Domain-general and language-related inhibition: What L2 comprehension can tell us about executive function skill in bilinguals

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Introduction

- Bilingual experience has been shown to have an impact on executive function skill across the lifespan (Bak et al., 2014; Gold et al., 2013). A majority of the research on this topic, however, focuses on the relationship between language production ability and performance on non-linguistic control tasks. As such, very little is known about how these reported changes in cognitive control ability might influence other aspects of language use, such as reading comprehension.

- By utilizing an aspect of reading comprehension that has been shown to rely on executive function skill (i.e., recovery from disconfirmed predictions; Federmeier et al., 2010; Zirnstein et al., in prep), our aim was to investigate how those control processes that have been implicated as critical for bilingual language processing might support online language use.

Methods and Approach

- In a series of studies, we asked participants to read sentences in the L2 while their EEG was recorded. ERPs were time-locked to target words that were highly **expected** or unexpected, based on prior context.

Table 1. Example sentence stimuli.

Condition	Example Sentence
High constraint, expected target	(1) They paid for their meals, but forgot to leave a **tip** for the waitress.
High constraint, unexpected target	(2) They paid for their meals, but forgot to leave a **ten** for the waitress.

- Across all experiments, performance on a domain-general control task (AX-CPT; adapted from the interference condition in Braver et al., 2001) was assessed, along with a battery of language proficiency and fluency measures.

- We determined domain-general inhibitory control ability by indexing, per participant, the average RT for correct responses to probes in the AY condition of the AX-CPT.

Inhibition in L1 and L2 Comprehension

- Performance on the AX-CPT significantly predicted modulation of processing costs related to having a lexical prediction disconfirmed (i.e., a reduction in the late frontal positivity for unexpected target words). This effect was found for both monolinguals and bilinguals, in the L1 and L2, and for bilinguals in different immersion contexts, suggesting that the recruitment of domain-general inhibitory control mechanisms during reading is not restricted to only native readers.

Figure 1. Results for young adult English monolinguals (N = 24).

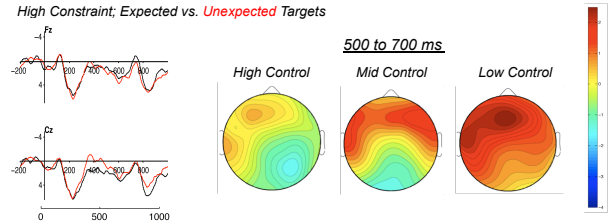


Figure 2. Results for young adult Chinese-English bilinguals immersed in an L2 context (N = 28).

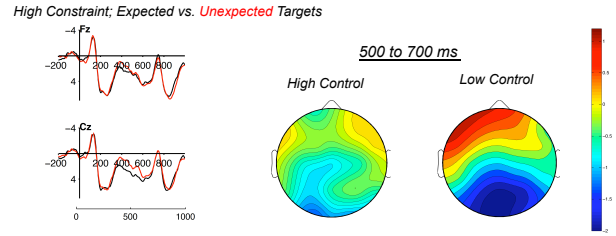
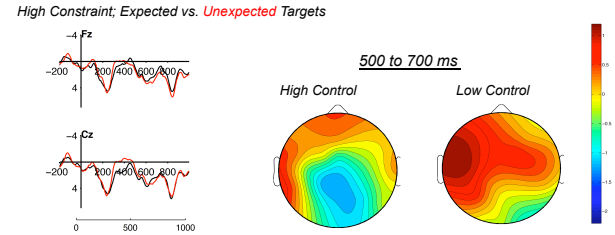


Figure 3. Results for young adult Dutch-English bilinguals immersed in an L1 context (N = 24).



- Based on these findings, a remaining question was whether the recruitment of domain-general inhibition during reading was in any way related to the types of language-related inhibition effects typically reported for bilingual language production. Therefore, in a follow-up study, we investigated the degree to which bilingual participants were capable of disinhibiting their more dominant, native language.

Domain-general vs. Language Inhibition

- Dutch-English participants from an earlier experiment were asked to produce words that began with particular letters (e.g., F, A, S) in both of their languages, first in the L2 and then in the L1, and using the same letters across languages. Previous work has shown that this arrangement is most likely to induce costs related to difficulty with disinhibiting the L1 when bilinguals are asked to produce words in the L1 following an L2 block (e.g., Van Assche et al., 2013).

L1 Letter Fluency Performance Measure	Correlation with better AX-CPT Performance	
	r	p-value
No. of Words Produced	0.39	< .05
No. of Non-cognates	0.42	< .05
Total Orthographic Similarity	-0.43	< .05

- Better performance on the AY condition of the AX-CPT was significantly correlated with multiple performance measures in the L1 letter fluency block. Those bilinguals with better domain-general inhibitory control were more likely to produce more words in the L1 following the L2, produced more non-cognates, and overall relied less on orthographic overlap between their L1 and L2.

Discussion

- Our results indicated a strong relationship between domain-general and language-related inhibition. Bilinguals with better domain-general control tended to produce more words overall in the L1 block, suggesting better skill in dis-inhibiting the L1.

- In addition, cognate status of the words produced in the L1, as well as the degree of orthographic overlap between that word and its L2 translation equivalent, was also important.

- Overall, then, we show that those bilinguals who utilize domain-general control during L2 comprehension to greater success are also more capable of flexibly switching languages, providing more evidence for the idea that bilingual experience can have a widespread effect on executive function skill.

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