

Santa Vinerte and Laura Sabourin
University of Ottawa

Research Questions

Does bilingualism confer domain-general executive control and global reaction time (RT) advantages?

Does the degree of bilingualism (AoA and L2 proficiency) play a role?

Predicted Results

Higher L2 proficiency and earlier AoA will result in smaller overall interference effects and faster RTs in both congruent and incongruent conditions for English-French bilinguals

Bilinguals will have an advantage in controlling interference in the linguistic Stroop task and in the non-linguistic Attention Network Test (ANT)

Background

For bilinguals, both languages are active simultaneously^{1,2}

Mediating between two languages requires cognitive control

- attention, inhibition, conflict resolution
- bilinguals may have a cognitive control advantage³

Global RT advantages have been observed for the ANT task⁴

Better inhibitory control may be an insufficient explanation for the bilingual advantage⁵

- bilinguals may be better overall on these tasks due to increased attentional network abilities

Inconsistent evidence for correlation among different tasks (Stroop, ANT, switch tasks, flanker tasks) of cognitive control in bilinguals⁶

Method

Participants

English-French bilingual learners of L2 French with varying AoA and degrees of proficiency

18-35 years of age, attending or completed university

Procedure

- Language background questionnaire and written language proficiency tests
- Control trials followed by Stroop task and ANT trials in alternating blocks
- 3 blocks of Stroop, 4 blocks of ANT
- Each block preceded by practice trials and followed by a self-timed break

Stroop Task

Control	Congruent	Incongruent
HOUSE MAISON	RED ROUGE	RED ROUGE

Colour words used

English: RED, GREEN, YELLOW, BLACK, WHITE, SILVER

French: ROUGE, VERT, JAUNE, NOIR, BLANC, ARGENT

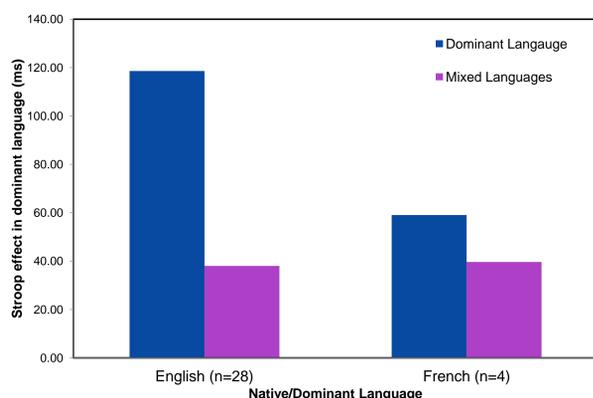
	MIXED ENGLISH	MIXED FRENCH	MIXED LANGUAGES
Fixation cross 250ms	+	+	+
Colour word stimulus Until button press	RED	ROUGE	RED
Fixation cross 250ms	+	+	+
Colour word stimulus Until button press	RED	ROUGE	VERT

ANT

Fixation (250-1500ms)	+			
Cue (100ms)	No Cue	Central	Double	Spatial
Fixation (250ms)	+			
Target (until response)	Neutral	Congruent	Incongruent	

Preliminary Results and Discussion

Stroop Effect in Dominant Language in Dominant-Only and Mixed-Language Conditions



English-dominant participants

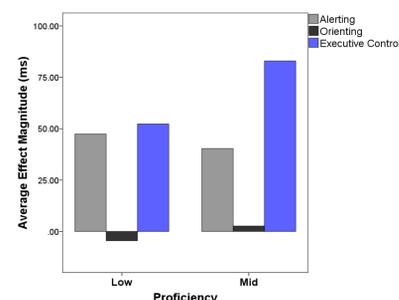
- Low-Mid L2 French proficiency
- Larger Stroop effect in English-only than in Mixed condition

French-dominant participants

- Highly proficient bilinguals
- Larger Stroop effect in French-only than in Mixed condition
- Smaller effects even in dominant language compared to English group

→ Highly proficient bilinguals show less interference effects, suggesting increased cognitive control

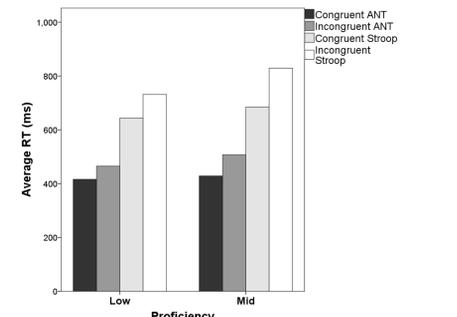
Attentional Network Effect Magnitudes by Low and Mid L2 French Proficiency



ANT Effect Magnitudes

- Increased Executive Control represented by lower bars
- Increased Alerting and Orienting represented by higher bars

RTs for Congruent and Incongruent ANT and Stroop Trials by Low and Mid L2 French Proficiency



Observations

- Trend suggesting that mid proficiency group has lower cognitive control ($p=.09$). Counters hypothesis.
- May need to test high proficiency bilinguals to see clearer effects

References

- Hall, M.L. (2011). Bilingual picture-word studies constrain theories of lexical selection. *Frontiers in Psychology: Language Sciences*, 2, 381.
- Roelofs, A., & Piai, V. (2011). Attention demands of spoken word planning: a review. *Frontiers in Psychology: Cognition*, 2, 307.
- Bialystok, E., Craik, F., & Luk, G. (2008). Cognitive control and lexical access in younger and older bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 34 (4), 859-873.
- Costa, A., Hernandez, M., & Sebastian-Galles, N. (2008). Bilingualism aids in conflict resolution: Evidence from the ANT task. *Cognition*, 106, 59-86.
- 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, 625-658.
- Paap, K.R., & Greenberg, Z.I. (2013). There is no coherent evidence for a bilingual advantage in executive processing. *Cognitive Psychology*, 66(2), 232-258.

Acknowledgements

This research was funded by a Social Sciences and Humanities Research Council of Canada grant to the second author. Thank you to all of the wonderful members of the Brain and Language Laboratory at the University of Ottawa, and to all of our participants for their time and enthusiasm!

Contact

svinerte@uottawa.ca