Psychology: General*, *113*(1), 1–29. https://doi.org/10.1037/0096-3445.113.1.1

Baker, C. (2011). *Foundations of Bilingual Education and Bilingualism*. Multilingual Matters.

Baker, C., & Jones, S. P. (1998). *Encyclopedia of Bilingualism and Bilingual Education*. Multilingual Matters.

Bialystok, E. (2001). Metalinguistic aspects of bilingual processing. *Annual Review of Applied Linguistics*, *21*, 169–181. https://doi.org/10.1017/s0267190501000101

Bialystok, E. (2009). Bilingualism: The good, the bad, and the indifferent. *Bilingualism: Language and Cognition*, *12*(1), 3–11. https://doi.org/10.1017/s1366728908003477

Bialystok, E., Craik, F. I. M., & Freedman, M. (2007). Bilingualism as a protection against the onset of symptoms of dementia. *Neuropsychologia*, *45*(2), 459–464. https://doi.org/10.1016/j.neuropsychologia.2006.10.009

Bialystok, E., Craik, F. I. M., & Luk, G. (2012). Bilingualism: consequences for mind and brain. *Trends in Cognitive Sciences*, *16*(4), 240–250. https://doi.org/10.1016/j.tics.2012.03.001

Bialystok, E., Craik, F. I. M., & Ryan, J. D. (2006). Executive control in a modified antisaccade task: Effects of aging and bilingualism. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *32*(6), 1341–1354. https://doi.org/10.1037/0278-7393.32.6.1341

Bialystok, E., Craik, F. I. M., Klein, R. M., & Viswanathan, M. (2004). Bilingualism, Aging, and Cognitive Control: Evidence From the Simon Task. *Psychology and Aging*, *19*(2), 290–303. https://doi.org/10.1037/0882-7974.19.2.290

Bialystok, E., Luk, G., Peets, K. F., & Yang, S. (2010). Receptive vocabulary differences in monolingual and bilingual children. *Bilingualism: Language and Cognition*, *13*(4), 525–531. https://doi.org/10.1017/s1366728909990423

Bice, K., & Kroll, J. F. (2015). Native language change during early stages of second language learning. *Neuroreport*, *26*(16), 966–971. https://doi.org/10.1097/wnr.0000000000000453

Bilingual: life and reality. (2010). *Choice Reviews Online*, *48*(01), 48–0098. https://doi.org/10.5860/choice.48-0098

Bright, P., & Filippi, R. (2019). Perspectives on the 'Bilingual Advantage': Challenges and opportunities. In *Frontiers Media SA eBooks*. https://doi.org/10.3389/978-2-88963-017-2

Brock-Utne, B. (2007). Learning through a familiar language versus learning through a foreign language—A look into some secondary school classrooms in Tanzania. *International Journal of Educational Development*, *27*(5), 487–498. https://doi.org/10.1016/j.ijedudev.2006.10.004

Callahan, R. M., & Gándara, P. C. (2004). On Nobody's Agenda: Improving English Language Learners' Access To Higher Education. In M. Sadowski (Ed.), Teaching immigrant and second-language students: Strategies for success (pp.107-127). Harvard Education Press.

Calvo, N., & Bialystok, E. (2014). Independent Effects of Bilingualism and Socioeconomic Status on Language Ability and Executive Functioning. Cognition, 130(3), 278-288. https://doi.org/10.1016/j.cognition.2013.11.015

Carlson, S. M., & Meltzoff, A. N. (2008). Bilingual experience and executive functioning in young children. *Developmental Science*, *11*(2), 282–298. https://doi.org/10.1111/j.1467-7687.2008.00675.x

Carreira, M., & Kagan, O. (2011). The results of the National Heritage Language Survey: Implications for Teaching, Curriculum Design, and Professional Development. *Foreign Language Annals*, *44*(1), 40–64. https://doi.org/10.1111/j.1944-9720.2010.01118.x

Chari, T., & Akpojivi, U. (2023). *Communication rights in Africa: Emerging Discourses and Perspectives*.

Cohen, J. (1988). **Statistical power** analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Corsaro, W. A. (1992). Language and Symbolic Power. By Pierre Bourdieu. Harvard University Press, 1991. 302 pp. $34.95. *Social Forces*. https://doi.org/10.1093/sf/71.1.242

Costa, A., & Santesteban, M. (2004). Lexical access in bilingual speech production: Evidence from language switching in highly proficient bilinguals and L2 learners. *Journal of Memory and Language*, *50*(4), 491–511. https://doi.org/10.1016/j.jml.2004.02.002

Costa, A., & Sebastián-Gallés, N. (2014). How does the bilingual experience sculpt the brain? *Nature Reviews Neuroscience*, *15*(5), 336–345. https://doi.org/10.1038/nrn3709

Costa, A., Hernández, M., Costa-Faidella, J., & Sebastián-Gallés, N. (2009). On the bilingual advantage in conflict processing: Now you see it, now you don't. *Cognition*, *113*(2), 135–149. https://doi.org/10.1016/j.cognition.2009.08.001

Costa, A., Santesteban, M., & Ivanova, I. (2006). How do highly proficient bilinguals control their lexicalization process? Inhibitory and language-specific selection mechanisms are both functional. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *32*(5), 1057–1074. https://doi.org/10.1037/0278-7393.32.5.1057

Crago, J. G. P., Genesee, F., & Crago, M. (2021). *Dual Language Development & Disorders: A Handbook on Bilingualism and Second Language Learning*. CLI.

Cummins, J. (2000). *Language, power, and pedagogy: Bilingual Children in the Crossfire*. Multilingual Matters.

Cummins, J. (2009). Multilingualism in the English-language Classroom: Pedagogical Considerations. *TESOL Quarterly*, *43*(2), 317–321. https://doi.org/10.1002/j.1545-7249.2009.tb00171.x

Cummins, J. D. (1981). The role of primary language development in promoting educational success for language minority students. *Schooling and Language Minority Students: A Theoretical Framework, 3(1), 3-49.* DOI:10.13140/2.1.1334.9449

Curdt-Christiansen, X. L. (2009). Invisible and visible language planning: ideological factors in the family language policy of Chinese immigrant families in Quebec. *Language Policy*, *8*(4), 351–375. https://doi.org/10.1007/s10993-009-9146-7

Cutiva, L. C. C., Bottalico, P., Nudelman, C., Webster, J., & Hunter, E. J. (2021). Do voice acoustic parameters differ between bilingual English-Spanish speakers and monolingual

English speakers during English productions? *Journal of Voice*, *35*(2), 194–202. https://doi.org/10.1016/j.jvoice.2019.08.009

De Bot, K., Lowie, W., & Verspoor, M. (2007). A Dynamic Systems Theory approach to second language acquisition. *Bilingualism: Language and Cognition*, *10*(01), 7. https://doi.org/10.1017/s1366728906002732

De Houwer, A. (2007). Parental language input patterns and children's bilingual use. *Applied Psycholinguistics*, *28*(3), 411–424. https://doi.org/10.1017/s0142716407070221

Dewaele, J. (2004). The emotional force of swearwords and taboo words in the speech of multilingual. *Journal of Multilingual and Multicultural Development*, *25*(2–3), 204–222. https://doi.org/10.1080/01434630408666529

Dörnyei, Z., & Csizér, K. (2005). The effects of intercultural contact and tourism on language attitudes and language learning motivation. *Journal of Language and Social Psychology*, *24*(4), 327–357. https://doi.org/10.1177/0261927x05281424

Durgunoğlu, A. Y., Nagy, W. E., & Hancin-Bhatt, B. J. (1993). Cross-language transfer of phonological awareness. *Journal of Educational Psychology*, *85*(3), 453–465. https://doi.org/10.1037/0022-0663.85.3.453

Ehrman, M., & Oxford, R. L. (1989). Effects of sex differences, career choice, and psychological type on adult language learning strategies. *The Modern Language Journal*, *73*(1), 1–13. https://doi.org/10.1111/j.1540-4781.1989.tb05302.x

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/brm.41.4.1149

Field, A. (2013). Discovering Statistics Using IBM SPSS Statistics (4th ed.). London: SAGE

Fink, A., & Goldrick, M. (2014). Pervasive benefits of preparation in language switching. *Psychonomic Bulletin & Review*, *22*(3), 808–814. https://doi.org/10.3758/s13423-014-0739-6

Flege, J. E., Yeni-Komshian, G. H., & Liu, S. (1999). Age constraints on Second-Language acquisition. *Journal of Memory and Language*, *41*(1), 78–104. https://doi.org/10.1006/jmla.1999.2638

Floccia, C., Butler, J. S., Girard, F., & Goslin, J. (2009). Categorization of regional and foreign accent in 5- to 7-year-old British children. *International Journal of Behavioral Development*, *33*(4), 366–375. https://doi.org/10.1177/0165025409103871

Floccia, C., Goslin, J., Girard, F., & Konopczynski, G. (2006). Does a regional accent perturb speech processing? *Journal of Experimental Psychology: Human Perception and Performance*, *32*(5), 1276–1293. https://doi.org/10.1037/0096-1523.32.5.1276

Garbin, G., Sanjuán, A., Forn, C., Bustamante, J. M., Rodríguez-Pujadas, A., Belloch, V., Hernández, M., Costa, A., & Ávila, C. (2010). Bridging language and attention: Brain basis of the impact of bilingualism on cognitive control. *NeuroImage*, *53*(4), 1272–1278. https://doi.org/10.1016/j.neuroimage.2010.05.078

Gardner, R. (1985). *Social psychology and second language learning: the role of attitudes and motivation*. https://ci.nii.ac.jp/ncid/BA00118070

Gardner, R. C., & Lambert, W. E. (1972). *Attitudes and motivation in second-language learning*.

Genesee, F. (2008). What do we Know About Bilingual Education for Majority-Language Students? In *Blackwell Publishing Ltd eBooks* (pp. 547–576). https://doi.org/10.1002/9780470756997.ch21

Green, D. (1998). Mental control of the bilingual lexico-semantic system. *Bilingualism: Language and Cognition, 1*(2), 67-81. https://doi.org/10.1017/S1366728998000133

Green, D., & Abutalebi, J. (2013). Language control in bilinguals: The adaptive control hypothesis. *Journal of Cognitive Psychology, 25*(5), 515–530. https://doi.org/10.1080/20445911.2013.796377

Green, S. B., & Salkind, N. J. (2013). Using SPSS for Windows and Macintosh: Analyzing and Understanding Data (7th ed.). Pearson

Grosjean, F. (1982). Life with Two Languages: An Introduction to Bilingualism. Harvard University Press.

Grosjean, F. (1998). Studying bilinguals: Methodological and conceptual issues. *Bilingualism: Language and Cognition, 1*(2), 131–149. https://doi.org/10.1017/s136672899800025x

Grosjean, F. (2010). Bilingual: Life and reality. Harvard university press.

Hakuta, K. (1986). *Mirror Of Language*. New York: Basic Books.

Halpern, D. F. (2000). *Sex differences in cognitive abilities: 3rd Edition*. Psychology Press.

Harrison, K. D. (2007). When languages die: the extinction of the world's languages and the erosion of human knowledge. *Choice Reviews Online, 45*(01), 45–0117. https://doi.org/10.5860/choice.45-0117

Herdina, P., & Jessner, U. (2002). A Dynamic Model of Multilingualism: Perspectives of Change in Psycholinguistics. Multilingual Matters 121. *Multilingual Matters.* https://eric.ed.gov/?id=ED463664

Hernández, M., Costa, A., & Humphreys, G. W. (2012). Escaping capture: Bilingualism modulates distraction from working memory. *Cognition*, *122*(1), 37–50. https://doi.org/10.1016/j.cognition.2011.08.002

Howard, E. P., Sugarman, J., & Christian, D. (2003). Trends in Two-Way Immersion Education. A Review of the Research. *Center for Applied Linguistics*. http://files.eric.ed.gov/fulltext/ED483005.pdf

Ianco-Worrall, A. D. (1972). Bilingualism and Cognitive Development. *Child Development*, *43*(4), 1390. https://doi.org/10.2307/1127524

James, S. (2011). The Cambridge Encyclopedia of Language (3rd ed.)2011121David Crystal. The Cambridge Encyclopedia of Language (3rd ed.). Cambridge: Cambridge University Press 2010. iv+516 pp., ISBN: 978 0 521 51698 3 (hbck); 978 0 521 73650 3 (pbck) £60, $99 (hbck); £24.99, $45 (pbck). Reference Reviews, 25(3), 28–30. https://doi.org/10.1108/09504121111118906

Kaushanskaya, M., & Prior, A. (2014). Variability in the effects of bilingualism on cognition: It is not just about cognition; it is also about bilingualism. *Bilingualism: Language and Cognition*, *18*(1), 27–28. https://doi.org/10.1017/s1366728914000510

Kellerman, E. (1979). Transfer and Non-Transfer: Where we are now. *Studies in Second Language Acquisition*, *2*(1), 37–57. https://doi.org/10.1017/s0272263100000942

Kharkhurin, A. V. (2010). Bilingual verbal and nonverbal creative behavior. *International Journal of Bilingualism*, *14*(2), 211–226. https://doi.org/10.1177/1367006910363060

Köpke, B. & Schmid, M. S. (2004) First language attrition: The next phase. In M. S. Schmid, B. Köpke, M. Keijzer, M. & L. Weilemar (Eds.), First language attrition: Interdisciplinary perspectives on methodological issues (pp. 1-43). Amsterdam: John Benjamins.

Köpke, B., & Genevska-Hanke, D. (2018). First language attrition and dominance: same or different? *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.01963

Köpke, B., & Schmid, M. S. (2004). Language Attrition: The next phase. In *HAL (Le Centre pour la Communication Scientifique Directe)*. French National Centre for Scientific Research. https://hal.science/hal-00879106

Köpke, M. Keijzer, & L. Weilemar (Eds.) (2004). *First language attrition: Interdisciplinary perspectives on methodological issues* (pp. 1-43). John Benjamins.

Krauss, M. E. (1992). The world's languages in crisis. *Language*, *68*(1), 4–10. https://doi.org/10.1353/lan.1992.0075

Kroll, J. F., & Bialystok, E. (2013). Understanding the consequences of bilingualism for language processing and cognition. *Journal of Cognitive Psychology*, *25*(5), 497–514. https://doi.org/10.1080/20445911.2013.799170

Kroll, J. F., Bobb, S. C., & Wodniecka, Z. (2006). Language selectivity is the exception, not the rule: Arguments against a fixed locus of language selection in bilingual speech. *Bilingualism: Language and Cognition*, *9*(2), 119–135. https://doi.org/10.1017/s1366728906002483

Kroll, J. F., Dussias, P. E., Bice, K., & Perrotti, L. (2015). Bilingualism, Mind, and Brain. *Annual Review of Linguistics*, *1*(1), 377–394. https://doi.org/10.1146/annurev-linguist-030514-124937

Kroll, J. F., Dussias, P. E., Bogulski, C. A., & Kroff, J. R. V. (2012). Juggling Two Languages in One Mind. In *Psychology of Learning and Motivation* (pp. 229–262). Elsevier BV. https://doi.org/10.1016/b978-0-12-394393-4.00007-8

Lightbown, P. M., & Spada, N. (2013). *How Languages are Learned 4th edition - Oxford Handbooks for Language Teachers*. Oxford University Press.

Loewen, S., & Sato, M. (2017). *The Routledge Handbook of Instructed Second Language Acquisition*. Taylor & Francis.

Meisel, J. M. (2009). Second language acquisition in early childhood. *Zeitschrift Fur Sprachwissenschaft*, *28*(1), 5–34. https://doi.org/10.1515/zfsw.2009.002

Meuter, R. F. I., & Allport, A. (1999). Bilingual Language Switching in Naming: Asymmetrical Costs of Language Selection. *Journal of Memory and Language*, *40*(1), 25–40. https://doi.org/10.1006/jmla.1998.2602

Mgbeadichie, C. (2023). Language-Cultural barrier in Ubang community. In *Routledge eBooks* (pp. 21–37). https://doi.org/10.4324/9781003388289-3

Mouloua, S. A., Castelin, S., & Mouloua, M. (2019, November). Do Monolingual and Bilingual Speakers Differ in Language Processing? Evidence from Behavior and ERPs. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting (Vol. 63, No. 1, pp. 1605-1609). Sage CA: Los Angeles, CA: SAGE Publications.

Mouloua, S. A., Castelin, S., & Mouloua, M. (2019). Do Monolingual and Bilingual Speakers Differ in Language Processing? Evidence from Behavior and ERPs. *Proceedings of the Human Factors and Ergonomics Society. Annual Meeting*. https://doi.org/10.1177/1071181319631514

Nettle, D., & Romaine, S. (2000). *Vanishing Voices: The Extinction of the World's Languages*. Oxford University Press.

Norris, J. E., & Ortega, L. (2000). Effectiveness of L2 instruction: A research synthesis and quantitative meta-analysis. *Language Learning*, *50*(3), 417–528. https://doi.org/10.1111/0023-8333.00136

Odlin, T. (1989). Language Transfer: Cross-Linguistic Influence in Language Learning. Cambridge: Cambridge University Press. http://dx.doi.org/10.1017/CBO9781139524537

Paap, K. R., Johnson, H. J., & Sawi, O. (2015). Bilingual advantages in executive functioning either do not exist or are restricted to very specific and undetermined circumstances. *Cortex*, *69*, 265–278. https://doi.org/10.1016/j.cortex.2015.04.014

Pap, E. B. (2023). *Multilingual language learners' intersemiotic translation into L3 English. A grounded theory on reliance on languages in the multilingual mental lexicon*. https://doi.org/10.15476/elte.2021.218

Pavlenko, A. (2012). Affective processing in bilingual speakers: Disembodied cognition? *International Journal of Psychology*, *47*(6), 405–428. https://doi.org/10.1080/00207594.2012.743665

Peal, E., & Lambert, W. E. (1962). The relation of bilingualism to intelligence. *The Psychological Monographs*, *76*(27), 1–23. https://doi.org/10.1037/h0093840

Philipp, A. M., Gade, M., & Koch, I. (2007). Inhibitory processes in language switching: Evidence from switching language-defined response sets. *European Journal of Cognitive Psychology*, *19*(3), 395–416. https://doi.org/10.1080/09541440600758812

Piske, T., Mackay, I. R., & Flege, J. E. (2001). Factors affecting degree of foreign accent in an L2: a review. *Journal of Phonetics*, *29*(2), 19-215. https://doi.org/10.1006/jpho.2001.0134

Prior, A., & Gollan, T. H. (2011). Good Language-Switchers are Good Task-Switchers: Evidence from Spanish–English and Mandarin–English Bilinguals. *Journal of the International Neuropsychological Society*, *17*(4), 682 - 691. https://doi.org/10.1017/s1355617711000580

Prior, A., & Kotz, D. (2009). A bilingual advantage in task switching. *Bilingualism: Language and Cognition*, *13*(2), 253–262. https://doi.org/10.1017/s1366728909990526

Prior, A., & Macwhinney, B. (2010). A bilingual advantage in task switching. Bilingualism: Language and Cognition, 13(2), 253-262. doi:10.1017/S1366728909990526

Ringbom, H. (2001). Chapter 4. Lexical Transfer in L3 Production. In *Multilingual Matters eBooks* (pp. 59–68). https://doi.org/10.21832/9781853595509-005

Schmid, M. S. (2011). Language Attrition. *Cambridge University Press*. https://doi.org/10.1017/cbo9780511852046

Schmid, M. S., & Köpke, B. (2017). The relevance of first language attrition to theories of bilingual development. *Linguistic Approaches to Bilingualism*, *7*(6), 637–667. https://doi.org/10.1075/lab.17058.sch

Skutnabb-Kangas, T., & Toukomaa, P. (1976). *Teaching migrant children's mother tongue and learning the language of the host country in the context of the socio-cultural situation of the migrant family*.

Soveri, A., Rodríguez-Fornells, A., & Laine, M. (2011). Is There a Relationship between Language Switching and Executive Functions in Bilingualism? Introducing a within group Analysis Approach. *Frontiers in Psychology, 2*. https://doi.org/10.3389/fpsyg.2011.00183

Spolsky, B. (2004). *Language policy*. Cambridge University Press.

Treffers-Daller, J., & Silva-Corvalán, C. (2016). *Language dominance in bilinguals: Issues of Measurement and Operationalization*. Cambridge University Press.

Tseng, V., & Fuligni, A. J. (2000). Parent-Adolescent language use and relationships among immigrant families with East Asian, Filipino, and Latin American backgrounds. *Journal of Marriage and Family*, *62*(2), 465–476. https://doi.org/10.1111/j.1741-3737.2000.00465.x

UNESCO (2003) Education in a multilingual world: UNESCO education position paper. https://unesdoc.unesco.org/ark:/48223/pf0000129728

US Census Bureau. (2022, December 13). *Nearly 68 million people spoke a language other than English at home in 2019*.

Census.gov. https://www.census.gov/library/stories/2022/12/languages-we-speak-in-united-states.html

VanPatten, B. (2004). Processing Instruction : Theory, research, and commentary. *Routledge eBooks*, 79–92. https://ci.nii.ac.jp/ncid/BA6753537X

Waked, A. N. (2020). *The role of age and Bilingualism on perception of vocoded speech*. https://doi.org/10.13016/uwv9-fltk

Wallentin, M. (2009). Putative sex differences in verbal abilities and language cortex: A critical review. *Brain and Language*, *108*(3), 175–183. https://doi.org/10.1016/j.bandl.2008.07.001

Wilson, S. (2020). To mix or not to mix: Parental attitudes towards translanguaging and language management choices. *International Journal of Bilingualism*, *25*(1), 58–76. https://doi.org/10.1177/1367006920909902

Yang, S., Yang, H., & Lust, B. (2011). Early childhood bilingualism leads to advances in executive attention: Dissociating culture and language. *Bilingualism: Language and Cognition*, *14*(3), 412–422. https://doi.org/10.1017/s1366728910000611

Yang, S., Yang, H., & Lust, B. (2011b). Early childhood bilingualism leads to advances in executive attention: Dissociating culture and language. *Bilingualism: Language and Cognition*, *14*(3), 412–422. https://doi.org/10.1017/s1366728910000611

Yow, W. Q., & Li, X. (2015). Balanced bilingualism and early age of second language acquisition as the underlying mechanisms of a bilingual executive control advantage: why variations in bilingual experiences matter. *Frontiers in Psychology*, *6*. https://doi.org/10.3389/fpsyg.2015.00164

Yücel, M., Stuart, G. W., Maruff, P., Velakoulis, D., Crowe, S. F., Savage, G., & Pantelis, C. (2001). Hemispheric and gender-related differences in the gross morphology of the anterior Cingulate/Paracingulate cortex in normal volunteers: an MRI morphometric study. *Cerebral Cortex, 11*(1), 17–25. https://doi.org/10.1093/cercor/11.1.17