What do linguistic and non-linguistic cognitive control have in common?

PSYCHOLOGY OF LANGUAGE & BILINGUALISM LAB

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Background

Mixed evidence on the impact of bilingualism on training of cognitive control
- cross-sectional comparisons do not always replicate 'the bilingual benefit'
- no demonstrated causality of the effect (in a longitudinal design)
- cognitive and language control are not unitary constructs

Question: What aspects of cognitive control **can** be modulated by language control?

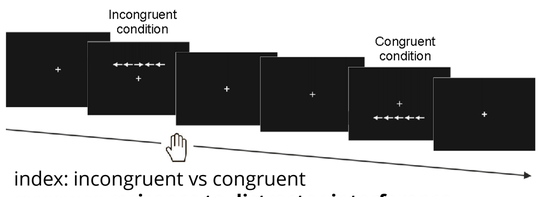
How are indexes of cognitive control related to the indexes of language control?

Which of the four tasks used in the literature to assess language control in bilinguals, predict performance in the three tasks measuring non-linguistic control?

Methods

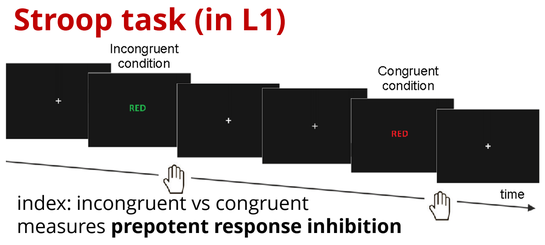
Non-linguistic control

Flanker task



index: incongruent vs congruent
measures **resisance to distractor interference**

Stroop task (in L1)



index: incongruent vs congruent
measures **prepotent response inhibition**

Running Span Task

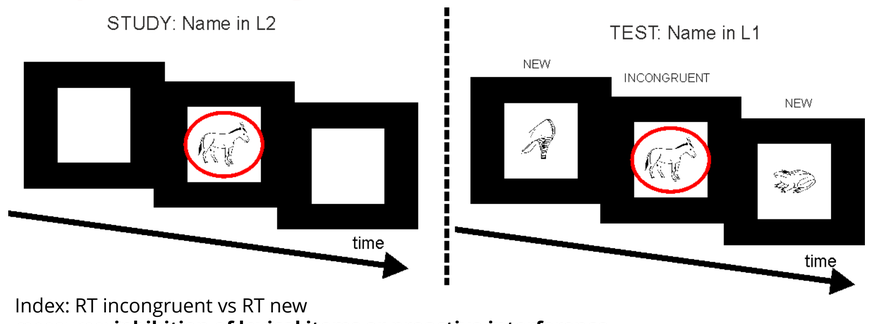
... K F W J M P G F Z G D [name last 5 letters]

sudden end

index: number of letters recalled at correct position
measures **updating ability**

Linguistic control

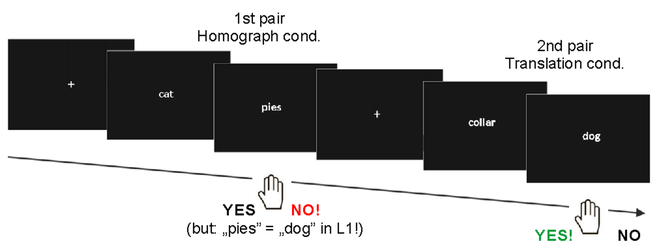
Competitor Priming task



Index: RT incongruent vs RT new
measures: **inhibition of lexical items or proactive interference**

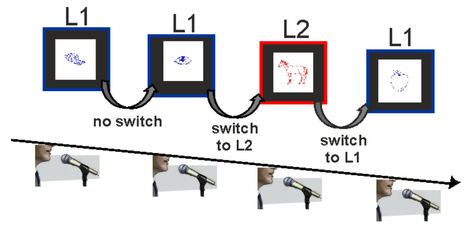
Interlingual Homograph task

Are presented English words semantically related or no?



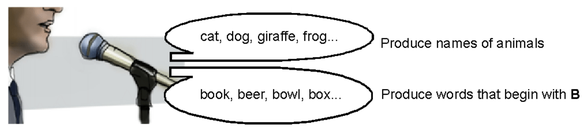
Index: 1st pair homograph vs control;
measures: **inhibition of prepotent response / interference resolution**
Index: 2nd pair after homograph vs after control
measures **inhibition of lexical items or proactive interference**

Language Switching task



Index: switch vs non-switch, for L1 and for L2
measures: **set-level language inhibition / reactivation cost**

Verbal Fluency



Letter and category fluency tasks, in L1 and in L2
Index: number of unique nouns produced in 1 min
measures **suppression of retrieved responses, controlled search, shifting between competing subcategories;**
VF in L2 also depends on L2 proficiency

L2 proficiency measure

LexTALE task

Lexical decision in L2:

crumper	✗	fray	✓
rascal	✓	lofty	✓
quirty	✗	proom	✗

Index: avg correctness for words and nonwords
measures **receptive vocabulary in L2**

Participants

63 high-school students, 16-17 years old
Native speakers of Polish
Fairly good knowledge of English (CEFL: B1/B2 - C2)

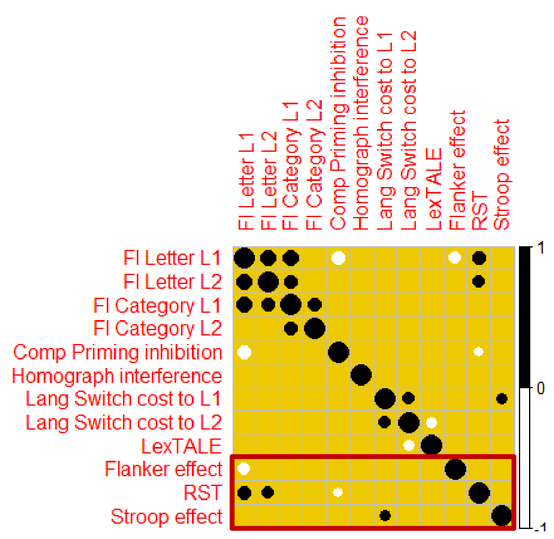
tested 3 times on the same set of tasks, across 2 years

Data analysis strategy

- All analyses conducted across the three stages, ignoring the contribution of testing stage
- All RTs logaritmized
- All indices involving substraction residualized instead (see e.g. Friedman et al 2004)
- Linear regressions used; best-fitting models shown (with the least AIC)

Results

Correlation matrix



Regression models

Flanker effect

	β	Std Error	t
Letter Fluency L1	-0,45	0,11	-4,02

Running Span Task

	β	Std Error	t
Letter Fluency L1	0,43	0,13	3,79
Homograph Interfer.	0,24	0,13	2,12

Stroop effect (in L1)

	β	Std Error	t
Lang Switch Cost to L1	0,31	0,12	2,61

Discussion

- Linguistic and non-linguistic control indices are extremely noisy
- Most effects obtain only after including data from all three stages
- Linguistic and non-linguistic measures of control share little variance
- Only weak links between the non-linguistic and linguistic control measures;

Flanker Effect

- the common component of the Flanker effect and L1 letter fluency: **resistance to interference**
- unlikely to be related to the language control mechanisms typically assessed in research on bilingualism

Running Span Task score

- predicted by letter fluency in L1 and by interference size induced by interlingual homographs
- little theoretical reason for these tasks to covary
- larger WM span promotes processing of both meanings of language ambiguous words? superior WM capacity leads to larger homograph interference?

Stroop effect

- common variance with costs of switching to L1, suggests that switching to L1 involves **inhibition of prepotent response** (L2 name)
- Inhibition of prepotent response might be trainable by bilingual experience

The reported links suggest areas in which the transfer is more likely to be observed.

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