

Does bilingualism enhance intra-language lexical competition resolution?

- Evidence from a response distribution analysis

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Introduction

Background

Bilingual speakers need to resolve the parallel activation of both languages all the time (Colome, 2001; Kroll, Bobb, & Wodniecka, 2006). Overtime they develop an exquisite mechanism for cognitive control which bears cognitive consequences in more general domain (Bialystok, Craik, & Luk, 2012).

While the bilingual advantage in the non-verbal domain has been extensively investigated (Hilchey & Klein, 2011), there is limited number of studies that look at the control ability within a language.

In this study, we asked whether bilingual experience brings speakers advantages over monolingual counterparts in terms of resolving lexical competition within a single language.

A semantic blocking paradigm was used to index the lexical competition resolution ability. Response distributions were analysed using an Ex-Gaussian analysis.

Ex-Gaussian Analysis

Ex-Gaussian distribution

- Results from the convolution of a Gaussian component and an exponential component
- Provides good fit with skewed data which is typical in RT studies
- Characterized by three parameters: Mu, Sigma, Tau

Mu parameter (μ)

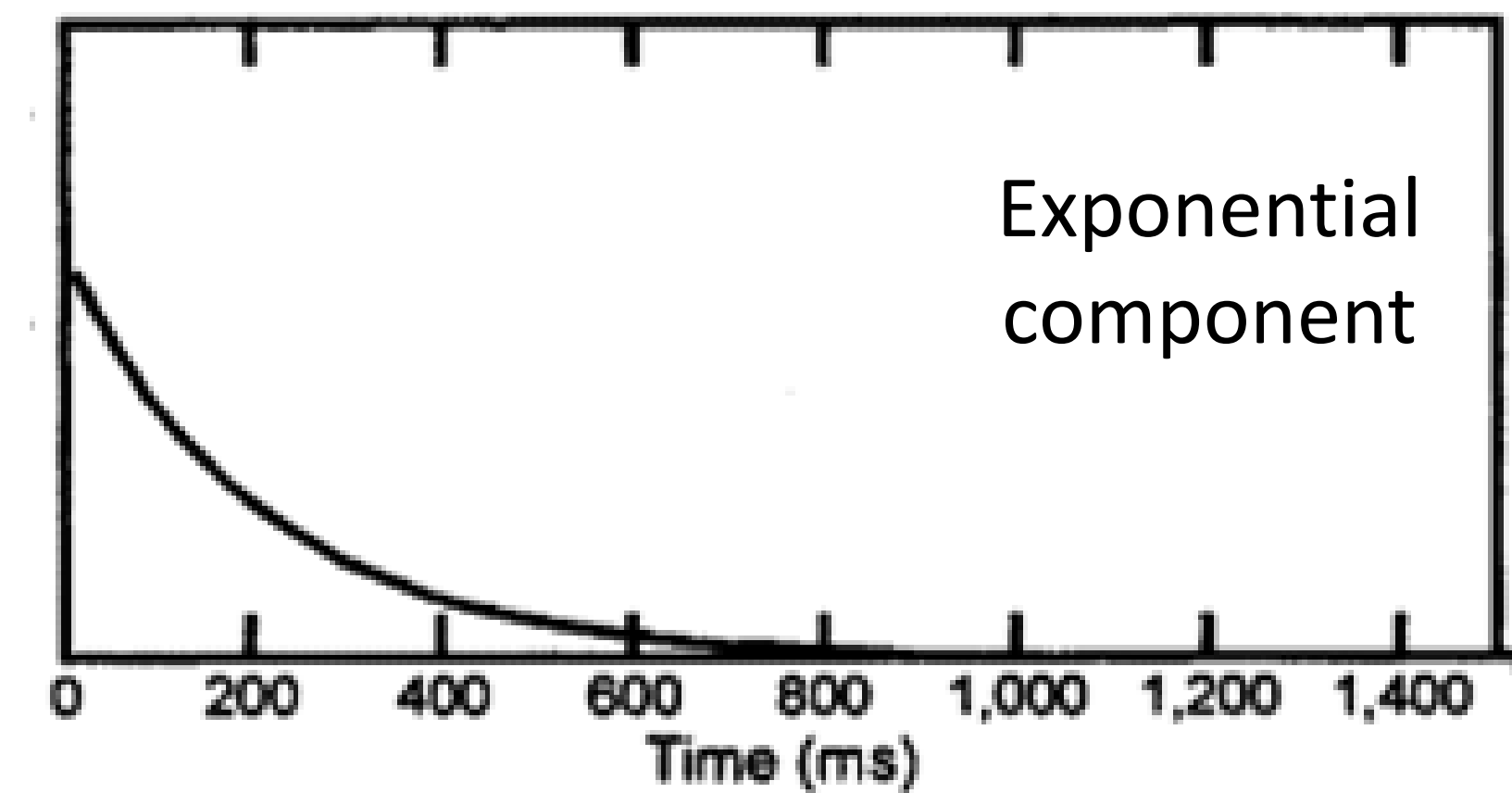
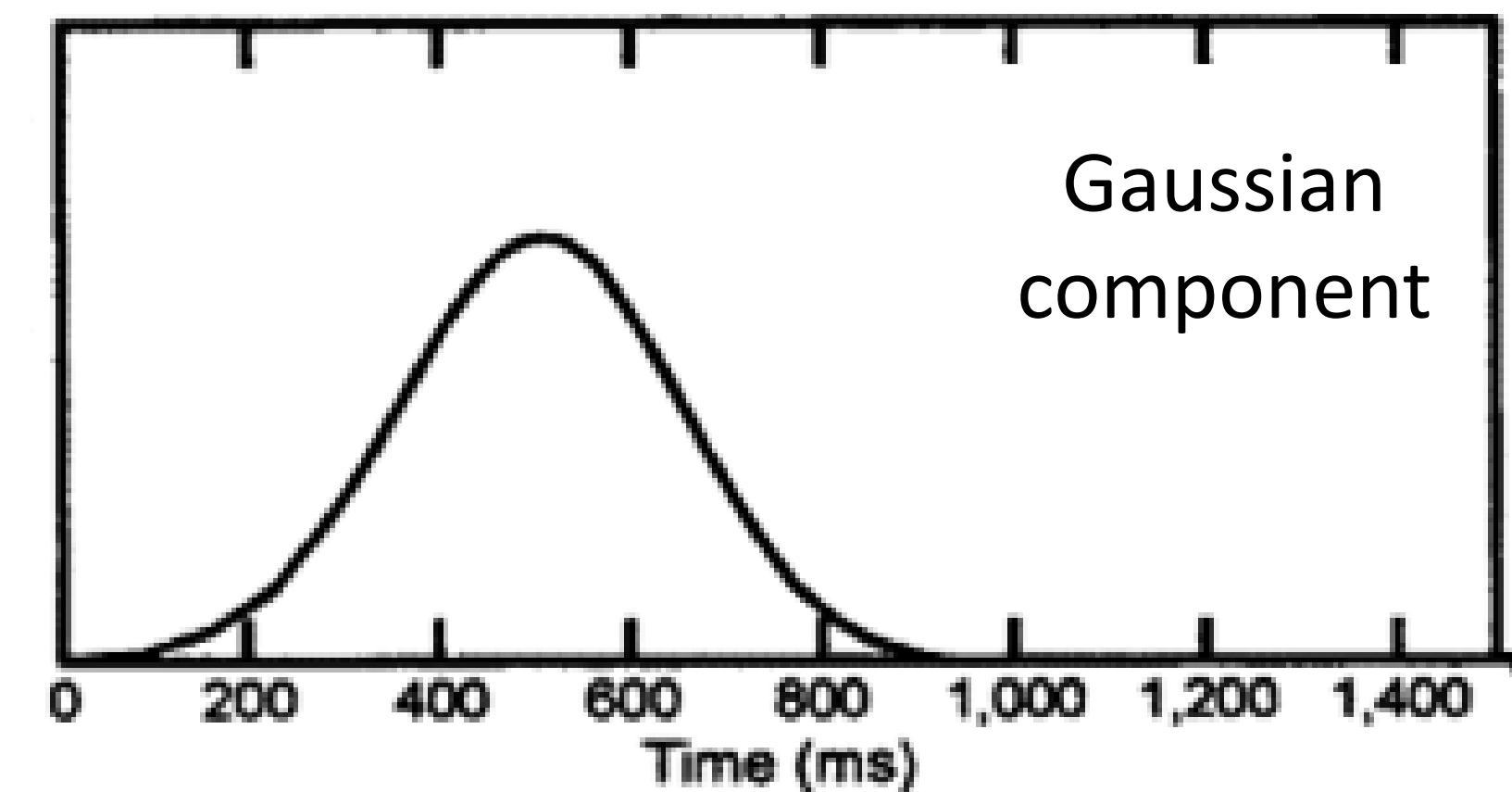
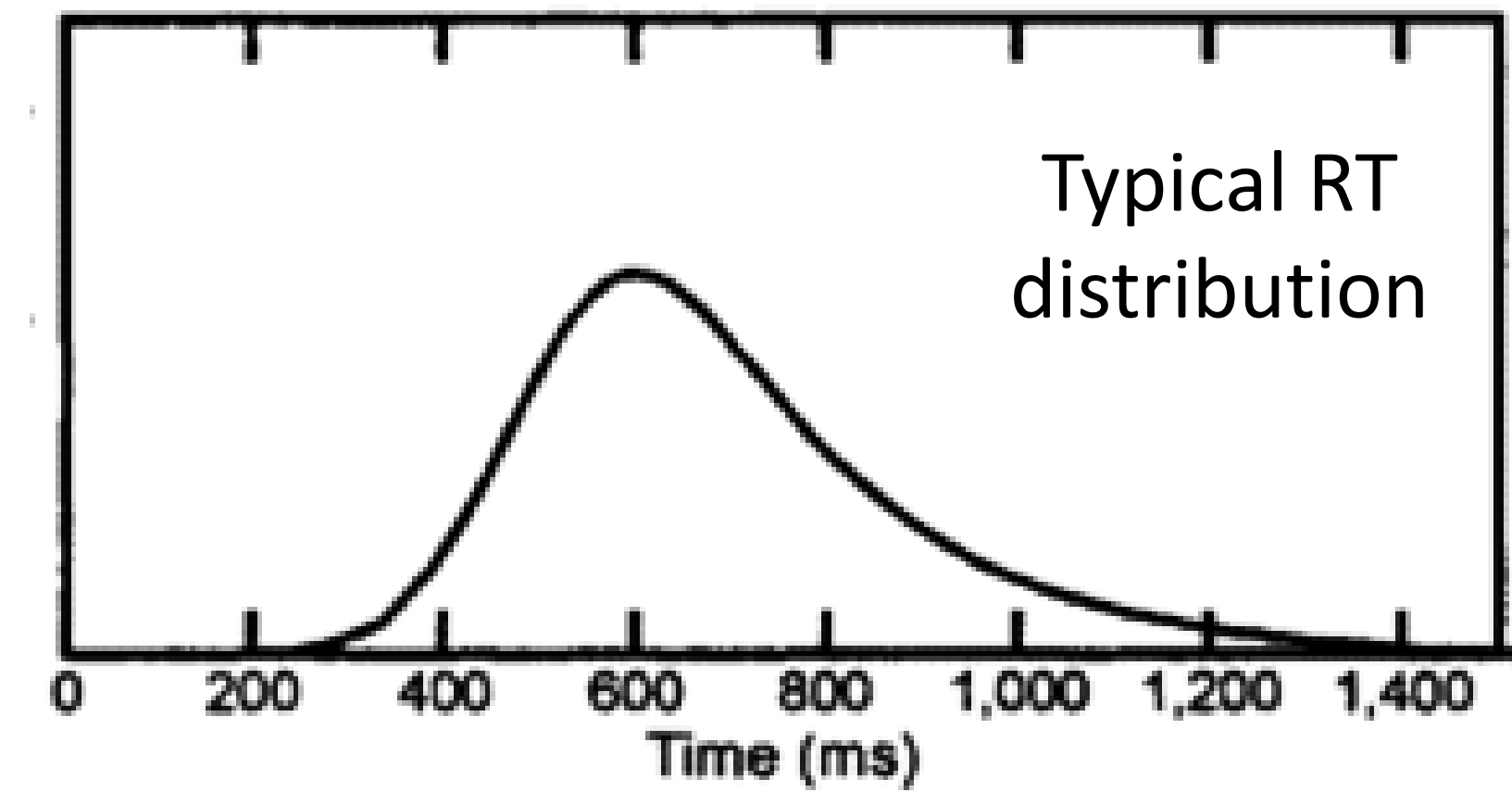
- Reflects the leading edge, main body of the distribution
- Sensitive to condition manipulation
- Changes in μ results in shift of shape

Tau parameter (τ)

- Captures the long responses, tail of the distribution
- Lapse of attention
- Changes in τ results in skew of tail

Rationale

- If one group is better at resolving conflict than the other, they should show smaller change in μ in different conditions.
- If one group is better at attentional control, they should have fewer lapses of attention, i.e. smaller tails (τ) in all conditions.



Balota, Yap, Cortese, & Watson, 2008

Method

Participants	Monolingual	Proficient L2 speaker	Chinese/English Bilingual
N (Female)	25 (17)	25 (20)	25 (20)
Age (SD)	20.3 (2.7)	20.4 (4.5)	20.6 (2.8)
Median Education (Min: Max)	2 (2:4)	2 (2:4)	2 (2:3)
Mean Vocabulary Score (SD)	.68 (.08)	.66 (.12)	.46 (.19)
Mean Proficiency Rating for English (SD)	.97 (.03)	.96 (.06)	.82 (.13)
Mean Proficiency Rating for Chinese/Language X (SD)	-	.67 (.21)	.82 (.21)
Mean Age of English onset (SD)	-	-	2.68 (1.68)
Mean Age of Chinese onset/Language X (SD)	-	6.6 (4.9)	1.96 (2.21)
Speak L2 fluently	No	Yes	Yes

M: monolingual English speakers

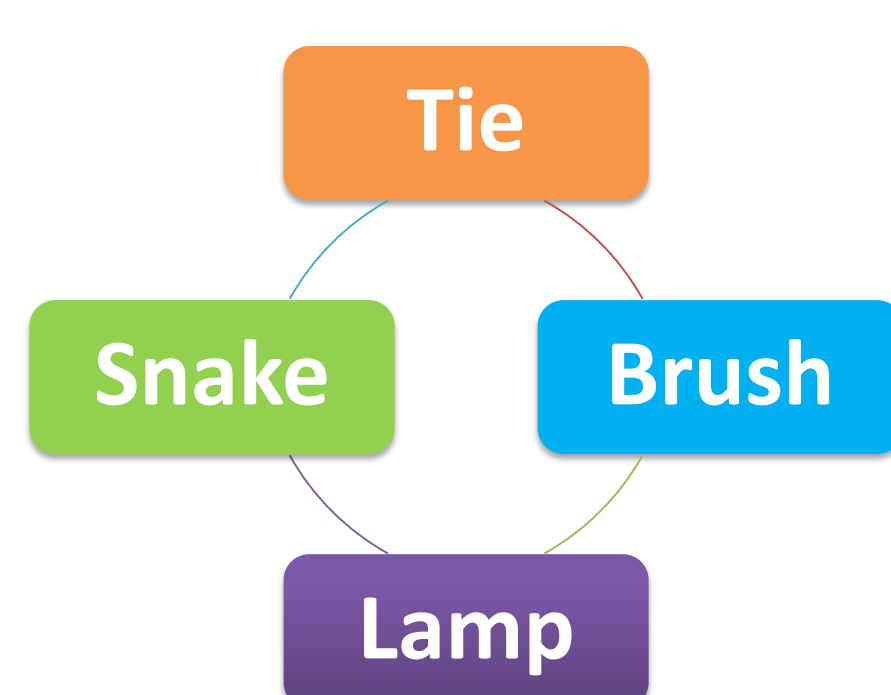
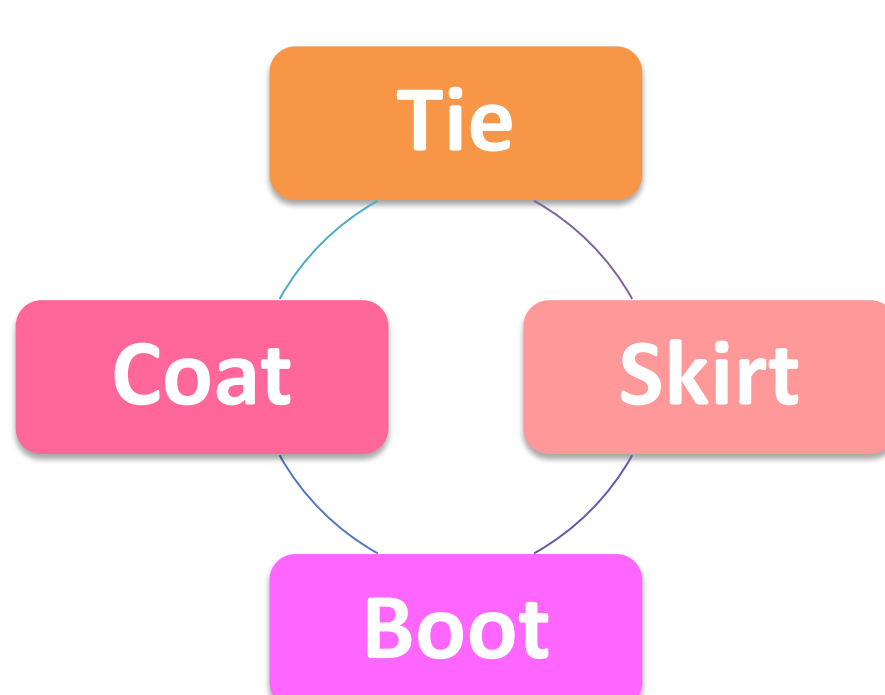
P: native English speaker who speak another language fluently

B: English/Chinese, Chinese/English bilingual speakers

Semantic Blocking Paradigm (Damian, Vigliocco, & Levelt, 2001)

- Cyclic presentation of pictures
- Same category (homogeneous)
- Different categories (heterogeneous)

Clothing	Animal	Tool	Furniture
Tie	Snake	Brush	Lamp
Coat	Duck	Saw	Chair
Boot	Mouse	Rake	Desk
Skirt	Fish	Drill	Bed



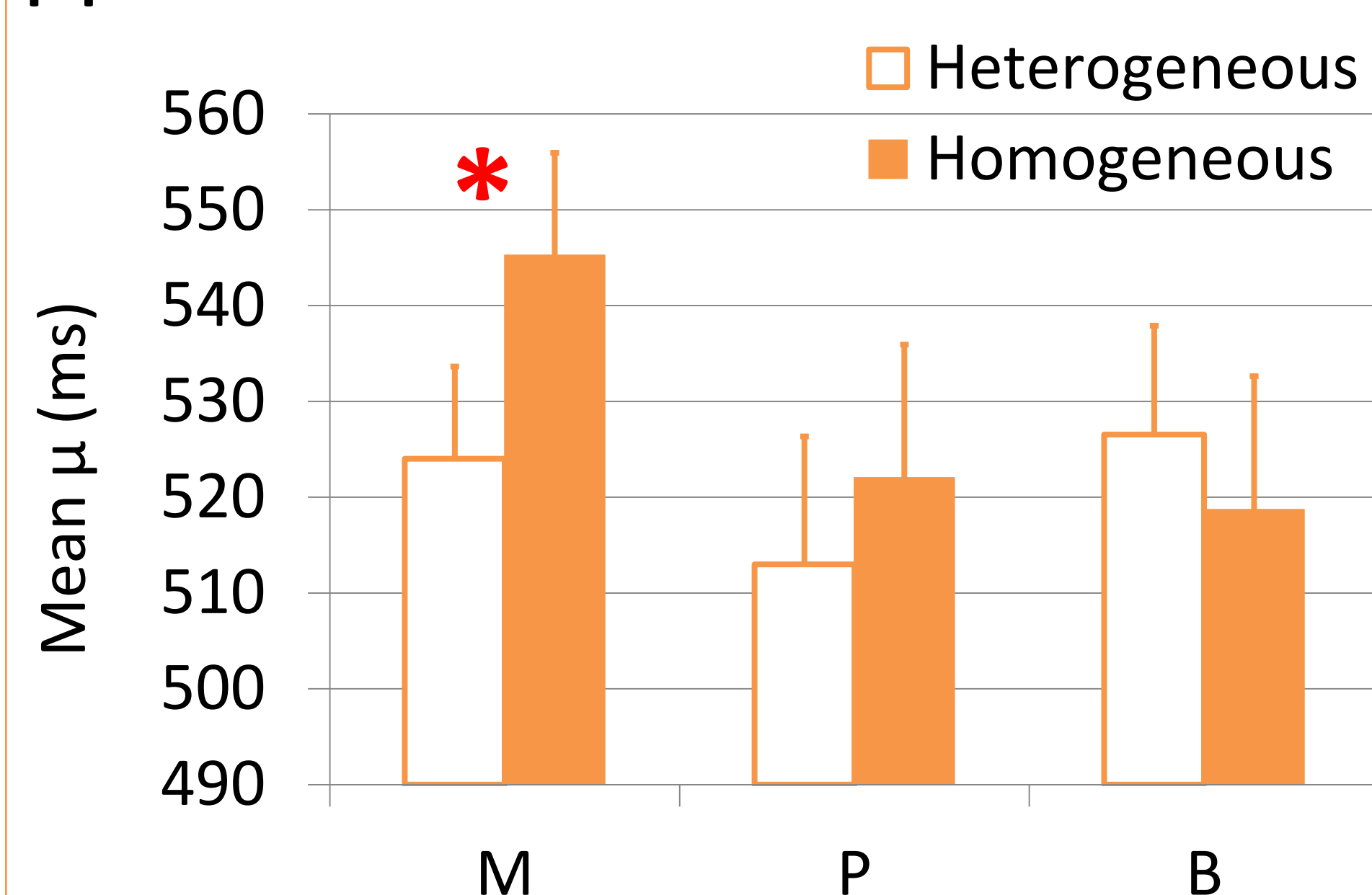
Homogeneous

Heterogeneous

- Classic finding: longer RT in homogeneous condition due to stronger lexical-semantic competition

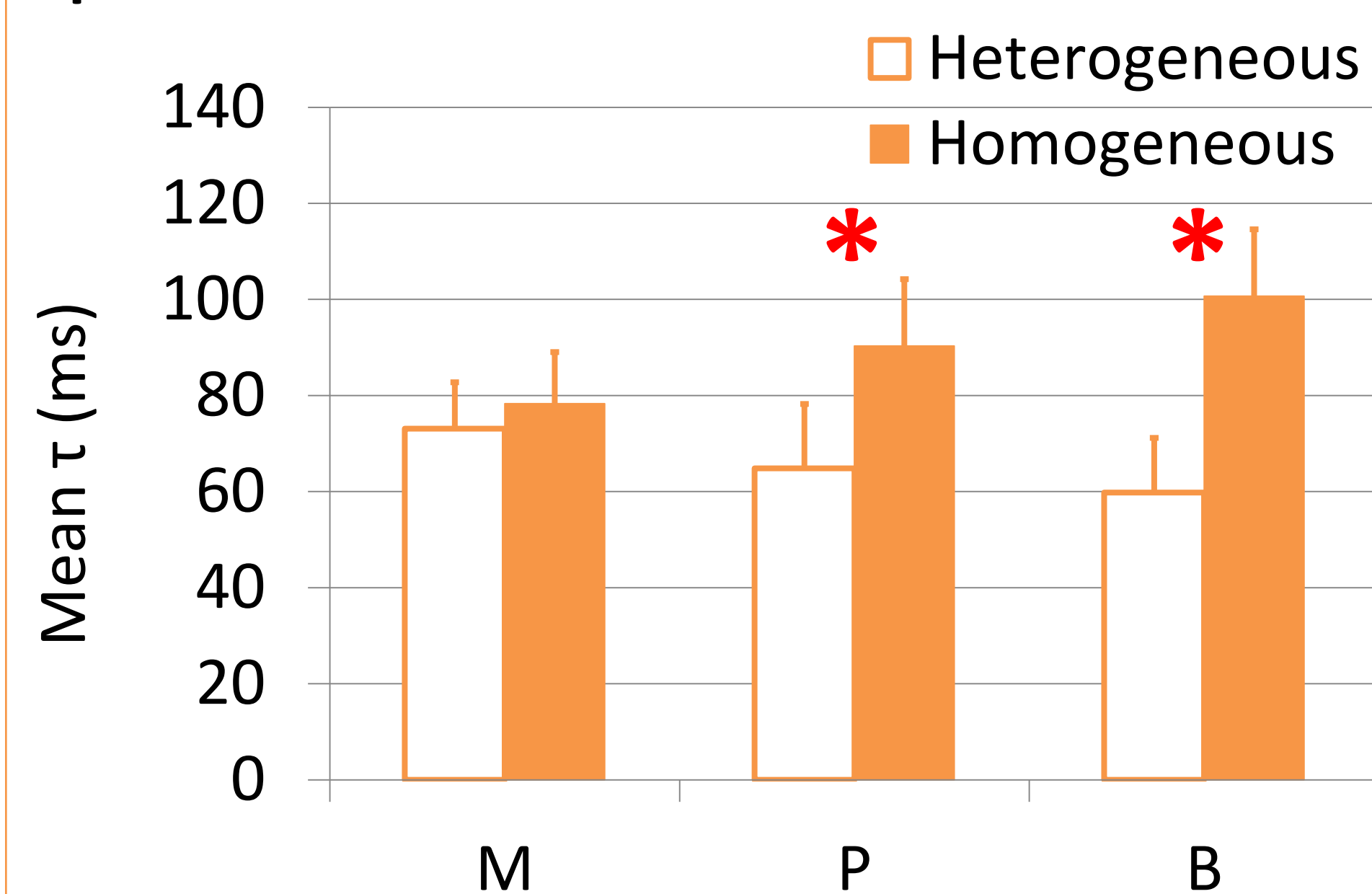
Results

μ parameter



- Significant interaction between condition and group $F(2, 70) = 3.50, p = .036$.
- Monolinguals showed semantic blocking effect, $t(24) = 2.8, p = .01$, whereas the other two groups did not.

τ parameter



- Significant interaction between condition and group $F(2, 70) = 3.24, p = .045$
- Monolinguals did not show semantic blocking effect, whereas Proficient L2 speakers had significant longer tails in homogeneous condition $t(22) = 3.28, p = .003$, as well as the bilinguals, $t(24) = 3.29, p = .003$

Discussion

All groups showed semantic blocking effect and response distribution analysis showed that the locus of the effect differs.

Monolinguals showed semantic blocking effect in μ . i.e. average response time is slowed down by the competitive semantic context in the homogeneous group. Other two groups showed no such effect suggest that they developed superior ability to resolve lexical competition. This is in line with the finding that proficient bilinguals showed smaller μ effect than a less proficient group (Tse & Altarriba, 2012).

Instead, two groups showed significant τ effect in the homogeneous condition whereas monolinguals were not affected. τ typically reflects attentional control or lapse of attention. This suggests that these two groups have difficulty maintaining attention in the homogeneous condition. τ on the other hand could result from an initial wrong lexical selection but corrected before articulated. Therefore, the longer tail in the bilingual groups could also possibly reflect a stronger suppression mechanism. Since the non-selected items were more strongly suppressed, it takes longer to recover from that suppression. And this results in a longer distribution tail.

References

- Balota, D. A., Yap, M. J., Cortese, M. J., & Watson, J. M. (2008). Beyond mean response latency: Response time distributional analyses of semantic priming. *Journal of Memory and Language*, 59(4), 495-523.
- Bialystok, E., Craik, F. I. M., & Luk, G. (2012). Bilingualism: consequences for mind and brain. *Trends in Cognitive Sciences*, 16(4), 240-250.
- Brown, S., & Heathcote, A. (2003). QMLE: Fast, robust, and efficient estimation of distribution functions based on quantiles. *Behavior Research Methods Instruments & Computers*, 35(4), 485-492.
- Colome, A. (2001). Lexical Activation in Bilinguals' Speech Production: Language-Specific or Language-Independent? *Journal of Memory and Language*, 45(4), 721-736.
- Damian, M. F., Vigliocco, G., & Levelt, W. J. M. (2001). Effects of semantic context in the naming of pictures and words. *Cognition*, 81(3), B77-B86.
- Hilchey, M. D., & Klein, R. M. (2011). Are there bilingual advantages on nonlinguistic interference tasks? Implications for the plasticity of executive control processes. *Psychonomic Bulletin & Review*, 18(4), 625-658.
- Kroll, J. F., Bobb, S. C., & Wodniecka, Z. (2006). Language selectivity is the exception, not the rule: Arguments against a fixed locus of language selection in bilingual speech. *Bilingualism: Language and Cognition*, 9(02), 119-135.
- Tse, C. S., & Altarriba, J. (2012). The effects of first- and second-language proficiency on conflict resolution and goal maintenance in bilinguals: Evidence from reaction time distributional analyses in a Stroop task. *Bilingualism-Language and Cognition*, 15(3), 663-676.