

# Phonological Stroop effects in Chinese and English: A comparison of children with dyslexia, typically developing children, and adults

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## ABSTRACT

Relative to good readers, poor readers tend to show stronger Stroop effects. Using homophones of color words as stimuli, Guo, Peng, and Liu [Cognition, 98(2), B21-B34 (2005)] found that children with lower reading ability demonstrated stronger phonological Stroop effects than those with higher reading ability. However, it is unclear whether the stronger effects reflected weaker inhibitory control, or stronger phonological activation upon seeing Chinese words, or both. In the current study, 23 second- or third-graders (12 with Chinese dyslexia and 11 typically developing) and 21 typically reading university students from Hong Kong completed both Chinese and English Stroop tasks, i.e., naming the ink color of Chinese and English words. The Chinese Stroop task included four types of words: 1) incongruent color words and 2) their controls, 3) homophones of incongruent color words and 4) their controls. The English Stroop task included these four conditions and two other conditions: 5) orthographic neighbors of incongruent color words and 6) their controls. Overall, the three groups showed significantly different Stroop effects in terms of accuracy rate, but not naming latency, in the Chinese Stroop task. Specifically, the dyslexic children showed a stronger phonological Stroop effect than the non-dyslexic children and adults. However, no significant group difference was found in the English Stroop effects. Since inhibitory control is a general cognitive ability, the group difference in the phonological Stroop effect of Chinese but not English suggests that Chinese dyslexic children may activate phonological codes more strongly than those without dyslexia when seeing Chinese words repeatedly.

## INTRODUCTION

### Background

Relative to good readers, poor readers tend to show stronger Stroop effects (Faccioli et al., 2008; Guo et al., 2005; Protopapas et al., 2007). However, it is unclear whether the stronger Stroop effects reflect weaker inhibitory control, or more automatic lexical activation, or both.

### The current study

- compared the Stroop effects among three groups of readers in both Chinese and English.
- ☐ Do all types of Stroop effects (e.g., homophones of color words) differ between dyslexic and typically reading children?
  - ☐ Is the group difference (if any) in the Stroop effects similar between different languages?

## Method

### Participants

12 dyslexic children (101.6 ± 8.0 months), 11 typical children (105.5 ± 7.6 months), and 21 adults; all native Cantonese speakers

### Design

Chinese Stroop : 2 types of words x 2 congruency levels x 3 groups  
English Stroop : 3 types of words x 2 congruency levels x 3 groups  
12 trials per condition, 120 trials in total

### Stimuli

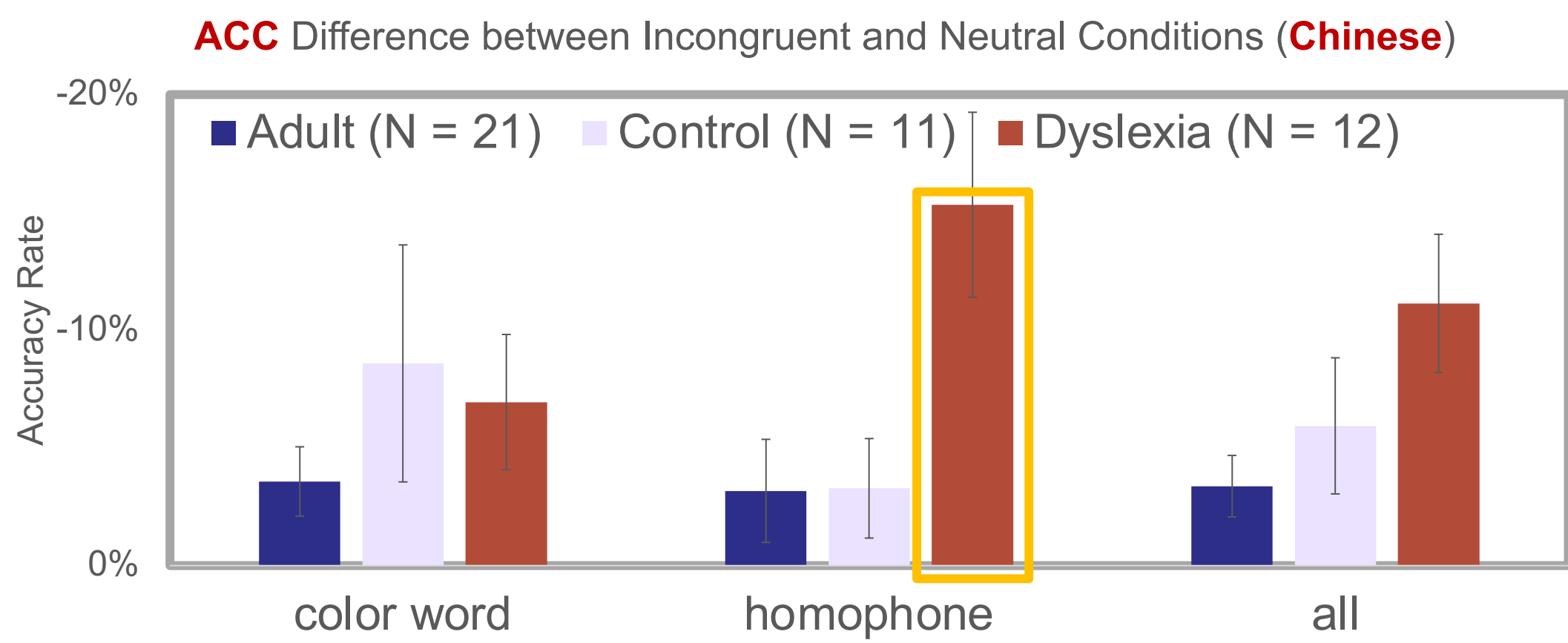
	Chinese stimuli			English stimuli		
	Example word	Frequency	Stroke number	Example word	Frequency	Number of letters
(1) Incongruent color words	綠	4174 (1464)	11.8 (2.1)	GREEN	93667 (58138)	4.8 (1.3)
(2) Controls of (1)	福	4210 (2653)	10.5 (2.6)	WATER	103419 (63841)	4.8 (1.3)
(3) Homophones of incongruent color words	六	4880 (3450)	7.0 (3.8)	GREAN	--	4.3 (0.5)
(4) Controls of (3)	支	4490 (2560)	7.5 (4.7)	WATOR	--	4.5 (0.6)
(5) Orthographic neighbors of incongruent color words	--	--	--	GWEEN	--	4.3 (0.5)
(6) Controls of (5)	--	--	--	WASER	--	4.5 (0.6)

## RESULTS (I)

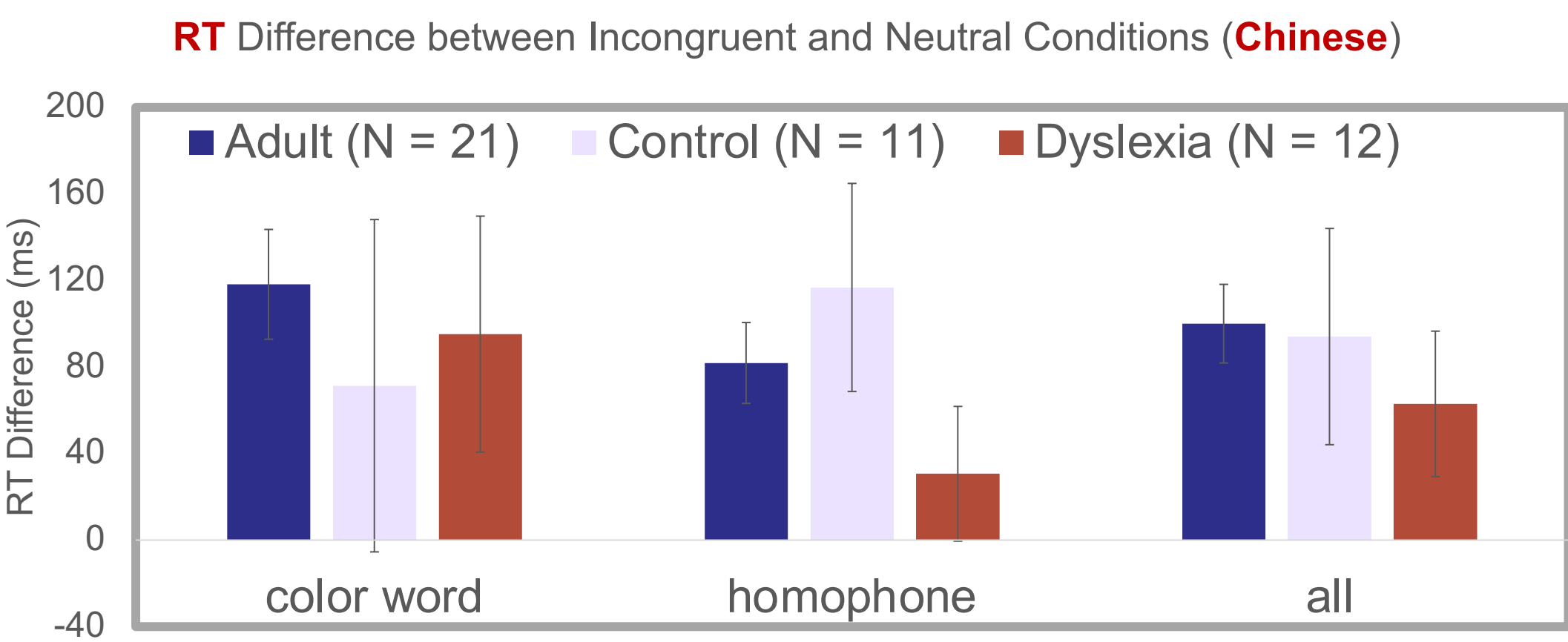
### Chinese Stroop Task

Repeated-measures ANOVA on ACC data: significant main effect of **congruency** ( $F_{(1,41)} = 27.83, p < .001$ ), significant interaction of **congruency \* group** ( $F_{(2,41)} = 3.41, p = .043$ ), non-significant interaction of type of words \* congruency ( $F_{(1,41)} = 0.18, p = .678$ ), marginally significant interaction of **type of words \* congruency \* group** ( $F_{(2,41)} = 3.07, p = .057$ )

One-way ANOVA on ACC difference between incongruent and neutral conditions: non-significant group effect for color words and controls ( $F_{(2,41)} = 0.88, p = .423$ ), significant **group effect for homophones** of color words and controls ( $F_{(2,41)} = 5.79, p = .006$ )

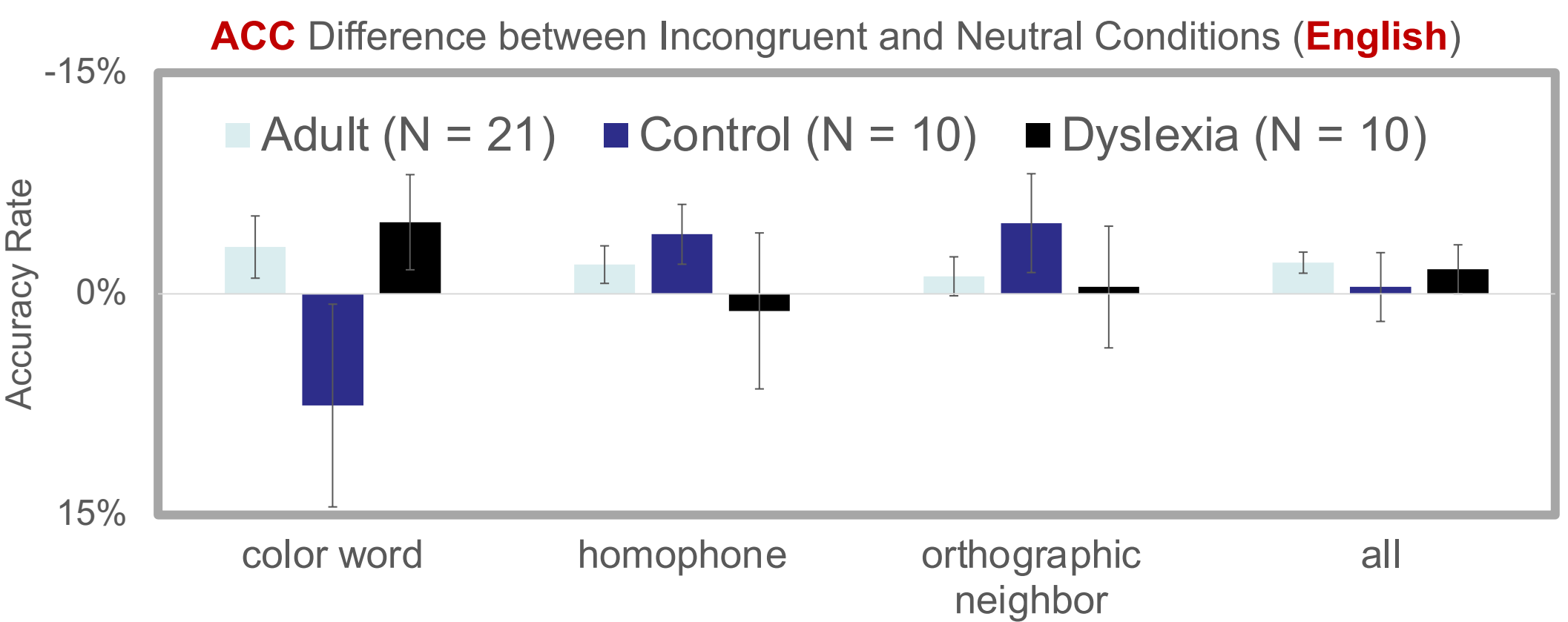


Repeated-measures ANOVA on RT data: significant main effect of **congruency** ( $F_{(1,41)} = 21.70, p < .001$ ), non-significant interactions involving congruency ( $p \geq .347$ )



### English Stroop Task

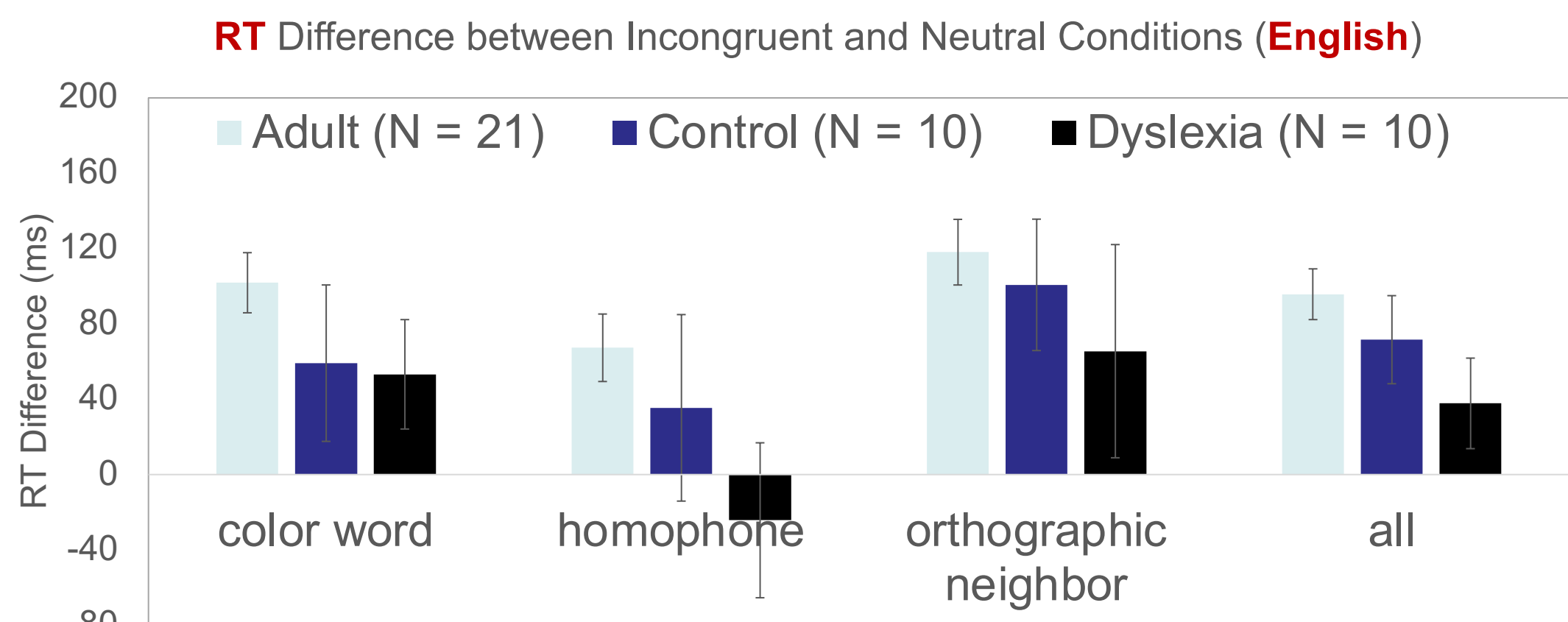
Repeated-measures ANOVA on ACC data: non-significant main effect of congruency ( $F_{(1,38)} = 2.63, p = .113$ ), non-significant interactions involving congruency ( $p \geq .122$ )



## RESULTS (II)

### English Stroop Task

Repeated-measures ANOVA on RT data: significant main effect of **congruency** ( $F_{(1,38)} = 33.52, p < .001$ ), non-significant interaction of congruency \* group ( $F_{(2,38)} = 2.27, p = .118$ ), significant interaction of **type of words \* congruency** ( $F_{(2,76)} = 3.81, p = .026$ ), non-significant interaction of type of words \* congruency \* group ( $F_{(4,76)} = 0.33, p = .857$ )



## DISCUSSION

In the Chinese Stroop task, the dyslexic children showed a stronger phonological Stroop effect than the non-dyslexic children and adults. However, no significant group difference was found in any of the English Stroop effects.

Not all types of Stroop effects differed between dyslexic and typically reading children.

The group difference in the phonological Stroop effect was found in Chinese but not in English.

A group difference in inhibitory control (a general cognitive ability) would influence the Stroop effects in a less specific way. Hence, the current preliminary finding seems to suggest that Chinese dyslexic children activate phonological codes more strongly than those without dyslexia in the Chinese Stroop task.

## REFERENCES

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