The origin of the second language after-effect in bilingual language production: and ERP investigation
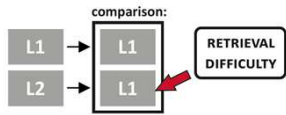
Agata Wolna[1], Jakub Szewczyk[2], Patrycja Kałamała[1], Zofia Wodniecka[1]

[1]Institute of Psychology, Jagiellonian University, [2]Department of Psychology, University of Illinois, Urbana-Champaign
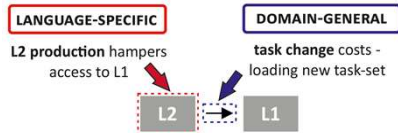Corresponding author: agata.wolna@doctoral.uj.edu.pl

Background

- Speaking in L1 after using L2 results in a word-retrieval difficulty ➡ **L2 after-effect** [1,2]

- **L2 after-effect** can be observed:
➡ **behaviourally:** longer naming latencies (RTs)
➡ **in ERPs:** modulation of components sensitive to word-retrieval difficulty (**P2** [2], **N300** [1])

Research question

IS THE WORD-RETRIEVAL DIFFICULTY DRIVEN BY PREVIOUS EXPOSURE TO l2 OR BY A MERE CHANGE OF TASK?

LANGUAGE-SPECIFIC
L2 production hampers access to L1

DOMAIN-GENERAL
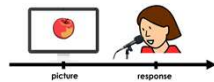task change costs - loading new task-set

Is the word-retrieval difficulty driven by **previous exposure To L2** or is it also influenced by the mere **change of task**?

Method
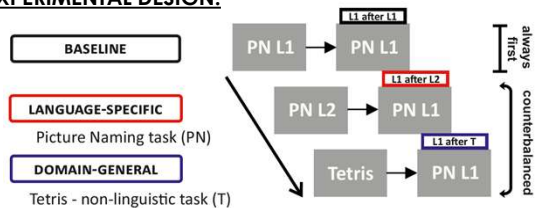
PARTICIPANTS: 33 Polish (L1) – English (L2) unbalanced bilinguals

CRITICAL TASK: blocked Picture Naming

EXPERIMENTAL DESIGN:

BASELINE

LANGUAGE-SPECIFIC
Picture Naming task (PN)

DOMAIN-GENERAL
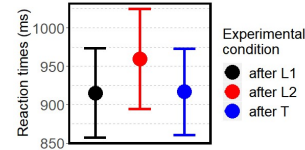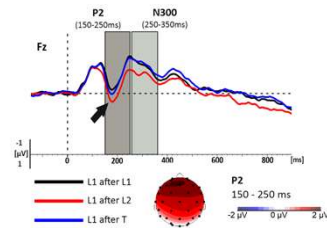Tetris - non-linguistic task (T)

Results

L2 after-effect: language-specific or domain-general?

BEHAVIOURAL RESULTS:

- **No** slow-down of naming **after L2**
- **No** slow-down of naming **after NLT**
➡ Significant effect of **trial number:** systematic rise of naming latencies throughout the experiment

ELECTROPHYSIOLOGICAL RESULTS:

P2 time-window (150-250 ms):
- **Significant effect of preceding language:**
  - L1 after L2 more positive than baseline
- **No** significant effect of task-change
  - no difference between L1 after NLT and baseline amplitude

N300 time-window (250-350 ms):
- Uninterpretable due to spill-over of the earlier effect

SUMMARY:

➡ Inconclusive behavioural results:
  - No differences between L1 after L2 and L1 after NLT ➡ **trial effect**
  - **Trial number** might reflect uncontrolled cumulative semantic interference [3]
  - **Trial effect** might conceal the L2 after-effect and task-change effect due to lack of full counterbalance: **baseline condition was always completed first**

➡ Electrophysiological results: what drives the effect in P2 time-window?
  ➡ lexical access difficulty – „*production P2*" [4]?
  ➡ trial-effect – *cumulative semantic interference* [3]?

Exploratory analysis: trial effect

Comparison of **L1 after L2** and **L1 after T** against **L1 after L1** (baseline) **can be confounded by the trial number** since the baseline block was **always completed first** within the experiment.

AIM OF THE EXPLORATORY ANALYSIS ➡ identify factors which modulate the P2 amplitude
  ➡ Cumulative semantic interference? – trial number
  ➡ Word-retrieval difficulty? – preceding language
  ➡ Langauge of naming?

RESULTS:

➡ **Trial-base increase** of the P2 amplitude through the entire experiment
➡ **Word-retrieval difficulty:** no effect of preceding language
➡ **Language of naming:** overall - smaller amplitude of the P2 compared to L1
➡ **Additionaly: disruption** of trial-base increase of the P2 amplitude in **L1 naming after Tetris!**
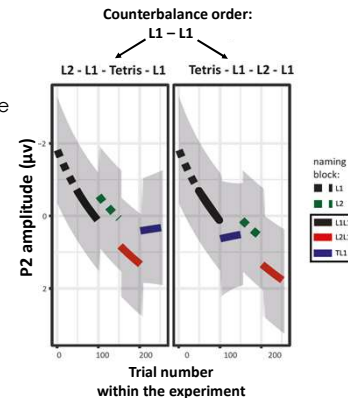
OUTSTANDING QUESTION:
Which component reflects the word-retrieval difficulty in L2 after-effect?

Conclusions

BEHAVIOURAL RESULTS:

- It is unclear if L2 after-effect is driven by **language-specific** or **domain-general** mechanism
- Trial-base increase of **RTs** can obliterate the **L2 after-effect.**
  ➡ Trial-effects might reflect the uncontrolled cumulative semantic interference [3]

ELECTROPHYSIOLOGIVAL RESULTS:

- Early processes in Picture Naming are strongly affected by **trial-based** effect:
  ➡ Cumulative semantic interference [3]? ➡ Consistent with behavioural results
  ➡ Methodological implications for all experiments measuring ERPs in a picture naming task
- After controlling for **trial number: P2 was not sensitive to L2 after-effect**
  ➡ **P2 modultaion** does not reflect **word-retrieval difficulty**
  ➡ It is affected by **language of naming**

References

[1] Wodniecka, Z., Szewczyk, J., Kałamała, P., Mandera, P., & Durlik, J. (2020). When a second language hits a native language. What ERPs (do and do not) tell us about language retrieval difficulty in bilingual language production. Neuropsychologia, 107390.

[2] Branzi, F. M., Martin, C. D., Abutalebi, J., & Costa, A. (2014). The after-effects of bilingual language production. Neuropsychologia, 52, 102-116.

[3] Costa, A., Strijkers, K., Martin, C., & Thierry, G. (2009). The time course of word retrieval revealed by event-related brain potentials during overt speech. Proceedings of the National Academy of Sciences, 106(50), 21442-21446.

[4] Strijkers, K., Costa, A., & Thierry, G. (2010). Tracking lexical access in speech production: electrophysiological correlates of word frequency and cognate effects. Cerebral cortex, 20(4), 912-928.