

Introduction and Aim

While some studies observed a cognitive advantage in bilingual and multilingual speakers (Bialystok, 2015), other studies have recently questioned the existence of such an advantage (Paap & Greenberg, 2013).

The aim of this study was to assess the potential cognitive **advantages of trilingualism** by focusing on **auditory-verbal short-term memory (STM) and attention**. Although these cognitive functions are strongly recruited during language learning and processing, they have rarely been explored in the context of multilingualism.

Methods

- Participants ($N = 51$) aged 18-32 (mean 23.86 years, SD 2.93) were raised in Luxemburg and spoke at least **three languages**: Luxemburgish, German and French.
- Language comprehension and production for German and French were assessed.
- Auditory-verbal STM was assessed via an immediate serial recall (**ISR**) task for lists of words and non-words (1-6 items).
- Attention was assessed via auditory-verbal running spans under two attentional control demands: automatic attention (**Fig. 1a**) and controlled attention (**Fig. 1b**). As the items are presented at a very fast rate, rehearsal and any other strategies are blocked (Cowan, Fristoe, Elliott, Bruner, & Saults, 2006).

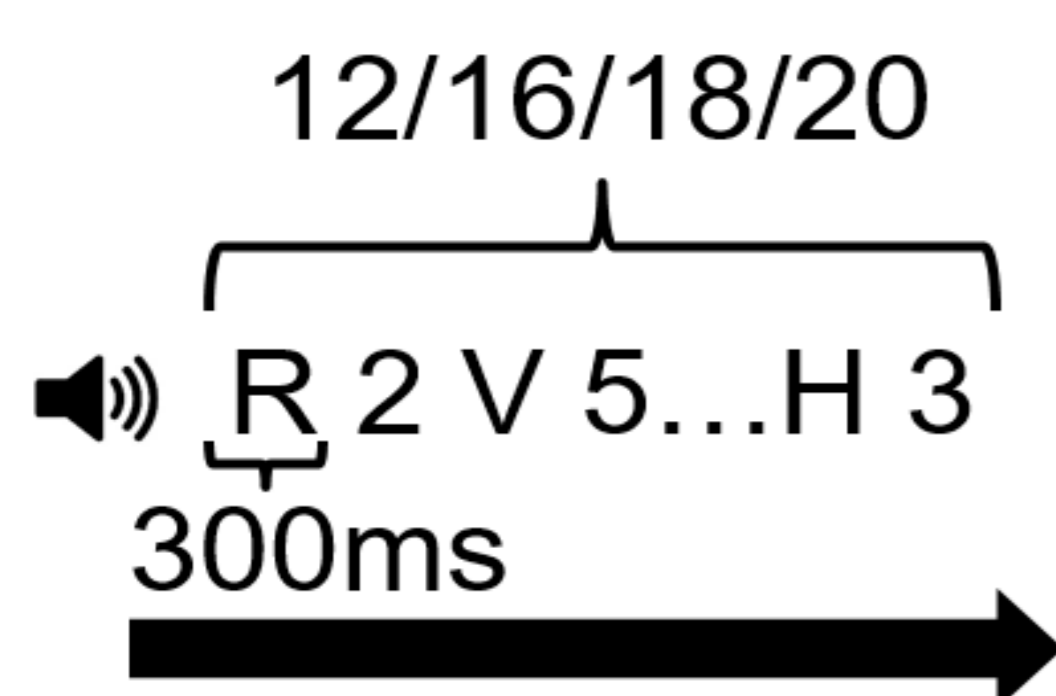


Figure 1a: Automatic attention running span condition. Items were presented at high speed, list length was unpredictable. Participants had to recall the items in their order of presentation **by starting at the end of the list**.

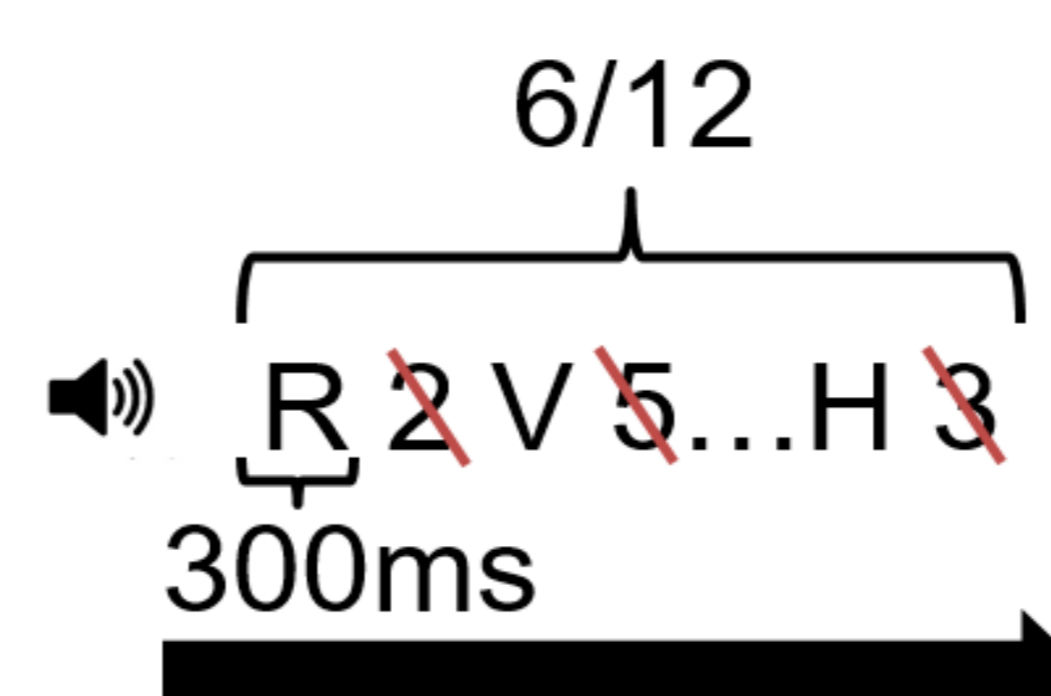


Figure 1b: Controlled attention running span condition. Participants had to focus on only one category (letters **or** numbers) and had to repeat **all** target items in their order of presentation.

Results

Bayesian correlation analysis

	Language	ISR	Automatic	Controlled	Raven
Language	-	0.55***	0.35 *	0.36 *	0.39*
ISR	-	-	0.65***	0.46***	0.27
Automatic	-	-	-	0.22	0.33
Controlled	-	-	-	-	0.33

* = $BF_{10} > 3$
** = $BF_{10} > 10$
*** = $BF_{10} > 30$

Bayesian regression analysis

BF_{10} values for the prediction of ISR, Automatic Attention, and Controlled Attention tasks by trilingual language proficiency and Raven's matrices scores.

	ISR	Automatic	Controlled
Language	689.119	3.890	4.678
Raven	1.365	2.938	2.936

Discussion and conclusion

- **Moderate to strong association between language proficiency and auditory-verbal STM as well as automatic and controlled attentional abilities, while controlling for general intellectual efficiency.**
- **This study suggests that:**
 - 1. Auditory-verbal STM and attention are important candidate functions for the exploration of a potential multilingual advantage.**
 - 2. Higher verbal STM capacities in highly proficient trilinguals may stem from higher auditory-verbal attention abilities, more efficient support from linguistic long-term memory, better serial order encoding abilities, or a combination of these.**

References

Bialystok, E. (2009). Bilingualism: The good, the bad, and the indifferent. *Bilingualism: Language and Cognition*, 12(1), 3-11.
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.
Cowan, N., Fristoe, N. M., Elliott, E. M., Brunner, R. P., & Saults, J. S. (2006). Scope of attention, control of attention, and intelligence in children and adults. *Memory & Cognition*, 34(8), 1754-1768.

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