Theory of Mind and Language Similarity in Bilingual Children

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Abstract

Recent research suggests bilingual children outperform monolingual counterparts on Theory of Mind (ToM) and Executive Function (EF) tasks. This study focused on the impact of language similarity on these abilities. Bilingual children (N=7; ages 3-5) were categorized into Close (C; N= 2) and Distant (D; N= 3) language similarity groups based on their secondary language's proximity to English. Additionally, a monolingual control group (N=2) was included. In this study, a total of 7 participants were asked to complete a flanker task aimed at assessing their inhibitory control (EF) using reaction time (RT) and error count. The task consisted of two conditions: congruent and non-congruent. The congruent condition involved all stimuli going in the same direction, while the non-congruent condition had the middle stimulus going in the opposite direction from the rest. Participants also completed a false belief task (FBT) to evaluate ToM skills on a pass/fail basis (N=4 Pass; N= 3 Fail). A 2-way ANOVA test examining language similarity by congruent and non-congruent conditions revealed that distant bilinguals tended to show faster reaction times and fewer errors than close bilinguals for both flanker conditions. Furthermore, both bilingual groups tended to perform better than the monolinguals in both flanker conditions. An analysis of the false belief task revealed that monolinguals tended to pass the false belief task at a higher rate than the bilingual groups. Distant bilinguals tended to pass the false belief task more frequently than close bilinguals. These results are consistent with previous research suggesting a bilingual advantage in executive function and may indicate that language similarity plays a role in this advantage. Though, no bilingual advantage was observed for the ToM task.

The ability to infer another individuals' mental states is often referred to as Theory of Mind (ToM). Since its initial debut in 1978 in a study involving chimpanzees (Premack & Woodruff, 1978), ToM has been documented in a number of child development studies (eg., Blom et al., 2014; Dahlgren et al., 2017; Goetz, 2003; Kovács, 2009; see Schroeder, 2018; Wellman & Liu, 2004; Yu et al., 2021 for review). The development of ToM is critical in the 3-5 age range for children's social and emotional development, as it enables them to understand that others have different beliefs and desires separate from their own (Bialystok et al., 2012; Kovács, 2009). Recent research suggests bilingual children outperform monolingual counterparts in ToM tasks (Goetz, 2003). Goetz hypothesized that this may be due to the inhibitory nature of switching languages as a bilingual. The ToM studies that followed predict that this ability comes from an enhanced executive function (EF), or rather bilinguals affinity for switching attention in tasks (Bialystok et al., 2010; Blom et al., 2014; Dahlgren et al., 2017). Further research by Bialystok et al. (2012) suggests that bilingual children possess this cognitive advantage in nonverbal EF tasks. However these children often struggle with the verbal nature of ToM tasks (Bialystok et al., 2012; Goetz, 2003).

Few ToM studies have researched language similarity as a possible factor for this executive function advantage (Schroeder, 2018). In an executive funciton study, Oschwald et al. (2018) focused on language similarity as an indicator for better EF performance in nonverbal tasks in adults. However, the results of this study only showed a marginal difference for dissimilar languages with no significant effects in nonverbal tasks. I hypothesize that Bilingual children, ages 3-5 years old, speaking languages similar to English will show better EF and ToM skills than those speaking languages less similar to English. Based on current research, evidence is mixed for the effects of a more dissimilar or similar language having greater cognitive effects.

Given that bilinguals may have an affinity for switching languages using higher executive function, I expect that a similar language will require less effort than a more complex language at this age. In the following section, I will further discuss bilingualism and the advantage that bilingual children possess.

Bilingualism

Bilingualism refers to an individual's ability to use two or more languages with native-like proficiency, and involves a high level of cognitive control to effectively manage multiple languages (Pliatsikas et al., 2015). This level of cognitive control is seen in the bilingual's ability to outperform monolinguals in ToM tasks (Dahlgren et al., 2017; Farhadian et al., 2010; Goetz, 2003; Kovács, 2009). The bilingual advantage was first postulated by Goetz (2003) after examining the impact of bilingualism on ToM development in children. Participants were 3–4-year-old English monolinguals, Mandarin Chinese monolinguals, and Mandarin-English bilinguals. ToM skills was measured on appearance-reality, level 2 perspective-taking, and false-belief tasks. The appearance-reality task measured the ability to distinguish between the real properties of an object and its superficial properties, which is related to the comprehension of false beliefs. The level 2 perspective-taking task measured the ability to understand and describe the visual perspective of another person, which is related to the comprehension of different points of view in ToM. The false-belief task measured the ability to understand that others can hold false beliefs about the world and that these beliefs can influence their behavior.

Results indicated that the skills of the two monolingual groups did not differ significantly, whereas the bilingual group exhibited superior skills compared to both monolingual groups. Goetz (2003) concluded that the notion of a bilingual advantage may be attributed to factors such as enhanced inhibitory control (EF), heightened metalinguistic

awareness, and greater sensitivity to sociolinguistic cues. The following section will discuss studies built off of Goetz (2003) findings.

The Advantage in Theory of Mind Studies

Subsequent to Goetz's (2003) seminal findings, a multitude of studies have examined the phenomenon of the bilingual advantage in various languages such as Mandarin, Turkish, Spanish, and French (Blom et al., 2014; Dahlgren et al., 2017; Diaz & Farrar, 2018; Farhadian et al., 2010; Kovács, 2009). A meta-analysis of 16 studies found a small bilingual ToM advantage (Cohen's d= 0.22, p = 0.050; Schroeder, 2018). Schroeder's (2018) meta-analysis aimed to investigate whether bilingual individuals have an advantage in theory of mind tasks compared to monolingual individuals. The analysis included 152 effect sizes from 16 studies and found a small but significant advantage for bilinguals in ToM tasks. Additionally, the advantage was greater for early bilinguals and for tasks that involved more complex language processing (Schroeder, 2018). However, a majority of these studies focused on Indo-European languages such as Spanish or French and rarely compared these languages based on similarity.

Among these studies, Kovács (2009) investigated the influence of early bilingualism on false-belief reasoning, a crucial cognitive component of theory of mind development. Using a standard false-belief task (Sally-Anne task), the study compared the skills of a sample of *n*= 64 children, including *n*= 32 Romanian-Hungarian bilinguals and *n*= 32 Romanian monolinguals, all aged between 2 to 10 years old (mean age = 3.3 years). Results indicated that the early bilingual group demonstrated superior skills compared to the monolingual group, thus providing evidence that early bilingualism is associated with a robust advantage in false-belief reasoning. I will discuss the significance of identifying the bilingual advantage in false belief tasks in the following section.

Theory of Mind and False Belief Tasks

A false belief task is a fundamental measure of Theory of Mind, which evaluates one's ability to recognize that others can possess beliefs that differ from their own and that those beliefs may not reflect reality (Wellman & Liu, 2004). These tasks involve presenting a scenario in which the participant is asked to predict the actions or thoughts of a character in a story, based on the character's beliefs and knowledge. A standard false-belief task is the "Sally-Anne" task, where a child is asked where a toy will be located after it has been moved by one of two characters who hold different beliefs about its location.

The current study focuses on the “Smarties” false belief task as described by Hogrefe et al. (1986). This task involves a scenario where the experimenter shows a box of smarties and asks the child about the inside contents. After the child answers “Smarties” the experimenter then reveals to the child that there is actually a pencil in the box and closes the box. Then the experimenter informs the child that their friend is going to come in and receive the same question. The child is then prompted to answer what they believe the experimenter’s friend will say is in the box. The average 4-year-old will say that the character will say “Smarties”. But sometimes younger children will say “Pencil” even when asked what they originally thought was in the box (Hogrefe et al., 1986). Bilingual children have been found to exhibit a superior skills on these tasks, which has been attributed to their heightened linguistic awareness (Cheung et al., 2010; Diaz & Farrar, 2018).

The term linguistic awareness refers to an individual's capacity to tailor their language usage to meet the communication needs of others (Goetz, 2003), a skill that is critical in Theory of Mind development (Cheung et al., 2010; Diaz & Farrar, 2018). Several studies have highlighted the significance of linguistic awareness in false belief tasks, which are widely

employed to evaluate ToM (Cheung et al., 2010; Genesee et al., 1996). Research has shown a positive relationship between linguistic awareness and false belief tasks in bilingual children (Cheung et al., 2010). This association supports the proposition that the bilingual advantage in ToM tasks may be attributable to heightened metalinguistic awareness and greater sensitivity to sociolinguistic cues, as postulated by Goetz (2003). In the following section I will discuss how the advantage in inhibitory control, as postulated by Goetz (2003), has also been found in bilingual EF studies.

Executive Function

Executive function (EF) refers to a set of general cognitive processes that are responsible for regulating an individual's thoughts and behaviors (Miyake & Friedman, 2012). The accepted set of processes are inhibition, updating (working memory), and shifting (see Miyake et al., 2000 for review). The contents of this study will focus on the inhibition aspect of EF as it is distinctively responsible for differences in the development of bilingual children (see Bialystok, 2015 for review). The advantage in inhibitory control, as postulated by Goetz (2003), has also been found in bilingual EF studies (Barac & Bialystok, 2012; Bialystok et al., 2010; Gold et al., 2013; Luk et al., 2010; Oschwald et al., 2018). Although various age groups were included in most of the studies, they all provided evidence for a bilingual advantage in executive function. Among the studies conducted, Luk et al. (2010) provides notable neurological evidence for the bilingual advantage. Specifically, Luk et al. (2010) found that bilingual adults displayed distinct neural patterns for response inhibition and interference suppression when compared to monolingual adults. This observation suggests that bilingualism may lead to more efficient neural mechanisms in cognitive control. This finding supports Goetz's (2003) postulation that executive function (EF) contributes to the bilingual advantage, as bilinguals have demonstrated

greater proficiency in suppressing irrelevant information and switching between tasks. Moreover, recent studies have further examined the relationship between language proficiency and EF.

Oschwald et al. (2018) examined the similarity of the languages and dialects spoken by adult German-English and German-Turkish bilingual and bidialectals (German-Swiss) as the connection between language and EF skills. They postulated that language similarity may facilitate the development of executive control, as bidialectal and bilingual individuals are required to switch between languages or dialects frequently, which requires cognitive flexibility and inhibitory control. Oschwald et al. (2018) utilized a number of tasks including the flanker task, a well-established measure of cognitive control, to assess the ability of participants to selectively attend to relevant information while inhibiting irrelevant information. The findings of the study suggested that there is no significant effect of language dissimilarity on nonverbal cognitive tasks in adults. While Oschwald et al. proposes the hypothesis that similar languages might intensify executive control requirements and thus potentially enhance cognitive performance, this idea is not empirically proven within the study itself. However, considering that the study by Oschwald et al. (2018) focused on young adults, they hypothesized that the effects might be different for children. A possibility is that more similar languages could lead to greater cognitive effects in children due to increased cross-language interference, as previous studies have indicated that bilingual children with more similar languages outperform those with less similar languages in linguistic tasks (Barac & Bialystok, 2012; Bialystok et al., 2003).

Conclusions

The literature in this review supports the bilingual advantage regarding executive function (EF) and theory of mind (ToM) skills as postulated by Goetz (2003). However, looking at language similarity as a predictor for this bilingual advantage is lacking in current child

research. The purpose of this study is to examine whether the similarity of two languages spoken by bilingual children has a positive effect on their ToM development. Most of the research presented has only focused on bilingual to monolingual differences. This study is the first to incorporate a bilingual-to-bilingual approach to both EF and ToM in children. Because of bilinguals' affinity for switching languages may be eased by a less complex secondary language, I hypothesize that the more similar the secondary language is, the greater of an effect there will be on EF and ToM skills.

Methods

Design Overview

This study incorporated a between participants design, comparing bilingual groups against one another with a monolingual control group. The two primary dependent variables for this study were: Theory of Mind (ToM) skills and Executive Function (EF) skills. EF skills were measured using a flanker task (FT) administered on a lab computer via Psychopy. ToM skills were assessed through a false belief task (FBT), with video recordings used for coding and scoring. To further address the research question, an additional independent variable was included, the similarity of the secondary language from English. Language similarity was categorized into one of two groups: Close Language and Distant Language. A separate category was given for monolinguals in the data. Participant data was collected from demographic surveys sent out to parents which included the child's age, monolingual/bilingual standing, and a self report of secondary language. Parents also filled out their own demographic form collecting the same information which may be used for further analysis. In addition to demographic data, the FT data included reaction times and associated errors for each condition: congruent, non-congruent, and neutral. However the neutral condition was not analyzed. Finally, the Pass/Fail data from the FBT provided another dependent variable, scoring participants on how many questions they pass. The study hypothesis posits that bilingual children, ages 3-5 years old, speaking languages similar to English will show better EF and ToM skills than those speaking languages less similar to English.

Participants

We recruited a population of n= 5 bilingual and n= 2 monolingual children (1 additional exclusion) ages 3-5 from the Children's Research Center Database (CRC) and word of mouth.

The monolingual group included two children: one aged 3 and another aged 4 years. The bilingual group, conversely, was composed entirely of 5-year-olds.The parents of the participants were contacted via email if their child met the age range and was not a part of or had not participated in another study within the past month at the time. The bilingual status of the child was confirmed by their parent or guardian through the Bilingual Demographics Survey. Depending on their secondary language, participants were categorized as either Close Language (CL) or Distant Language (DL). The monolingual children served as the control for ToM and EF tasks in order to compare English skills for both groups. It should be noted that an additional monolingual participant had to be excluded due to technical issues with the experimental computer.

Materials and Measures

Language Similarity and Ethnologue

To accurately classify the secondary languages of the participants, the present study relied on Ethnologue (Eberhard et al., 2023). This comprehensive linguistic database provides detailed information on linguistic characteristics, familial relationships, and geographical distribution of languages worldwide. Secondary languages were categorized into Close Language (CL) and Distant Language (DL) groups based on their linguistic family and branches. The CL group was categorized as containing languages belonging to the same language family or sub-branch as the participant's primary language, indicating a closer genetic and historical relationship. On the other hand, the DL group contained languages from entirely different language families or branches that bear less resemblance to the participant's primary language in structure, origin, and development. The utilization of Ethnologue for the classification of

secondary languages in the present study ensured the accuracy of the placement of participant categories.

General Forms

Three forms were given to the family of each child during this study: a general pre-visit Parent Consent Form, Child Assent Form (verbal), Demographic Form (Online). Included in the Demographic form is a section titled “Bilingual Language Profile Form”. This section of the Demographic Form aimed to gather comprehensive information about the child's language history, education, and proficiency, including when they were first exposed to or began speaking both languages. This form is a version of the Bilingual Language Profile Form (Ramirez, 2017) that was modified to serve as a parental report of children’s language. Its purpose was to gain deeper insights into the language profiles of child bilingual and monolingual speakers across diverse backgrounds and settings.

Flanker Task

A flanker task was administered on a lab computer using PsychoPy. PsychoPy is an open-source software used for creating and running experiments in psychology through a user-friendly approach to Python. The flanker task is a nonverbal task where participants respond to a target stimuli with conflicting cues on either side (Bunge et al., 2002; Eriksen & Eriksen, 1974). Given that the participants were the in 3-5 age range, the target stimuli and conflicting cues were represented as fish (See Figure 1). This is a child version of the flanker task that was administered to 4 year olds in research by Rueda et al., (2004). This version of the task differs from Rueda et al., (2004) in the following ways: the fish and the screen are different colors (previously yellow, now orange), number of trials (6 total), fish stimuli are presented in the middle, and no spatial cues are present. In addition two large red buttons were used to indicate the direction of the target stimuli (See Figure 2). The primary objective of this task was to measure the speed and accuracy of response to the direction of the target stimulus (middle fish) while disregarding the distractors (general row of fish). This task is comprised of three conditions: congruent, incongruent, and neutral (See Figure 1). In the congruent condition, the fish orientations are aligned with the target direction, thereby facilitating accurate responses. In the incongruent

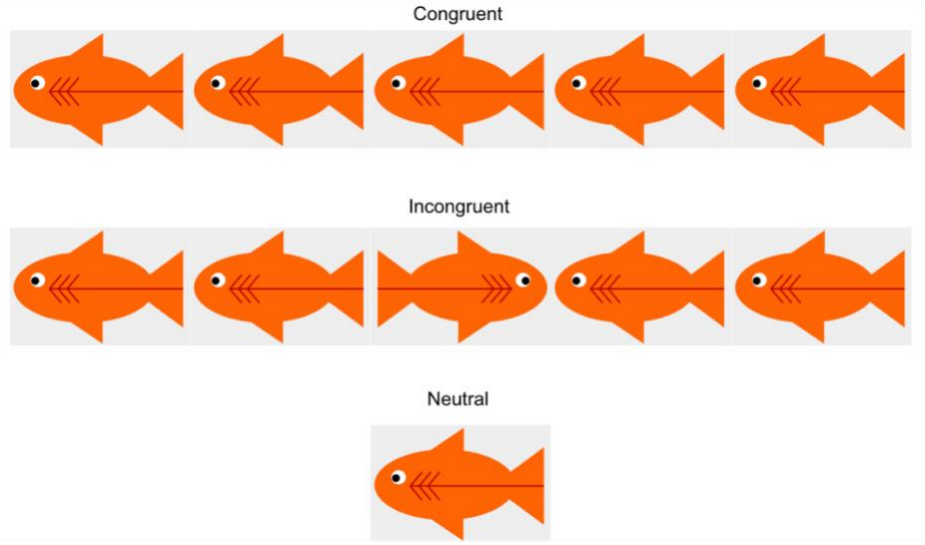

Figure 1. Depiction of the three conditions of the flanker task used in the current study. Participants had to identify the direction of the middle fish (target stimuli) amidst the conflicting cues of the surrounding fish for each condition. Thank you to Julia Sadka for the stimuli graphics.

condition, the fish orientations are opposite to the target direction, thereby impeding accurate responses. The neutral condition features no distractors. The task consisted of 24 trials for each condition with each containing a left or right version of the stimuli. However the directionality of these stimuli are only nessesary for identifying errors. The assessment of the participants' skills on the task is based on the error and mean reaction times for each conditions across the 72 trials. Reaction time is the duration taken by the participant to respond to the target stimulus, while error is the amount of incorrect respones for a specified condition. Low error and reaction time values represents a higher level of attentional control, which corresponds to superior EF skills.

Figure 2. Two large red buttons used to identify the direction of the target stimuli (middle fish).

Smarties False Belief Task

The second task, based on Hogrefe et al. (1986), is a variation of the traditional false belief task and involved recording the participant's responses using a camera. In this task, a doll named Finn is introduced to the participant. The doll leaves the space, and the experimenter shows a box of M&Ms asking the participant what's inside. Regardless of their response, the experimenter reveals that the box actually contains a pen and asks the participant an ignorance question, “Did you expect there to be a pen inside?” followed by a false belief question, “What do you think the Finn will say is in the box?”. The expected response from the ignorance

question is “No” which indicates that the child is now aware that their prior belief of what was in the box is now false. If the participant says “Yes” then they have ignored their previous understanding of what they presumed to be in the box. This current understanding is then carried into the second question where the expected response is "M&Ms” or “Candy” which indicates an understanding of false beliefs. Participants that respond with "Pen" do not indicate an understanding of false beliefs as they now use their current knowledge rather than considering the doll’s perspective.

Procedure

Before the participant could begin the study, the parent had to complete the consent and Demographic forms. The experimenter then escorted the child to the experimental room within the Language Development Lab. Parents were given the opportunity to watch their child through an observation window in a room adjacent to the experimental room. The experimenter remained in the room with the participant throughout the length of the study. Prior to the administration of the two experimental tasks the experimenter read the assent form to the child and requested verbal assent for the study (Child Assent). Assent had to be obtained while being video recorded which did not end until the last task of the study.

The experimenter first administered the flanker task via PsychoPy on the lab computer. The participant was given an explanation of the task before starting. They were told it was a game where fish would appear on the screen, and they have to identify the direction the middle fish was facing while disregarding the surrounding fish. Participants indicated the direction of the middle fish by pressing a large red left or right button (see Figure 2). The experimenter made sure to point to each button respectively during the explanation. Additionally, the experimenter supervised a practice round to have the participant achieve a general understanding of the

mechanics. After the practice round, the participant was informed that the task was about to begin and with consent the experimental trials were administered. Following the flanker task, the experimenter moved on to the false belief task.

In this task the experimenter introduced a doll named Finn and had the participant greet him. The experimenter then explained to the participant that Finn had to leave the space to take a nap and placed him outside. Following Finn's absence, the experimenter presented a box of M&Ms and asked the participant "Lets begin with this box, what do you think is in it?". Regardless of the participant's answer the experimenter revealed that there was actually a pen in the box and followed up with an additional question, "Looks like there are pens in the box. What did you think was in the box when you first saw it?". Following the participant's answer the experimenter then informed them that Finn had woken up from his nap and didn't know what was just discussed. The experimenter then asked, "What do you think Finn will say when I ask him what's in the box?". After the participant's answer they were greeted with the end of the study. The entire experimental sequence lasted for roughly 15min on average. After completing both tasks, participants were rewarded with a toy or t-shirt, and escorted out of the lab with the parent.

Statistical Analysis

To observe the reaction times and errors for the congruent and incongruent conditions of the flanker task, two 2-way ANOVA tests were conducted on JASP. The false belief task was analyzed on a Pass/Fail basis and was represented on a table. Using a between-participants design the dependent variables were ToM skills, assessed via the false belief task, and EF skills, measured using the flanker task. Independent variables included language similarity (Close Language, Distant Language), along with a separate category for monolinguals. The flanker task

data contained the mean reaction times and errors in congruent and incongruent conditions from the raw data collected from Psychopy. Additionally, outcomes of the false belief task (FBT) were coded as binary values (1 for pass, 0 for fail). Both sets of data were compiled in Excel and subsequently formatted into a CSV document for analysis.

Results

Flanker Task

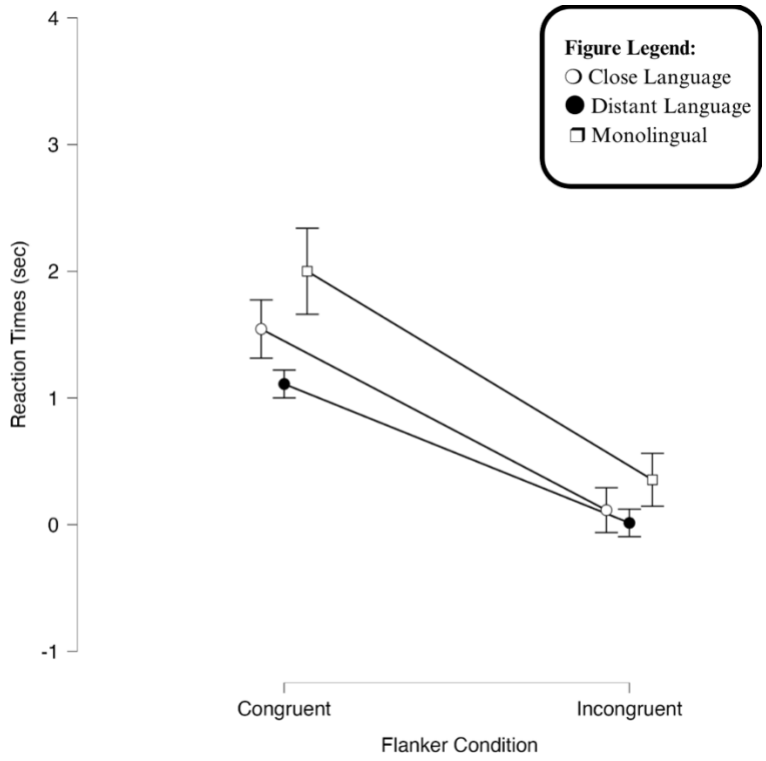

Figure 3. Average reaction times for distant bilinguals, close bilinguals, and monolingual participants under congruent and incongruent conditions in the flanker task.

In the flanker task, used to assess executive function, distinct differences were observed between each group. Distant bilinguals tended to have faster reaction times, with an average of 1.089 sec for congruent conditions and 1.131 sec for incongruent conditions. This contrasts with close bilinguals, who had an average reaction time of 1.373 sec for congruent conditions and 1.716 sec for incongruent conditions (see Figure 3). Furthermore, distant bilinguals made fewer errors, maintaining an error rate of 1.4% for both conditions, compared to close bilinguals, who exhibited an error rate of 6.3% for congruent conditions and 16.7% for incongruent conditions (see Figure 4).

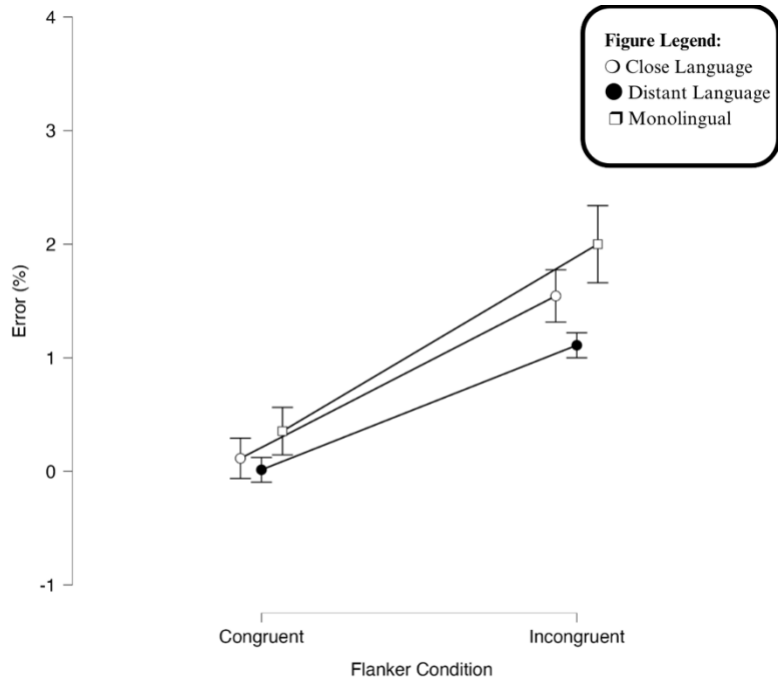

Figure 4. Comparison of error rates between distant bilinguals, close bilinguals, and monolingual participants for congruent and incongruent conditions in the flanker task.

When these groups were compared to monolinguals, both distant and close bilinguals demonstrated superior skills in terms of reaction time and accuracy. Monolingual participants showed an average reaction time of 1.586 sec for congruent conditions and 2.415 sec for incongruent conditions (see Figure 3). Additionally, monolinguals had an error rate of 14.6% for congruent conditions and 56.3% for incongruent conditions (see Figure 4). These findings suggest that a more distant language may provide cognitive advantages in nonverbal tasks.

Table 1

Descriptive Statistics for Reaction Times

	FlankerRTCon			FlankerRTIncon		
	C	D	M	C	D	M
Mean	1.373	1.089	1.586	1.716	1.131	2.415
Std. Deviation	0.472	0.399	0.221	0.689	0.415	0.178

Note. A table depicting the mean and standard deviation reaction times (sec) for the flanker task under three language categories.

Table 2

Descriptive Statistics for Error Rates

	ErrorCon			ErrorIncon		
	C	D	M	C	D	M
Mean	0.063	0.014	0.146	0.167	0.014	0.563
Std. Deviation	0.029	0.024	0.088	0.000	0.024	0.324

Note. A table depicting the mean and standard deviation error rates (%) for the flanker task under the three language categories.

False Belief Task

The false belief task, aimed at evaluating theory of mind skills, revealed contrasting results. Monolingual participants tended to pass the task at a higher rate, with all monolingual participants passing. In comparison, 2 distant bilinguals passed and 1 failed. Among the bilingual groups, distant bilinguals outperformed close bilinguals, with 2/3 distant bilinguals passing the task and 0 close bilinguals passing (see Table 3).

Table 3

False Belief Task Skills

	Language Category			
FBT Pass	**C**	**D**	**M**	**Total**
0	2	0	0	2
1	0	3	2	5
Total	2	3	2	7

Note. A contingency table depicting the number of participants who passed or failed the false belief task for the three language categories.

Preliminary Nature of Findings

It is crucial to note that these results should be treated with caution due to the low participant count in our study. The current participant pool consists of N= 7 , and data collection is ongoing. These preliminary findings provide an initial insight into whether language similarity may play a role in the cognitive advantage found in theory of mind literature, but they warrant further investigation with a larger sample size to validate these observations.

Discussion

The purpose of this study was to examine whether the similarity of a language provided an explanation for the bilingual advantage proposed by Goetz (2003). The results of our preliminary data show that a dissimilar language may improve executive function and theory of mind skills when compared to similar languages. Preliminary data on the flanker task suggests a tendency for distant bilinguals to outperform their close bilingual and monolingual peers in reaction times and errors for both congruent and noncongruent conditions. This observation contrasts the findings of Oschwald et al. (2018), where the results for nonverbal executive function tasks among adults suggest that did not strongly differentiate between similar and dissimilar bilinguals. However, these results do align with Oschwald et al.'s (2018) hypothesis that this effect might be different in children. Conversely, the theory of mind data does not support existing research on a bilingual advantage but does indicate a difference in the ToM skills between bilinguals. However, these results should be treated with caution due to the low participant count.

A limitation of the number of participants in this study primarily stems from the scarcity of registered bilinguals in the Children's Research Center (CRC) database. During the study, we found that a significant proportion of children initially identified as bilingual in the CRC database were either no longer residing in the state or were only available for online studies. Additionally, in our efforts to collect data from monolingual participants, we observed that many participants with culturally diverse names, who were categorized as monolingual in the CRC database, were actually bilingual. Given that this study is still ongoing, we plan to register any bilingual participants from our study on the CRC database. Additionally, we are collaborating

with other labs, including the Austin Thought Lab and directly with the CRC, to address this issue in future studies.

The scarcity of bilinguals in the CRC was not the only limitation of this study as the experimental computers proved to be difficult to work with. The flanker task data is collected from the experimental computers using psychopy and unfortunately due to the age of the computers it often wouldn't register that the stimuli file even existed. Due to this complication one participant could not complete the study as the experimental computer blue screened effectively ruining any chance of running them that day. Fortunately, at the time of writing this, the issue has been resolved and a protocol for RAs encountering this problem has been created.

Another limitation of this study thus far is the lack of diverse languages for both bilingual groups. While this study aims to collect data from multiple similar and dissimilar languages, we were only able to collect Spanish and Vietnamese bilinguals. While these languages are in two different language trees, they do not encompass the scope that we aimed to achieve. I hypothesize that a more diverse group of bilinguals will greatly shift the current data for the false belief task as the limited participant count gave contrasting results from the current literature. Additionally, having an equal number of bilingual and monolingual participants will yield better results than the skewed nature of the 2-2-3 ratio (2 monolinguals, 2 close bilinguals, and 3 distant bilinguals) of participants currently analyzed.

Overall, our preliminary findings suggest that the bilingual advantage may be affected by the dissimilarity of the secondary language as it requires a higher level of executive function. However, these findings do not suggest that this is true for theory of mind reasoning as both monolinguals passed with both close bilinguals failing. Furthermore, the higher ratio of distant

bilinguals passing the task compared to close bilinguals may support a more dissimilar language advantage amongst bilinguals.

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