Earlier and more distributed neural networks for bilinguals than monolinguals during switching

Kalinka Timmer, John G. Grundy, and Ellen Bialystok

Department of Psychology, York University, Canada

INTRODUCTION

The behavioural advantage during non-verbal switching for bilinguals compared to monolinguals is not always present in young adults due to ceiling performance. The present study compared processing of English monolinguals and English-French bilinguals during non-verbal switching and verbal switching while electrophysiology (EEG) was recorded.

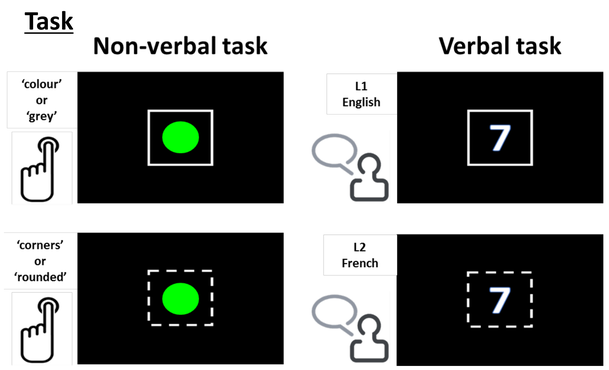
METHOD

Participants

	Monolinguals (n = 23)	Bilinguals (n = 20)
Age	22.2 (4.6)	23.5 (5.6)
Mother's Education[a]	3.5 (1.2)	3.7 (1.3)
English Speaking[b]	96.7 (6.8)	96.1 (6.4)
English Comprehension[b]	97.2 (6.2)	96.8 (5.8)
English Reading[b]	98.7 (3.8)	95.9 (7.5)
English Writing[b]	96.3 (7.9)	96.3 (7.4)
French Speaking[b]	.	86.6 (12.2)
French Comprehension[b]	.	87.8 (11.7)
French Reading[b]	.	91.1 (9.8)
French Writing[b]	.	87.68 (11.1)
GSA bilingualism[c]	8.0 (11.5)	89.5 (11.8)
Shipley (Vocabulary & blocks)[d]	103.2 (10.7)	108.8 (11.0)

[a] SES based on mother's education: 1 = no high school diploma, 2 = high school diploma, 3 = some post-secondary, 4 = post-secondary degree/diploma, and 5 = graduate/professional degree.
[b] English and French proficiency: 0 = no proficiency, 100 = native like fluency.
[c] Global Self Assessment of bilingualism: 1 = no second language ability, 5 = fully proficient in two languages.
[d] Shipley II standardized scores.

Task

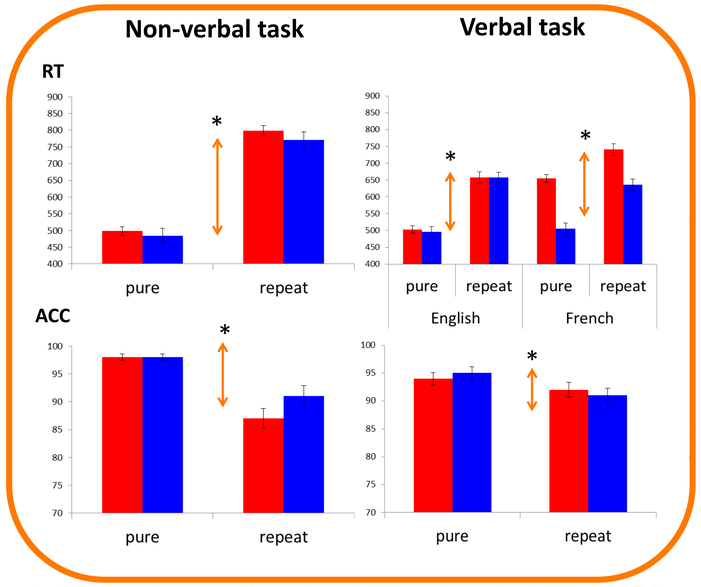


Procedure

Block	Trial Type	
pure blocks	pure	
mixed blocks	repeat	mixing cost
	switch	switching cost

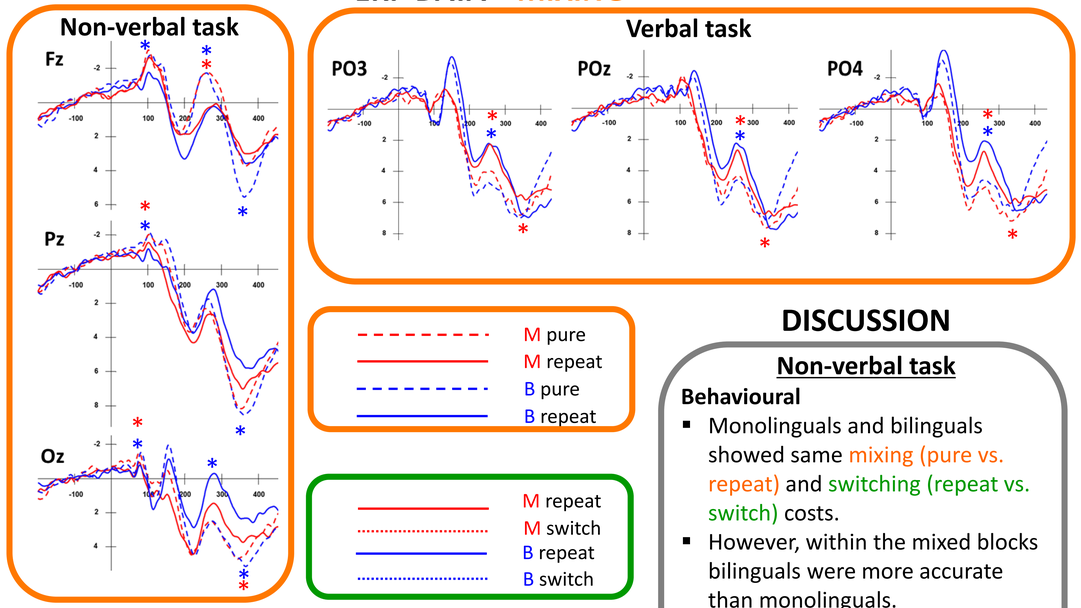
Contact: Kalinka Timmer – ktimmer@yorku.ca

BEHAVIOURAL DATA – *MIXING*

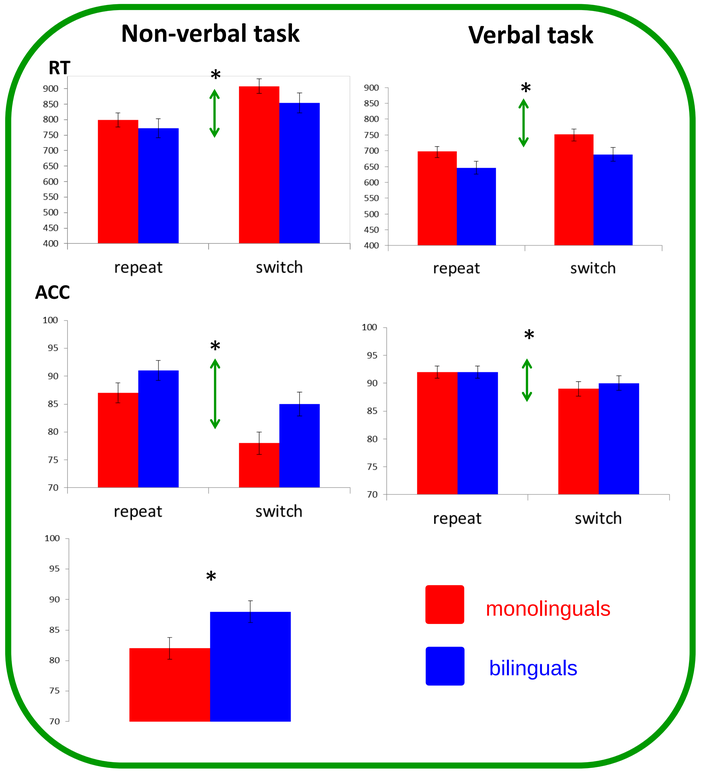


Mixing cost for monolinguals and bilinguals on both RT and ACC.

ERP DATA – *MIXING*

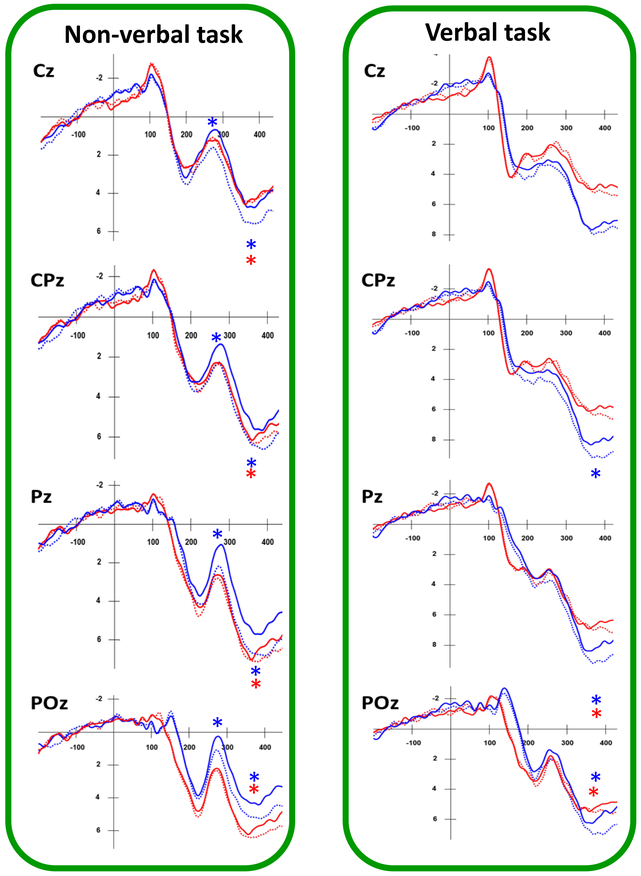


BEHAVIOURAL DATA – *SWITCHING*



Switch cost for monolinguals and bilinguals on both RT and ACC. Bilinguals are more accurate than monolinguals on the non-verbal task.

ERP DATA – *SWITCHING*



DISCUSSION

Non-verbal task

Behavioural

- Monolinguals and bilinguals showed same mixing (pure vs. repeat) and switching (repeat vs. switch) costs.
- However, within the mixed blocks bilinguals were more accurate than monolinguals.

ERPs

- Mixing cost was reflected in a more distributed neural network for bilinguals than monolinguals even with equivalent costs.
- Switching cost revealed earlier processing differences for bilinguals (275 ms) than monolinguals (325 ms).
- Processing differences could explain enhanced performance during the mixed blocks.

Verbal task

Behavioural

- Mixing and switching costs for both monolinguals and bilinguals.

ERPs

- Additional late control component for monolinguals compared to bilinguals for the mixing cost.
- More distributed networks for bilinguals than monolinguals for the switching cost.

CONCLUSION

More distributed networks for bilinguals suggests the integration of verbal and non-verbal control networks during early visual processing and later control processing.