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Interference Suppression vs. Response Inhibition: An Explanation for the Absence of a Bilingual Advantage in Preschoolers' Stroop Task Performance

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Abstract

The well-documented advantage that bilingual speakers demonstrate across the lifespan on measures of controlled attention is not observed in preschoolers' performance on Stroop task variations. We examined the role of task demands in explaining this discrepancy. Whereas the Color/Word Stroop used with adult participants requires interference suppression, the Stroop task typically used with preschoolers requires only response inhibition. We developed an age-appropriate conflict task that measures interference suppression. Fifty-one preschool children (26 bilinguals) completed this new Color/Shape task and the Day/Night task used in previous research. Bilingual in comparison to monolingual children performed better on incongruent trials of the Color/Shape task, but did not differ on other measures. The results indicate that the discrepancy between preschoolers and older individuals in performance on Stroop task adaptations results from characteristics of the task rather than developmental differences. Further, the findings provide additional support for the importance of interference suppression as a mechanism underlying the bilingual advantage.

Keywords

bilingual advantage; inhibition; preschool; Stroop; executive function; interference suppression

1. Bilingual Advantage

The regular use of two or more languages benefits controlled attention, with advantages found among bilingual preschoolers, school-aged children, and adults on a variety of tasks requiring controlled attention (for reviews, see Adesope, Lavin, Thompson, & Ungerleider, 2010; Hilchey & Klein, 2011). This bilingual advantage arises in part from the management of two (or more) linguistic representations, which results in extensive practice in selective attention and cognitive flexibility. Among preschoolers, the differences between bilingual and monolingual children vary across tasks. Bilinguals show an advantage on conflict tasks such as the Simon task (Martin-Rhee & Bialystok, 2008), the Dimensional Change Card

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Sort (Bialystok & Martin, 2004), and the Attentional Network Task (Yang, Yang, & Lust, 2011). In contrast, comparable performance is found on age-appropriate variants of the Stroop task (Martin-Rhee & Bialystok, 2008; Siegal, Iozzi, & Surian, 2009), although Stroop tasks reliably differentiate monolingual and bilingual adults (Bialystok, Craik, & Luk, 2008; Hernández, Costa, Fuentes, Vivas, & Sebastián-Gallés, 2010).

Although this pattern of results could have a developmental explanation, it may be attributable to differences among the tasks used to measure the Stroop effect across the lifespan. The studies documenting a bilingual advantage with adults utilized tasks with bivalent stimuli; participants responded to images that contained both relevant and distracting information. Responding correctly thus required suppressing the irrelevant content. The investigations with preschool aged children used the commonly-employed Day/Night task (Gerstadt, Hong, & Diamond, 1994), which has a univalent display. There is no perceptually distracting information in the stimuli to require suppression, an aspect of attention regulation that contributes to the bilingual advantage.

In this investigation, we examined the role of task demands in explaining the absence of a bilingual advantage in Stroop task adaptations among preschoolers. We developed an age-appropriate task for preschoolers that has bivalent conflict in the stimuli, similar to the classic Color/Word Stroop. We tested for the presence of a bilingual advantage in the performance of this task. In an attempt to replicate previous findings, we also included the Day/Night task. We expected to observe a bilingual advantage only with the new Color/Shape task, providing evidence that age differences in performance are due not to developmental changes but to task requirements.

1.1. Defining Stroop

Stroop (1935) designed the Color/Word Stroop task to measure interference between potentially conflicting stimulus dimensions. The task is bivalent in that color word names are presented printed in colored ink. The test items can be congruent, when the color word is consistent with the color of ink in which it is printed, or incongruent, when the color word and the color of ink do not correspond (e.g., the word “green” printed in blue ink). Participants respond to congruent and incongruent items within the same set of trials (mixed block) and must inhibit the prepotent reading response in order to answer correctly with the color of the ink in which the color name is printed. In comparison to performance on congruent trials, incongruent trials are more challenging, as evidenced by slower response times and lower accuracy.

Gerstadt et al. (1994) developed the Day/Night task as an alternative for young children to circumvent the need for well-developed literacy. In this task, children are presented with univalent pictures of a sun and a moon. Participants are asked to respond to the pictures by saying “night” to the sun and “day” to the moon, representing an incongruent response. A correct response requires the maintenance of task instructions and the inhibition of a dominant response pattern, but does not require inhibiting irrelevant distracting perceptual information.

Existing variations of the Day/Night task are not ideal for work with bilingual preschoolers for several reasons. For instance, both the Sun /Moon task (Archibald & Kerns, 1999) and the 4 Pairs task (Livesey, Keen, Rouse, & White, 2006) require an opposite response to a univalent picture, but present no distracting perceptual information. The Big/Little Stroop (Kochanska, Murray, & Harlan, 2000), and the Shape Stroop (Poulin-Dubois, Blaye, Coutya, & Bialystok, 2011) are bivalent in that they depict small pictures of fruits within larger images of fruits> However, they are designed for use with toddlers and have other limitations, including the absence of a congruent condition and the reliance on rapid vocabulary naming, possibly putting bilingual individuals at a disadvantage (Gollan & Kroll, 2001; Gollan & Silverberg, 2001). The Color/Object Stroop (Prevor & Diamond, 2005) is also bivalent, with line drawings of familiar objects drawn in different ink colors. Congruent trials present a picture drawn in the expected color (e.g., an orange carrot) and incongruent trials show the picture in an unexpected color (e.g., a green carrot). This task also requires rapid picture naming, and the color outline appears to offer little distraction when naming the object (Prevor & Diamond, 2005).

The absence of distracting perceptual information in the stimuli of the Day/Night task may be responsible for the lack of observed differences between language groups. This possibility is consistent with Martin-Rhee and Bialystok's (2008) claim that the suppression of distracting perceptual information is necessary to demonstrate the bilingual advantage. They found a bilingual advantage in preschoolers' performance on the Simon task, which uses location as a distracting element, but no such advantage using univalent tasks with no distracting spatial element. Bunge et al. (Bunge, Dudukovic, Thomason, Vaidya, & Gabrieli, 2002) described the bivalent tasks as employing interference suppression, whereas the univalent tasks required response inhibition. Interference suppression requires the participant to ignore salient perceptual information in a bivalent task while attending to the less salient conflicting information. In the Simon task, this means attending to color while ignoring location. Response inhibition, on the other hand, is inhibiting a dominant or prepotent response in favor of a less dominant response and is required for univalent tasks such as the Day/Night task. There is no evidence of a bilingual advantage in tests designed to measure response inhibition (Bialystok, Craik, & Luk, 2008; Robertson, Manly, Andrade, Baddely, & Yiend, 1997). Similarly, Carlson and Meltzoff (2008) found a bilingual advantage for kindergarten children in inhibitory control tasks with conflicting attentional demands, but not for tasks that relied on impulse control. As discussed by Martin-Rhee and Bialystok (2008), interference suppression tasks correspond to the everyday experience of bilingual speakers in that they require choosing between two active and viable alternatives, rather than refraining from responding or using an opposite term.

Supporting the role of interference suppression in the Stroop Effect, three previous studies found a bilingual advantage with preschoolers. All of these studies included distracting perceptual information embedded in the stimuli. Bialystok, Craik, and Luk (2008) utilized the Color/Word Stroop. Hernández et al. (2010) employed a Numeric Stroop in which the numbers 1, 2, or 3 were presented in groups of 1, 2, or 3 digits either congruently (e. g., 22) or incongruently (e. g., 222). Additionally, Poulin-Dubois et al. (2011) used the Shape Stroop to find an advantage in bilingually-exposed toddlers. Taken as a whole, these studies suggest that the presence of distracting stimulus elements may differentiate conflict task contexts in which the bilingual advantage can and cannot be observed.

To test this hypothesis, we needed a conflict task that matched the defining characteristics of the original Color/Word Stroop but was suitable for use with bilingual and monolingual preschool age children. Critically, the task must include both congruent and incongruent bivalent test items presented in a mixed block and must not require reading or number knowledge. In addition, because acquiring two languages at once may limit vocabulary development in each language (Bialystok, Luk, Peets, & Yang, 2010), the task must not be dependent on word knowledge. We developed the Color/Shape task, described below, to fulfill these requirements.

1.2 Hypotheses

Consistent with previous research, we expected to find no language group differences in performance of the Day/Night task. In contrast, we expected that the Color/Shape task would produce a larger Stroop effect (in the form of more incongruent compared to congruent errors) for monolingual preschoolers than for bilingual preschoolers. We also expected that on incongruent trials, the bilingual groups would show significantly fewer errors than the monolingual group, but that the groups would not differ in errors on congruent trials. Support for these hypotheses would indicate that the discrepancy in Stroop task performance among preschoolers is explained by task features rather than developmental changes. In addition, it would provide evidence that bilingual experience more strongly influences interference suppression than response inhibition.

2. Method

2.1 Participants

Participants were healthy, typically developing preschool children with either bilingual (Spanish and English) or monolingual (English) experience. All of the children attended full-time child care centers and none met the age requirement for entry into public school kindergarten. Our final sample included 26 bilingual (16 females; mean age = 49.8 months, SD = 7.5 months, range 37–63 months) and 25 monolingual (12 females; mean age = 50.1 months, SD = 8.6 months, range 37–58 months) children. An additional 28 children were recruited but were not included in the analyses; of these, 23 did not meet criteria for language group classification stipulated below; two were absent during testing; and three declined participation. The final sample reflected the ethnic composition of the community, with about three-fourths of the sample (37 children) of European descent and the remainder with at least one parent of Asian, African, or Latino heritage (as reported by parents). As expected, the bilingual group was more ethnically diverse, χ^2 (1) = 11.57, $p < .001$. Groups did not differ significantly by gender (χ^2 (1) = 1.80, $p = .18$. Although information about income and parental occupation was not available, the school administrators characterized the families they served as middle- to upper-middle class. In addition, the schools charged constant tuition and reported no subsidized students.

To increase recruitment of bilingual children, we contact local childcare centers offering second language immersion. Two Spanish immersion-only childcare centers, one English monolingual childcare center, and one center offering both Spanish immersion and traditional English monolingual programs participated in the research. Children spent approximately nine hours a day, five days a week, in their centers. Letters sent to parents via the schools explained the study, asked permission for children’s participation, and requested information regarding the children’s language backgrounds.

Children were categorized as bilingual or monolingual based on parents’ reports of language history and use in the home and teachers’ reports of language use in the classroom. A participant was categorized as monolingual when both the parent and teacher reported that the child used only English. Children categorized as monolingual and enrolled in an immersion child care program were excluded from analysis because of possible effects of second language exposure (Kovács & Mehler, 2009). Categorizing children as bilingual was complicated by the observation that some families did not use Spanish in the home, and hence parents with children attending immersion childcare from a young age may not have been aware of their children’s Spanish fluency. Consequently, to be classified as bilingual, a child had to be described as using two languages fluently by both the parent and teacher or, alternatively, to be described as fluently using Spanish by a teacher. Children categorized as bilingual by teacher report only were excluded from analysis if they had been enrolled in immersion childcare for one year or less. Among the bilingual participants, 35.7% used English in the home and Spanish in their child-care setting.

2.2 Materials

The Day/Night task stimuli were 3 inch by 3 inch color printed cards depicting either a sun or a moon. Consistent with Gerstadt et al. (1994), there were 18 reproductions of each stimulus, with one of each stimulus used for training and eight of each stimulus employed in the test.

The Color/Shape task was developed using Psychology Experiment Building Language (PEBL; Mueller, 2011, 2010). The task utilized a Compaq Presario CQ60 laptop computer attached to a HP Compaq L2105 21.5 inch color touch screen monitor. Two active buttons remained at the bottom of the screen, a red circle and a blue square. Stimuli (circles and squares in either red or blue for four possible test items) appeared above the buttons in the center of the screen (see Figure 1). Congruent stimuli matched one of the buttons in both color and shape, and incongruent stimuli matched in shape to one button but in color to the other. Participants were directed to match the shape. The manual response of matching the shape means that no verbal response or vocabulary was required. The test items were bivalent in that participants were required to ignore the very salient color and only respond to the shape. Test items were presented in a fixed but mixed block order.[1]

2.3 Procedure

In this within-subjects design, children participated in both the Day/Night task and the Color/Shape task. The two tasks were presented in counterbalanced order across participants, separated by a vocabulary fluency task and a block game. The order of trials was constant within each task. The procedure for the Day/Night task followed the description by Gerstadt et al. (1994), with the exception of adding a congruent condition, as per Martin-Rhee and Bialystok (2008). Children were first presented with the stimuli and asked to say “day” in response to a picture of the sun and “night” in response to a pict ure of the moon. Once 100% accuracy was reached on both test stimuli, children were encouraged to move as quickly and accurately as possible through the 16-card block. Following the completion of the congruent block, the researcher said that it was time to make the game “silly” and instructed them to say “day” when presented with the moon and “night” when shown the sun. Children who did not master the instructions after three rounds of practice trials did not continue to the test trials.

An additional task was administered to provide a general comparison between language groups in verbal productivity, which was not expected to be affected by language status (Bialystok, 2010). The task is based on those included in language or verbal sections of ability assessments (NEPSY II, Korkman, Kirk, & Kemp, 2007; McCarthy Scales of Children’s Abilities, McCarthy, 1972) and assesses verbal productivity. Children were first asked to name as many animals as they could and then to name as many things to eat and drink as they could. The children were given 60 seconds to respond to each request. Bilingual children were not given specific language instructions for this task, but no corrections were made if children utilized both languages. The outcome variable was the number of unique correct responses across both trials. The block stacking game was included to minimize task interference and included no measure of performance.

Participation in the Color/Shape task involved first allowing the children a few minutes to play a simple match-the-picture game to familiarize them with the touch screen’s sensitivity and novelty. Upon completion, children were given the following instructions: “The next

[1]The task, updated for ongoing research by the authors, is available for download free at http://pebl.sf.net/battery.html. Updates include modification of practice period, the addition of neutral stimuli and separate block presentation, as well as the ability to manipulate the number of stimuli per block and response time window.

computer game is the Shape Game. You are going to match the circles to the circle picture at the bottom and the squares to the square picture at the bottom. We are going to practice first. The first few we do will make a 'ding' if you do it correctly and an 'eh' if you do it incorrectly. That way we can make sure you know how to play! The sound will go away after the first few, but that does not mean you are playing it wrong; just keep playing. Let's play the Shape Game!"

The first five trials of the practice included a "ding" sound if the child touched the matching shape or an "eh" sound if the child chose the incorrect shape. The last five trials included no sound. If the child answered correctly on four of the last five trials, comprehension was assumed and the child moved on to the test trials. If 80% accuracy was not achieved, the practice was repeated a second time and, if necessary, a third time before terminating the test. Practice trials contained all four possible test stimuli and were presented in a constant random order. The test contained 20 test items, five of each type, in a constant random order. Children were given 6 seconds to respond in each trial. Self-correction was not permitted and only the first response was recorded.

Children were tested individually in quiet rooms in their childcare centers by trained undergraduates who were fluent in Spanish and English. Bilingual children were given the choice of receiving instructions in English or Spanish when greeted and the examiner consistently honored the child's preference throughout the assessment. Examiners recorded Day/Night task performance, vocabulary task performance, and notes on interruptions, repeat of practice trials, and any other pertinent information. The computer used to administer the Color/Shape task recorded the accuracy of each trial and collected response times. Because response time is often more variable in children than in adults and accuracy is considered a better measure for young participants (Diamond & Kirkham, 2005), accuracy data were collected to ensure that responses reflected purposeful intent only.

3. Results

Color/Shape task trials with a mean response time under 300ms were removed as they were deemed too fast to represent responses to the test items. These occurred on only 36 of 940 test trials. In addition, a few children were unable to contribute data to one of the two tasks due to interruptions while testing or failure to meet accuracy criteria in practice trials. In these cases, data from the completed task but not the interrupted task were included.

Preliminary analyses determined the variables to be retained in the models used to test the hypotheses. There were no order effects on any dependent variables, so data were collapsed across order for further analysis. Vocabulary fluency (total sample mean = 9.61, SD = 4.87; bilingual mean = 9.64, SD = 5.50; monolingual mean = 9.58, SD = 4.20) was not predicted by language group, $F(1, 51) = .36$, $p = .55$, gender, $F(1, 51) = .00$, $p = .99$, or race, $F(4, 51) = ..42$, $p = .79$, when controlling for age. Vocabulary fluency did not predict any dependent variables, $rs < .28$, $ps > .06$, controlling for age. In addition, there were no effects of gender, $F(6, 33) = .26$, $p = .95$, or race, $F(6, 33) = .1.82$, $p = .13$, on any of the dependent variables when controlling for age. Thus, vocabulary, gender, and race were not included in further models. Months of age was significantly and negatively correlated to errors in both the Day/Night task and the Color/Shape task, $rs < -.35$, $ps < .014$. Therefore, age in months was included as a covariate in the models used to test the hypotheses. .

3.1 Day/Night task

Number of errors were analyzed with a mixed model, 2 within-subject (error type; congruent or incongruent) × 2 between-subject (language group; bilingual or monolingual) analysis of variance (ANOVA) for repeated measures, with age as a covariate. Replicating previous findings, there was a significant overall cost for incongruent trials compared to congruent trials in the form of more errors in the incongruent block than the congruent block, $F(1, 42) = 8.34$, $p = .006$, $\eta^2 = .17$. The relation between congruent and incongruent trials was not qualified by language group, $F(1, 42) = .01$, $p = .91$. There were no differences between bilingual and monolingual participants in number of errors for either trial type and no interaction with error type, $F(1, 41) = .07$, $p = .80$. (See Figure 2.)

3.2 Color/Shape task

Number of errors were analyzed in a second, mixed model, 2 within-subject (error type) × 2 between-subject (language group) repeated measures ANOVA, with age as a covariate. Although there was no significant difference between errors in congruent and incongruent trials on the Color/Shape task, $F(1, 43) = 1.19$, $p = .26$, the predicted interaction between trial type errors (congruent or incongruent) and language group was observed, $F(1, 43) = 7.79$, $p = .008$, $\eta^2 = .15$. Pairwise comparisons using Bonferroni corrections revealed no difference between language groups in congruent errors, $F(1, 43) = .12$, $p = .73$, but monolinguals made significantly more incongruent errors than did bilinguals, $F(1, 43) = 9.69$, $p = .003$, $\eta^2 = .18$. In addition, monolinguals made significantly more errors in the incongruent compared to congruent trials, $F(1, 43) = 4.21$, $p = .046$, $\eta^2 = .09$, whereas error rates for bilinguals did not differ between trial types, $F(1, 43) = 3.59$, $p = .07$. Hence, monolinguals showed greater cost for incongruent as compared to congruent trials than bilinguals (Figure 2). As expected, response times were too large to reflect meaningful cognitive processing and are thus not included.

3.3 Cross-task Correlations

We performed first-order partial correlations controlling for age for the full sample and within each language group to explore the relations between tasks. There were no significant correlations between tasks in the full sample, partial correlations $<= .19$, ps $>= .25$. Within the monolingual sample, however, incongruent errors in the Color/Shape task and the Day/Night task when controlling for age were significantly correlated, partial correlation = .46, $p = .047$. There were no significant correlations between tasks within the bilingual sample, partial correlations $< = -.29$, ps $> = .22$.

The incongruent trials may have differed by task in level of difficulty. To test this relation and whether it was consistent across language groups, we analyzed incongruent errors with a mixed model, 2 within-subject (task type; Day/Night task or Color/Shape task) × 2 between-subject (language group) repeated measures ANOVA with age as a covariate. The incongruent trials of the Day/Night task were more difficult than incongruent trials of the Color/Shape task, $F(1, 39) = 6.95$, $p = .01$, $\eta^2 = .15$, and this relation did not differ by language group, $F(1, 39) = 1.08$, $p = .31$.

4. Discussion and Conclusions

We replicated previous results in finding no difference between monolingual and bilingual preschoolers' performance on the Day/Night task. We observed the bilingual advantage, however, using a task that incorporated key aspects of the Color/Word Stroop. In performing this task, bilingual preschoolers made significantly fewer incongruent errors in comparison to their monolingual peers, and the incongruent trials were significantly more difficult than congruent trials for monolingual but not bilingual preschoolers. These findings support a methodological explanation for the absence of a bilingual advantage in young children's performance on Stroop task variations in the extant literature.

The characteristics of the participants in this study as well as the usability of the new measure must be carefully examined in evaluating the results. Our designation of bilingual status was limited in that it was based on information provided by parents and teachers rather than by a comprehensive vocabulary assessment including both languages. Nonetheless, our classifications were conservative, and the results attest to the validity of our categories in that language group differences were observed in the predicted pattern.

Another limitation is the comparison of intact language groups, resulting in a quasi-experimental design. There is, however, no reason to assume there were pre-existing differences between the bilingual and monolingual groups other than the effects of language usage. The two groups were of similar socio-economic backgrounds; they lived in middle class neighborhoods, attended the same or comparably priced childcare centers, and did not receive government subsidies. Importantly, the monolingual and bilingual children showed equivalent performance on all measures that did not involve interference suppression, including both congruent and incongruent Day/Night task trials and the congruent trials of the Color/Shape task.

The language groups were also comparable with regard to the fluency task included as an index of vocabulary development. It is possible that our acceptance of answers provided in either language explained the absence of language group differences, but equivalent performance on vocabulary tasks is not unprecedented (Bialystok, 2010). Further, the lack of correlation between the verbal fluency measure and the EF tasks may stem from the fact that the latter were selected to be independent of vocabulary.

Our primary objective in the conceptualization of the Color/Shape task was to design a measure that, like the Color/Word task, assessed interference suppression rather than response inhibition (as does the Day/Night Task). We recognize, however, that our two EF tasks differed in other regards. Although the Day/Night task utilized cards and the Color/Shape task was computerized, it is unlikely that this difference affected performance. Our traditional presentation of the Day/Night task replicated results from a computerized presentation (Martin-Rhee & Bialystok, 2008), and previous research (Piper et al., 2012) has shown similarities in performance on traditional and computerized versions of EF assessments. It is also the case that the Color/Shape task, like the Color/Word Stroop task, employed a mixed block design, whereas the Day/Night task is a continuous block assessment. Future research must determine the impact of this difference.

Practice trials also differed between tasks, with the Color/Shape task incorporating more practice than the Day/Night task. This factor may have contributed to the greater difficulty of the Day/Night task. It is also possible that this greater difficulty simply reflects a more robust pattern of higher accuracy in interference suppression tasks. Supporting this interpretation, Bunge et al. (2002) also found more errors among older participants in a response inhibition task than in an interference suppression task. Possibly, more trials with a more restricted period of response would help equate the task difficulty, but the significant difference between congruent and incongruent errors for the monolingual sample confirms sufficient perceptual distraction in the stimuli.

Performance on the two tasks was not correlated in the full sample or in the bilingual group. However, a correlation was found between the incongruent trials of the tasks within the monolingual sample. This pattern of results is consistent with the possibility of a bilingual-specific developmental advantage affecting interference suppression but not response inhibition. Consistent with this interpretation, Luk, Anderson, Craik, Grady, and Bialystok (2010) used fMRI to show differences in neural activation for bilingual and monolingual participants during an interference suppression task, but no differences during a response inhibition task. Further research is needed to understand the development of these areas of

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inhibition in both bilingual and monolingual samples, but the pattern of results provides validity for the new task.

The results offer further support for the work of Bialystok and colleagues regarding the role of interference suppression rather than response inhibition in the bilingual advantage. An emerging pattern of results underscores the importance of the inclusion of bivalent stimuli and hence the necessity of interference suppression in invoking the bilingual advantage in conflict tasks. Bialystok and Barac (2012) found a bilingual advantage using a bivalent task designed to measure switching. The task used in this research was very similar to the Dimensional Change Card Sort (Zelazo, 2006), which has also shown a preschool bilingual advantage (Bialystok & Martin, 2004). The Color/Shape task also requires that children sort bivalent stimuli, but it shows a bilingual advantage in the absence of the switching component. The Color/Shape Stroop more closely parallels research on the Stroop effect in monolingual and bilingual adults (Bialystok, Craik, & Luk, 2008; Hernández, Costa, Fuentes, Vivas, & Sebastián-Gallés, 2010). As was the case in this adult research, our results indicated that bilingualism attenuated the cost of incongruent trials in performing a Stroop-like task, supporting the importance of interference suppression.

In conclusion, this study provides evidence for a methodological explanation of the discrepancy for a Stroop-task advantage in adults but not preschool aged children. Bilingual preschoolers showed enhanced performance compared to monolingual preschoolers on a new conflict task that closely matches the defining elements of the Color/Word Stroop. The pattern of results justifies further research with the Color/Shape task, which may be an option for examining the Stroop Effect in both monolingual and bilingual participants across the lifespan.

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Research Highlights

- Examined absence of a bilingual advantage in preschoolers' Stroop task performance.
- Developed an age-appropriate Stroop task that requires interference suppression.
- Bilingual advantage found in preschoolers on new task but not Day/Night task.
- Support interference suppression as a key component of the bilingual advantage.

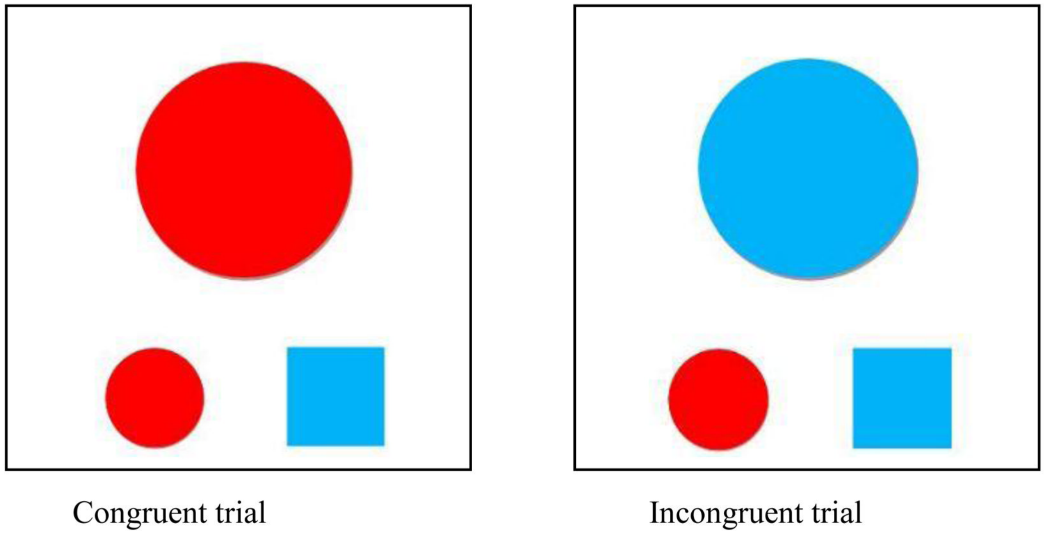

Figure 1.
Stimuli for the Color/Shape task.

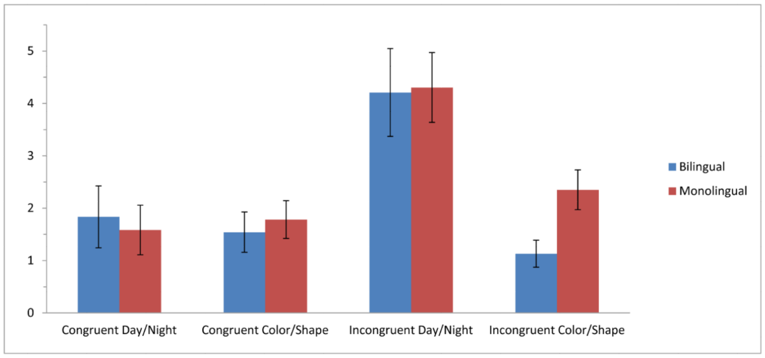

Figure 2.
Errors made by monolingual and bilingual preschoolers on congruent and incongruent trials in the performance of the Day/Night and Color/Shape tasks.