MONOLINGUAL VERSUS BILINGUAL BRAINS: THE EXECUTIVE FUNCTION EVALUATION

A DISSERTATION SUBMITTED TO THE FACULTY

OF

PSY.D. (DOCTOR OF PSYCHOLOGY) PROGRAM IN CLINICAL PSYCHOLOGY

OF

WILLIAM PATERSON UNIVERSITY OF NEW JERSEY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

OF

DOCTOR OF PSYCHOLOGY

June 13th, 2025

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Abstract

This study is an evaluation of whether bilingual versus monolingual individuals perform better on tasks that tap executive function, working memory and visual spatial abilities. Participants were undergraduate and graduate students who were either English speaking monolinguals or English-Spanish speaking bilinguals. They participated in a series of assessments that evaluated non-linguistic performance, verbal fluency and visual spatial executive function. Previous literature has suggested that bilinguals outperform monolinguals on tasks of executive function. However, some research has shown bilinguals perform poorly on tasks of verbal memory with no observed differences on processing speed tasks, such as simple reaction time. This study hypothesized that bilinguals have an executive function advantage over monolinguals and will outperform monolinguals on tasks that assess working memory and cognitive flexibility. Additionally, it is hypothesized that monolinguals will outperform bilinguals on a task of verbal fluency. Results indicated that monolingual participants performed better on both executive functioning and verbal fluency tasks.

Acknowledgments

The support that I have received from my family, friends and community during this journey cannot be measured and I appreciate their prayers, love, well wishes and encouragement. I would like to extend my gratitude to my committee, Dr. Bruce Diamond, Dr. Justina Ekeocha and Dr. Aileen Torres for their continued guidance, investment and mentorship during this research process. A special thank you to my classmates who have listened, and similarly endured, the ebbs and flows of this graduate journey, especially their support and feedback of this research. Additionally, I am especially thankful to the research assistants who dedicated their time to the facilitation of this project. To Him be the glory forever (Romans 11:38).

Monolingual versus Bilingual Brains: The Executive Function Evaluation

Introduction

Every day we encounter various stimuli and information that we consciously and unconsciously interpret, manipulate, maintain and/or store. These functions occur in both monolingual and bilingual individuals, however, the processes may differ in various ways. In fact, decades of controversy have surrounded a number of issues in the field of bilingualism research. One of the issues was whether an association existed between bilingualism and possible disadvantages in academic performance, intelligence, and communication (Barac & Bialystok, 2011). However, more recent research has shifted the focus to whether bilingualism, in comparison to monolingualism, is associated with advantages in both linguistic and non-linguistic executive functions, on a behavioral and neural basis (Whitford & Luk, 2019). The findings have reported mixed results, partially dependent on the participants' age group and experimental design. In large part, many studies have investigated the potential executive function advantages of bilingualism across various cognitive domains, age groups and languages.

Executive functions involve cognitive processes that include working memory, processing speed, attention, inhibitory control, task switching, and so on. These higher order processes are utilized either proactively, which is an anticipatory response to future task demands or reactively, attending to task demands in the moment (Braver, 2012). As bilinguals regularly manage two languages and the associated cognitive demands, they must attend to the necessary stimuli while disregarding the irrelevant stimuli in their environments This can be a challenging effort as they experience interference between their two languages. A salient theme in this research has been the exploration of interference and the potential advantages bilinguals may possess in this type of processing.

Many have hypothesized that the bilingual advantage is rooted in cross-language activation and attending to multiple and competing language systems (Whitford & Luk, 2019). Some research suggests that working memory, executive and attentional control mechanisms are the prominent features of these processes (Diamond et al., 2014)

Cross language activation refers to the ability to activate both first language (L1) and second language (L2) lexical systems and processes (e.g., orthography, phonetics, semantics). Monolinguals are not tasked with the activation of multiple language systems as they only draw from the knowledge of one lexical system; thus, they do not experience cross-language interference as compared to their counterparts. Models of activation have indicated that bilinguals experience a greater cost in this process due to the switching nature involved in activating two languages, but this type of processing may also be facilitated and thus more efficient in bilinguals (Diamond et al., 2014).

One great benefit of this activation is an overlap in words across their languages, which are known as cognates. Cognates refer to words that share both orthography and semantics, such as the word *animal* in both English and Spanish. A cost of this activation is words that are interlingual homographs which share orthography but differ in semantics across languages; for example, *pie* in English and Spanish share the same spelling but have different meanings. Previous literature reveals that cognates are an advantageous feature because they share a common meaning, however interlingual homographs are considered disadvantageous because they differ in meaning, an inhibitory effect (Whitford & Luk, 2019)

Knowledge of L1 and L2 create the challenge that bilinguals experience of having to activate or suppress either language, depending on the context of their encounters. Managing both language systems requires the ability to attend to the competing lexical systems and present with the language appropriate to the environment. The difficulty arises since both languages are always active, despite the contextual demand for just one. The bilingualist would have to inhibit L1 to produce speech in L2 (Kroll & Gollan, 2014). An original theory to explain bilinguals' inhibitory control was posited by Green (1998) where it is explained that the supervisory attentional system is a domain-general inhibitory control mechanism unique to bilinguals that inhibits the irrelevant language to retrieve the language relevant to the situation. This theory further explained that the strength required to suppress is proportional to the strength required to activate the language in demand. Following this finding, Carlson and Meltzoff (2008) examined this inhibitory control skill between bilingual and monolingual children by administering verbal and executive function batteries to both populations. Their results supported the advantage of inhibitory control among bilinguals as they significantly performed better on tasks that required managing conflicting attentional demands.

In tasks of verbal fluency, the results have been variable about the performance between the two groups. Verbal fluency measures assess the individual's production of as many words within a fixed time within a specific criterion (e.g., semantic or letter). The letter fluency condition poses a greater challenge as individuals are asked to produce words of a specific letter (e.g., F, A, S), not a common practice in daily life. Whereas the semantic condition requires individuals to produce words commonly associated with a given category (e.g., clothes, fruit, vegetables). This provides the opportunity to recall existing associations from their mental repertoire related to the presented concept and produce novel words (Friesen et al., 2015). Delis et al. (2001) constructed an assessment of executive function, mediated by the frontal lobe, to include a verbal fluency subtest. They reported a higher demand is placed on executive control in the letter fluency condition, meanwhile the semantic fluency condition relies on linguistic abilities. In a study to assess letter fluency, Luo and researchers (2010) found that bilinguals perform better on this measure compared to monolinguals when there is vocabulary match. Vocabulary match refers to both bilingual and monolingual individuals having similar receptive and expressive vocabulary abilities. It is also of note to report findings of bilingual individuals having lower vocabulary scores than monolinguals (Portocarrero et al., 2007). This discrepancy in vocabulary knowledge can serve as a bilingual disadvantage in verbal vocabulary tasks.

Researchers employ brain imaging techniques to explore the brain regions often activated during the switch between two languages. Functional magnetic resonance imaging revealed an increased activation in the dorsolateral prefrontal cortex, which is the region associated with attention and inhibition, both salient processes in the bilingual brain. Other regions commonly involved during language switching are the anterior cingulate cortex, bilateral supermarginal gyri, and the left inferior frontal gyrus. The left-IFC, known as the language production center of the brain, is activated in both linguistic and non-linguistic cognitive control processes (Marian & Shook, 2012). In addition to neuronal activation, imaging suggests that differences affect the brain structure. Correlations exist between higher proficiency and earlier acquisition of the second language and higher gray matter volume in the left inferior parietal cortex (Mechelli et al., 2004). The extant literature highlights these main regions and structures, but primarily the frontal lobe, to be responsible for higher order cognitive skills, such as language and other executive function domains.

In ongoing investigations to explore the continued bilingualism and monolingualism controversy, researchers have investigated the differences that have been reported to exist in comparison of these two groups and various executive function domains. Diamond and colleagues (2014) examined processing speed, attention, working memory and verbal fluency in the bilingual brain and the cost involved in non-linguistic tasks and switching between two languages. This study provided the foundation for the hypotheses and research that was conducted. Age of acquisition was another variable to consider, and this study suggested cognitive advantages for simultaneous exposure to both languages before the age of five compared to late sequential exposure to L2 after age 12. After administering measures of attention, verbal fluency and memory, results indicated that processing speed of bilinguals were significantly slower than monolinguals and switching between two languages poses a greater processing burden. However, overall, they exhibited better performance on executive type tasks. Notably, the researchers did not observe differences in simple reaction time or processing speed on non-linguistic 2-back switch tasks between both groups. Similarly, Luo and colleagues (2013) also found that bilinguals perform poorly on verbal memory tasks compared to monolinguals. Additionally, they also found that bilinguals have lower vocabulary scores than monolinguals indicating knowledge of fewer vocabulary words. This finding could suggest difficulty that bilinguals encounter in verbal processing given their reduced vocabulary knowledge. Another study conducted by Wiseheart et al. (2016) revealed no significant differences on processing speed tasks between the two groups.

While much of the research report similar findings, there is variability pertaining to the nuances of certain executive function domains. These discrepancies emphasize the need for continued exploration in the field of bilingualism. In an effort to help resolve these discrepancies, this study aimed to investigate executive function differences that may exist between English-Spanish bilinguals and English monolinguals. Based on some previous findings, this study hypothesized that bilinguals possess a greater executive function advantage compared to their monolingual counterparts. Additionally, it was hypothesized that bilinguals will perform poorly on verbal fluency tasks compared to monolinguals.

Method

Participants

Fifty-five participants completed this study where 27 individuals were monolingual and 28 individuals were bilingual individuals. The participants of this study were between the ages of 17 to 41 years and were on average 20.5 years old within the undergraduate and graduate student population. Within the bilingual sample, 19 participants reported Spanish to be their first language, seven reported to have learned to speak English and Spanish simultaneously, while two reported English to their first language. See Table 1 for additional descriptive statistics of the participants involved in the analysis of this study. They were recruited via the university's SONA Systems software or word of mouth. Those in participation for SONA credit received their credit upon completion of study, to partially fulfill a course requirement for their introductory psychology courses.

Individuals who have been diagnosed with a neurologic or psychiatric disorder, have sensory deficits that would interfere with task performance or who are taking medications that would interfere with performance were excluded from participation in the study. This information was assessed during the intake procedure. English monolinguals and English-Spanish bilinguals were encouraged to participate. With the major emphasis of this study being English-Spanish bilingualism, fluency in other languages served as exclusion criteria for participation.

Procedures

The measures and research plan were submitted to the Institutional Review Board (IRB) and received approval on October 23, 2023, code 2024-310. All participants remained anonymous and were assigned an ID number. All data was kept in a locked cabinet and on a password protected computer kept in a locked room to comply with confidentiality standards. Data will be destroyed at the seven-year mark unless it must be retained based on external requests.

Participants were asked to sign a consent form prior to their participation in the study. They were instructed that they can choose to not answer a question or participate in a specific task and that they can withdraw from the study at any time. Fatigue is a potential risk, so the option for breaks was provided in between tasks. Some tasks might be challenging to the participants, and so participants were advised to do their best, but that task performance is confidential and will have no impact on their academic record.

This study's format was conducted in-person and took approximately 60 minutes to complete in the lab of a northeast suburban university. After consent was obtained, participants were administered an intake form to assess information about the participant's demographic, psychological and medical history. To control for order or sequence effects, the measures were counterbalanced and therefore administered in a differing sequence for each participant.

Measures

Language Background Questionnaire. The Language Background Questionnaire, Short Version (Sabourin et al., 2016) is self-report questionnaire that collects information about the dominance, immersion, sequence, and proficiency of L2 language acquisition. This was useful information to differentiate participants of the English and English-Spanish groups, while additionally providing insightful information about their language experiences.

Depression and Anxiety Measures. Previous literature has found that depressive and anxiety symptoms and disorders can impact cognitive functioning (Castaneda et al., 2008). Considering this finding, symptoms of depression and anxiety were screened to account for potential confounds of participants' performance. Though participants with higher depression and anxiety scores are not excluded from the study, these scores will later be analyzed as covariates to assess if such symptoms impacted cognitive performance. Beck Depression Inventory-II (BDI-II) (Beck et al., 1996) was used to assess for symptoms of depression and State-Trait Anxiety Inventory (STAI) (Spielberger, 1983) was used to assess for state and trait anxiety symptoms. The BDI-II consists of 21 self-report items that are characteristic of depressive symptoms. It is reported to have high internal consistency ranging from .73 to .92 with alpha coefficients of .86 for psychiatric and .81 non-psychiatric populations (Beck et al., 1988). The STAI consists of 20 state items to assess how the individual feels in the moment of assessment and 20 trait items to assess general anxiety. This scale has demonstrated internal consistency of .86 to .95 and additional evidence supports the construct and concurrent validity as well (Spielberger et al., 1983).

Digit Span. To assess working memory, the forward and backward conditions of the Digit Span subtest on the Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV) (Wechsler, 2008) was administered. In the forward condition, participants are asked to recall an increasing series of numbers in the same order and in the backward condition, they are asked to recall an increasing series of numbers in the reverse order. In this study, the forward condition serves as an evaluation of working memory whereas the backward condition serves as an evaluation of executive control. This is due to the complex feature of having to store, manipulate and present the response contrary to the presentation of the initial stimuli. Each condition of the

Digit Span subtest (forward, backward and sequencing) has adequate internal consistency between .81 to .83 and for 13 clinical groups between .86 to .89 (Lichtenberger & Kaufman, 2012).

Stroop Test. The Stroop Test (Stroop, 1935) is a well-established measure of executive function. The participants were presented with various color word combinations. They are to assess whether the color and word presentations are congruent, meaning a color word is written in its corresponding ink, or incongruent, differing color and word presentation. An example of congruency would include the word "red" written in red ink while incongruency can be represented as the word "red" written in green ink. This measure was used to assess executive function domains of inhibition, interference, and cognitive flexibility. This computer task presents the stimulus for 200 milliseconds and participants have a response window of 1000 milliseconds with a 1500 millisecond intertrial interval period.

Simple Reaction Time. A Simple Reaction Time assessment was administered as a measure of non-linguistic simple processing speed. In this task, the participants are asked to indicate a response on the computer keyboard as soon as a green square is presented on the computer screen.

Visual Spatial 2-Back Switching Dual Task. Lastly, a Visual Spatial 2-Back Switching Dual Task (Diamond et al., 2014) is an executive, non-linguistic computer program used to evaluate working memory abilities among both groups. It requires each participant to determine if the current stimulus (e.g., an icon) is the same stimulus and in the same location as the stimulus that was presented two trials prior. It is an assessment that demands attention and concentration to store, remember and recognize a stimulus and its spatial location.

Controlled Oral Word Association Test. The Controlled Oral Word Association Test (COWAT) (Benton et al., 1983) was used as a measure to evaluate verbal fluency. This task would require the participant to free associate various words that begin with the presented letters, *F*, *A*, and *S*. They are asked to produce as many words as possible within 60 seconds. Additionally, they are asked not to provide other tenses of one word (e.g., train, training, trainable) or proper nouns (e.g., Timothy, Texas) but rather to provide novel words each time. This measure has demonstrated high internal consistency of .83 and test-retest reliability of .74 (Ruff et al., 1996).

Statistical Analyses

In order to address the first hypothesis that bilinguals possess an executive function advantage compared to monolinguals, a one-way Analysis of Variance (ANOVA) was used to determine whether there were significant differences in group means with respect to Simple Reaction Time. An independent samples t-test was conducted to compare performance on Digit Span and Visual Spatial 2-Back values. Lastly regarding this hypothesis, a 2x2 repeated measures mixed design factorial ANOVA was conducted as this assessment consists of a between-subjects variable, the language group, and a within-subjects variable, the congruent and incongruent trials.

To address the second hypothesis that bilinguals will perform poorly on a verbal fluency task compared to monolinguals, an independent-samples t-test was used to compare the verbal fluency variable between the two groups.

Statistical analyses were conducted using IBM SPSS 30.

Results

Of the 55 participants, this study included monolingual (n = 27) and bilingual (n = 28) individuals. Table 1 represents the descriptive statistics of the participants involved in the analysis of this study. The mean and standard deviation are presented for the age of participants for the monolingual and bilingual groups. Notably, gender was assessed as an open-ended question on the intake form and all participants self-identified as either male or female. In a study conducted by Diamond and colleagues (2014), subgroups within the bilingual sample were proposed and are as follows. Simultaneous bilingual speakers are those who acquired both L1 and L2 before the age of five years old. Sequential speakers were exposed to L2 after age five but prior to age 12. Lastly, late sequential speakers were exposed to L2 after age 12. Of note, twenty-six bilingual participants reported their first language to be Spanish while two bilingual participants reported English to be their first language.

Table 1

Participant Demographic Information

	Monolingual n = 27	Bilingual n = 28
	M (*SD*)	*M* (*SD*)
Age	19.74 (3.17)	21.32 (5.94)
Gender		
Male	n = 12	n = 5
Female	n = 15	n = 23
Language Acquisition		
Simultaneous	-	n = 20
Sequential	-	n = 4
Late Sequential	-	n = 4

Table 2 illustrates the means and standard deviations for the various executive functioning and verbal fluency tasks completed by the two language groups. All confidence intervals were 95%. Latencies thresholds are reported for the Simple Reaction Time and Visual Spatial 2-Back assessments and raw scores of correct responses are reported for the Stroop and Digit Span measures. Analysis of covariance revealed no statistically significant difference of higher depressive and anxiety scores across every assessment given. Therefore, the presence of depressive and anxiety symptoms did not impact the cognitive or verbal fluency performance among participants in this study.

Table 2

Performance on Executive Function and Verbal Fluency Tasks

	Monolingual *M* (*SD*)	Bilingual *M* (*SD*)
Executive Functioning		
Digit Span		
Forward	9.48 (2.19)	9.50 (1.37)
Backward	8.22 (1.97)	7.50 (1.45)
Stroop Test		
Incongruent	3.22 (4.76)	2.21 (2.96)
Congruent	4.26 (4.41)	4.11 (3.35)
Simple Reaction Time	307.93 ms (46.75)	334.43 ms (50.81)
Visual Spatial 2-Back		
Threshold	507.00 ms (193.04)	531. 86 ms (185.18)
Verbal Fluency		
COWAT	34.56 (11.44)	27.29 (9.62)

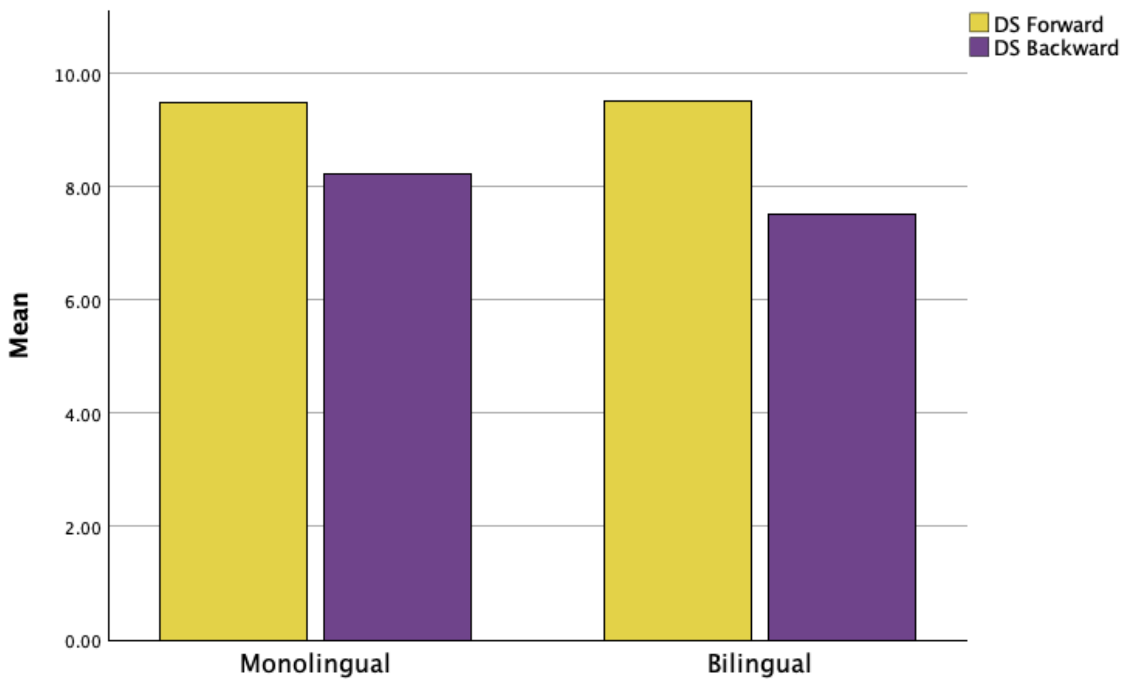
Digit Span

An independent samples t-test was conducted to compare working memory performance in Digit Span Forward and Digit Span Backward tasks between monolinguals and bilinguals.

There was no significant difference in Digit Span Forward scores between monolinguals (*M* = 9.48, *SD* = 2.19) and bilinguals (*M* = 9.50, *SD* = 1.37), *t*(43.46) = -0.037, *p* = .970, *d* = -0.01. Similarly, no significant difference was found in Digit Span Backward performance, *t*(53) = 1.55, *p* = .127, although monolinguals (*M* = 8.22, *SD* = 1.97) outperformed bilinguals (*M* = 7.50, *SD* = 1.45) with a small to moderate effect size (*d* = 0.42). These findings suggest minimal to no differences in basic verbal working memory tasks between the two language groups.

Figure 1

Means of Digit Span Forward and Backward conditions by language group

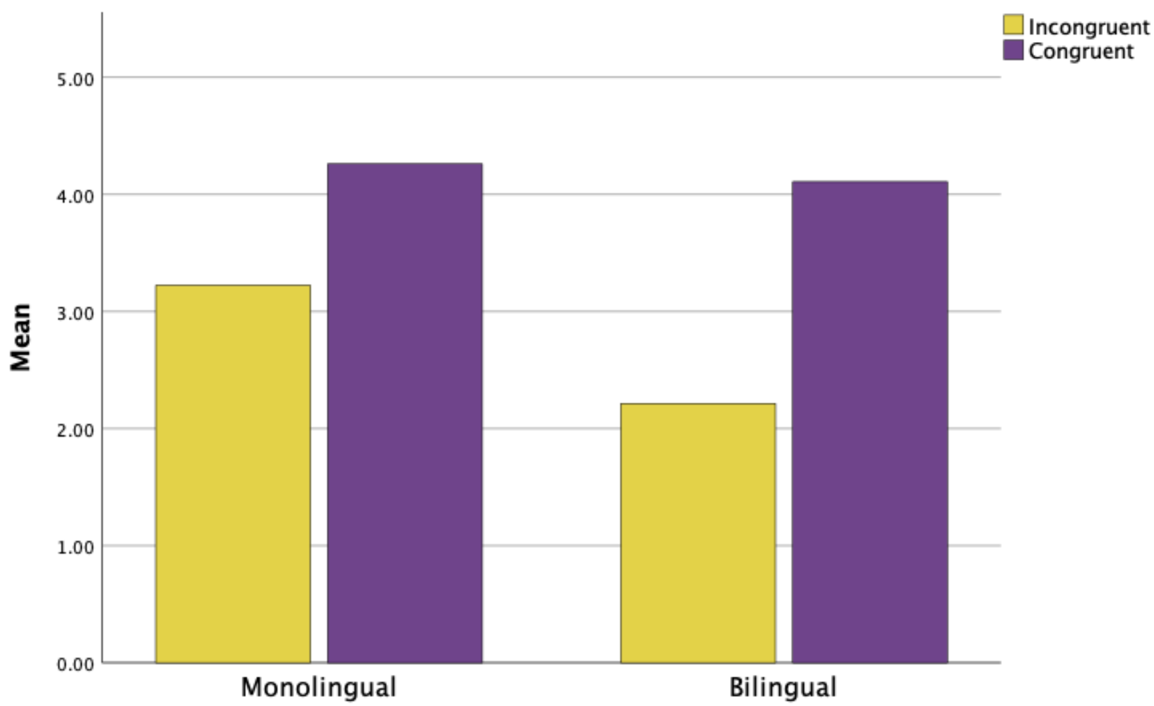


Stroop Test

A repeated measures ANOVA was conducted to compare Stroop task accuracy under congruent and incongruent conditions across language groups. There was a significant main effect of condition, $F(1, 53) = 22.21$, $p < .001$, $\eta^2 = .295$, with participants performing better in the congruent condition. This means that accuracy was higher when the color and word matched, which is consistent with Stroop task expectations. However, the interaction between Stroop condition and language group was not significant, $F(1, 53) = 1.90$, $p = .174$, $\eta^2 = .035$, indicating that both monolinguals and bilinguals showed similar Stroop performance. Descriptively, monolingual participants had higher average accuracy scores than bilinguals in both conditions. In the incongruent condition, monolinguals had a mean score of 3.22 (*SD* = 4.76), while bilinguals averaged 2.21 (*SD* = 2.96). In the congruent condition, monolinguals averaged 4.26 (*SD* = 4.41), compared to 4.11 (*SD* = 3.35) for bilinguals. There was also no significant main effect of language group on overall accuracy ($F(1, 53) = 0.33$, $p = .569$, $\eta^2 = .006$).

Figure 2

Mean of accurate congruent and incongruent responses by language group



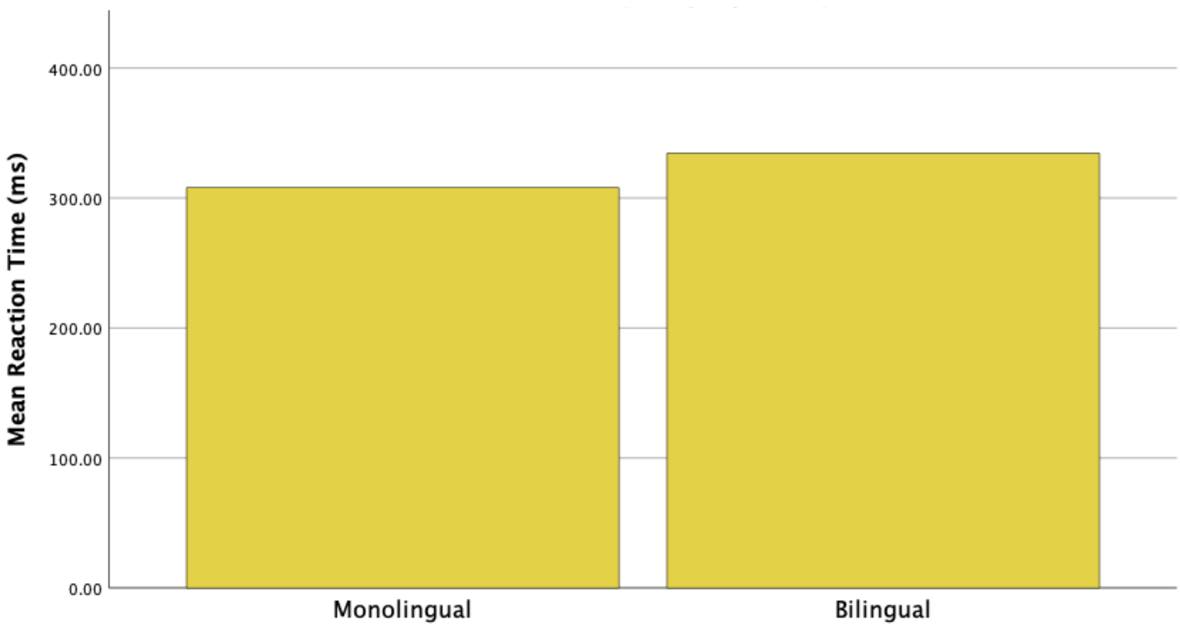
Simple Reaction Time

Participants responses in milliseconds were used to assess for differences in simple reaction time. The results revealed a statistically significant difference between groups, $F(1, 53) = 4.04$, $p = .049$, with monolingual participants (*M* = 307.93 ms, *SD* = 46.75) responding faster than bilingual participants (*M* = 334.43 ms, *SD* = 50.81). The effect size was small to moderate

($\eta^2 = .071$) suggesting that language status may have a modest impact on simple reaction time performance.

Figure 3

Mean of Reaction Time in milliseconds by language group

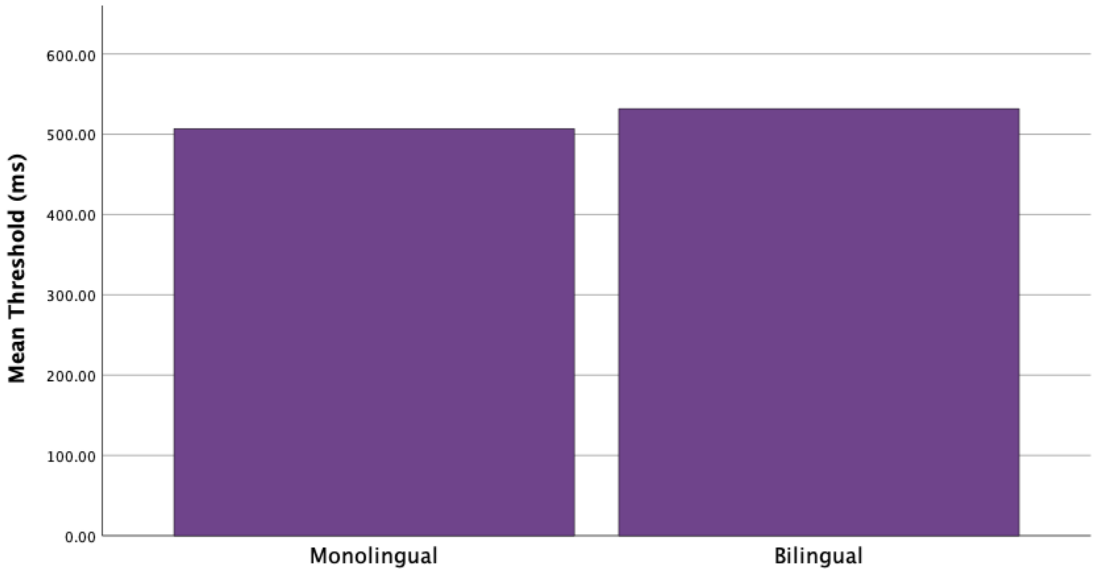


Visual Spatial 2-Back Switching Dual Task

Threshold values represent the mean response time across trials. An independent samples t-test was conducted to examine differences in speed performance (reaction time threshold) on a visual-spatial 2-back task between monolinguals and bilinguals. The results indicated that there was no statistically significant difference in performance between monolinguals (M = 507.00, SD = 193.04) and bilinguals (M = 531.86, SD = 185.18), $t(52.68) = -0.49$, $p = .628$. Levene's test showed that the assumption of equal variances was met, $F(1, 53) = 0.06$, $p = .803$. Therefore, no meaningful difference in threshold performance was found between the two language groups.

Figure 4

Mean of threshold values by language group

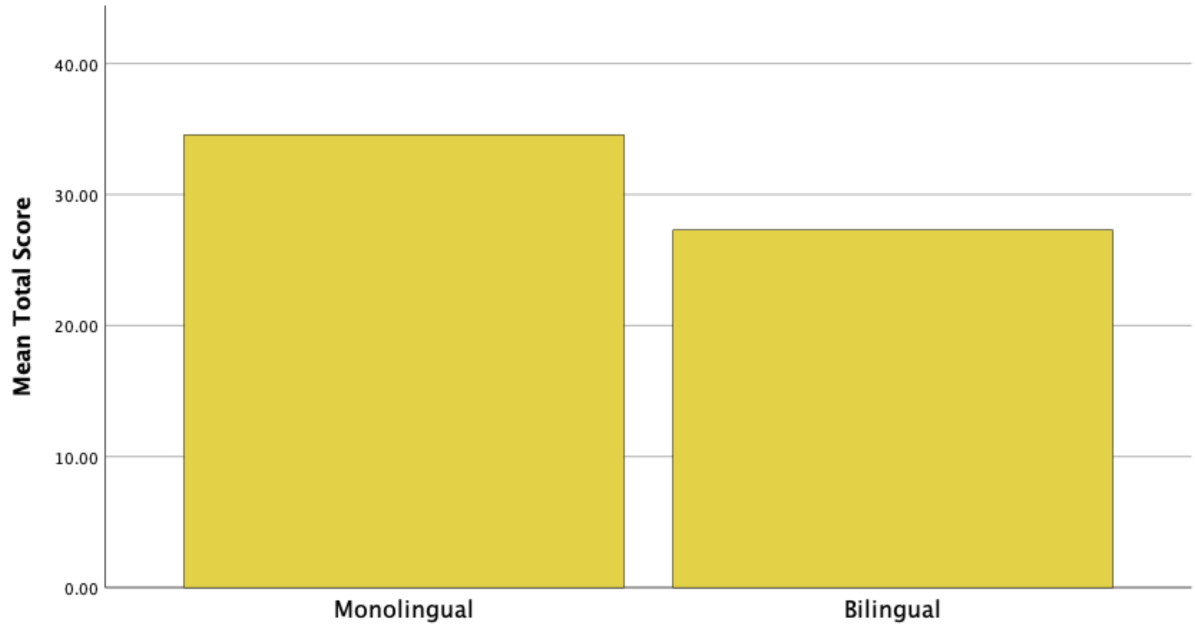


COWAT

Additionally, an independent-samples t-test was utilized to evaluate the second hypothesis of the monolinguals performing better on verbal fluency tasks compared to bilinguals. The verbal fluency results were recorded as a raw score indicated by the total number of words each participant reported, respective of their language group. The independent variables included the monolingual and bilingual groups, and the dependent variable was the performance on the COWAT measure analyzed as total raw scores. Results indicated that the monolingual group (*M* = 34.56, *SD* = 9.62) scored better on average than the bilingual group (*M* = 27.29, *SD* = 9.62) on a measure of verbal fluency ($t(53) = 2.554$, $p = .014$, $d = 0.69$)). The p-value suggests a statistically significant difference between the groups while the effect size suggests moderate to large effects.

Figure 5

Mean of total words produced by language group



Discussion

This study presented an investigation of the executive function differences between bilinguals and monolinguals. It was hypothesized that bilinguals would possess a greater executive function advantage compared to monolinguals in domains such as working memory, processing speed and inhibition. This study examined such cognitive differences with a series of executive function tasks to evaluate if the proposed differences exist. The scope of the study explored domains of executive function such as working memory, processing speed and task switching.

With respect to the simple reaction time task, the findings clearly indicate that response to non-linguistic stimuli are performed at faster rates by monolinguals than bilinguals. This is supported by the monolingual cohort having quicker response times than their counterparts, which can suggest the presence of a processing speed advantage. Additionally, this finding was not in support of the proposed hypothesis regarding a bilingual executive functioning advantage.

Among the executive function tasks, it was revealed that the only statistically significant difference was the simple reaction time task, a non-linguistic task of processing speed, in which monolinguals outperformed bilinguals. Plausibly, this discovery could be attributed to the simple demands of the task and that the reaction time task was less sensitive at being able to differentiate bilingual from monolingual processing speed performance. If bilinguals are inherently habituated to complex cognitive demands, a simple task of processing speed may have been underestimated, and bilinguals may have been less engaged, leading to their slower performance. This could also be supported by their slower response threshold on the Visual Spatial 2-Back measure. Furthermore, subtle demographic differences among the language groups may also explain the outcome. Though this task was not language based, all testing instructions were recited in English to all participants. Perhaps the bilingual group engaged additional attentional resources that could have depleted attentional resources used to process the presented material. Such a subtle nuance as this may impact performance of subsequent tasks.

With respect to other domains of executive function, such as working memory, inhibition, cognitive flexibility, task switching and visual spatial abilities, the results indicate that monolinguals performed with greater accuracy and faster responses on measures such as the Stroop, Digit Span forward and backward conditions, and the Visual Spatial 2-Back Task. These results do not support the initial hypothesis. Though the findings were not statistically significant, they are suggestive of a greater advantage of holding, manipulating and/or recalling presented stimuli among the monolingual sample in comparison to their peers.

The verbal fluency task showed a significant difference revealing that the monolingual group outperformed the bilingual group, in support of the proposed hypothesis. These findings provide support for the existing literature about the verbal fluency advantage of monolinguals.

Limitations

First, a convenience sample of undergraduate and graduate students was used, which is unlikely representative of the general population. Additionally, though the sample size was sufficient to possess statistical power, it is a small sample of each monolingual and bilingual group, also not likely to represent the general population.

Also, this study prioritized English monolinguals and English-Spanish bilinguals and did not account for diverse language immersion experiences; for example, monolingual individuals who may have exposure to another language in their environment though are only fluent in one. The focus reflects the fact that the university is a Hispanic serving institution and that English-Spanish bilingualism is prominently represented among bilingual communities across the United States of America.

Eligibility criteria for participation in the bilingual group was speaking English and Spanish languages. However, another limitation to consider is the study did not distinguish English or Spanish as L1 and L2. Therefore, bilingual participants' first language could either be English or Spanish which could have implications on variables such as executive functioning and verbal fluency.

Another limitation to consider is the use of language in the selected executive function assessments. Measures of memory, cognitive flexibility and processing speed, assessed by measures such as Digit Span and the Stroop Test have a language component as the presented color words and numbers read aloud are done so in English. This could have impacted the cognitive performance on the selected measures of the bilingual group.

Lastly, the COWAT task was inclusive of only English words which limits a bilingual participant's other lexical system and use of vocabulary. Ultimately this restriction to only list

English words could impact their performance and contribute to this study's findings of a monolingual advantage.

Future Directions

Bilingualism literature can influence application among various clinical and educational settings, perhaps even relational and familial dynamics. Such implications can inform appropriate interventions and assessments for cultural and psychosocial consideration.

One aspect not explored is the potential gender differences that could exist in the context of bilingualism and executive function. It could be beneficial to explore the influence that gender could have on the development of expressive and receptive language, and how such influence could impact bilingualism.

Further assessing language acquisition is another variable for future research. Although, this information was collected during intake, the bilingual acquisition subgroups were not diverse as much of the participants fell within the simultaneous group. Evaluating across various acquisition groups is valuable and could provide additional insight about bilinguals' executive functioning in respect to the timing, duration and nature of the language acquisition.

Immersion in other languages can likely influence receptive communication and potentially expressive communication. Individuals' understanding of another language but not expressively speaking the language is a factor for future research to investigate this effect on cognitive abilities. It is imaginable that although an individual may comprehend additional languages frequently spoken in their environment, without having the expressive capability, differences in executive function capacities could appear by nature of frequent exposure. Further investigation may reveal such nuances and contribute to bilingualism literature.

The use of non-linguistic measures of executive function such the Wisconsin Card Sorting Test or Halstead Category Test can be considered for future research in this area. Such assessments do not use language but rather shapes and patterns, it can better capture cognitive performance without a linguistic component.

If bilingual individuals are presenting with executive functioning deficits, they may benefit from services such as executive functioning coaching and other interventions to strengthen domains such as attention, cognitive flexibility and working memory. This research demonstrated that differences between bilingual and monolingual individuals were not significant; however, if an individual is experiencing difficulties that are impacting their cognitive functioning, they could seek specific interventions.

Lastly, results from this study can contribute to the literature about concerns bilingual parents have about raising their children to be bilingual regarding their cognition and school performance. Bilingual parents have expressed hesitation about teaching their children the native language due to thoughts about confusing the child and their language development thereby affecting academic performance. Results from this study have demonstrated that there no significant differences in executive functioning among monolingual and bilingual participants and can support the position in this controversy that teaching another language in the home would not cause children to differ from their monolingual counterparts.

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