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WORKING MEMORY CAPACITY IN FRENCH-GERMAN BILINGUALS

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BILINGUALISM AND EXECUTIVE FUNCTIONS

EXPERIMENTS: WORKING MEMORY TASK WITH COLLEGE AND APPRENTICESHIP STUDENTS

DISCUSSION

A bilingual person interacting in an environment



select the appropriate language to use



switch between two languages, highlighting one and suppressing the other

INTRODUCTION

In recent years, research:

- **investigated the mechanism involved when switching languages.**
- **attempted to determine whether this mechanism was common to other nonverbal tasks.**

(e.g., Bialystok et al. 2010; Costa et al., 2008)

If this is the case:

- **bilinguals could have some cognitive advantages**
- **especially in executive control**

WHAT IS EXECUTIVE CONTROL?

- **Ability to guide one's cognitive skills.**
- **It is not a single entity but is composed of executive functions (Miyake et al., 2000).**
- **Executive functions:**
 - « A set of general-purpose control mechanisms, often linked to the prefrontal cortex of the brain, that regulate the dynamic of human cognition and action. »
(Miyake & Friedman, 2012)

WHAT ARE EXECUTIVE FUNCTIONS?

- The three main executive functions (Miyake & Friedman, 2012)

Updating (constant monitoring/ fast +/- WM contents)


Shifting (switching flexibility between tasks or mental sets)

Inhibition (deliberate deletion of possible response)

SOME OTHERS IN THE LITTERATURE: MONITORING,
ANTICIPATION, TASK-SWITCHING, SHIFT, PLANNING/
ORGANIZATION, EMOTIONAL CONTROL

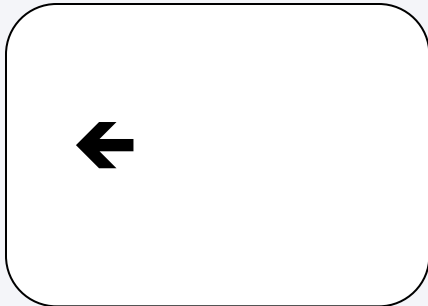
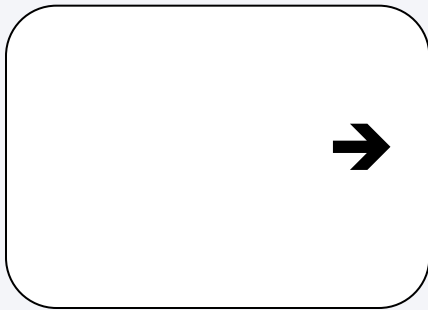
THE INHIBITION HYPOTHESIS (GREEN,1998)

The language a bilingual individual does not want to use to express himself

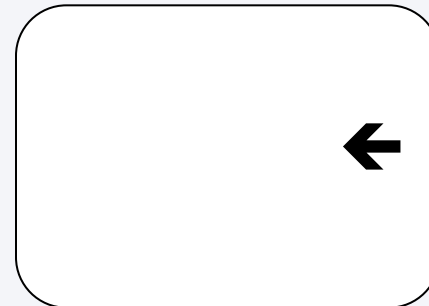
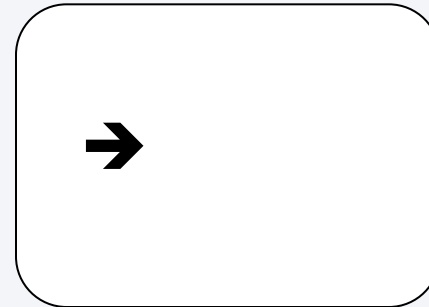
 **suppressed by inhibition control**



Congruent trials



Incongruent trials



Bialystok et al. (2004) :

**BILINGUALS: FASTER ANSWERS ON
INCONGRUENT TRIALS IN A SIMON TASK THAN
MONOLINGUALS.**

**BIALYSTOK ET AL. (2004) CONCLUDED THAT
BILINGUALS HAD BETTER INHIBITORY CAPACITY
THAN MONOLINGUALS.**

However, in a replication when language and socio-economic status (SES) are controlled,

difference between bilingual and monolingual
children **disappears**.

- Review on inhibition research among bilinguals.
- 13 papers.
- A bilingual advantage is most of the time **absent**, if not, **sporadic**.
- Comments on the seminal paper from Bialystok et al., (2004):
 - Magnitudes of interference effects are amazingly large. -> anomalous
 - Not replicated or partially (e.g., Bialystok et al., 2008) under very restricted conditions.

EXPERIMENT 1

- On young adults, college students.
- Controlling language, SES & ethnicity.
- Fribourg: a bilingual city.
- Working memory span task.

ASSESSING WORKING MEMORY: WHY?

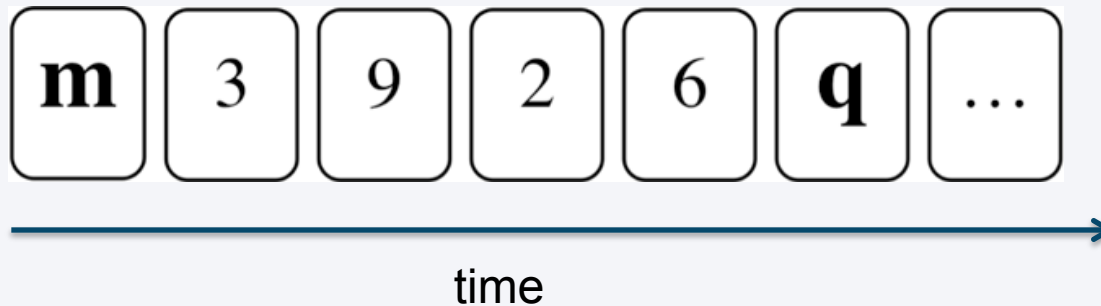
- **There is a relationship between working memory and executive functions (e.g., Baddeley et al., 1996, Miyake & Shah, 1999).**
- **Bonifacci et al. (2010) tested working memory, but only for tasks requiring small executive control.**
- **No study has assessed a complex span task on bilinguals vs monolinguals.**

METHOD EXPERIMENT 1

- **N=59 (35 monolinguals, 24 bilinguals)**
- **Swiss socioeconomic status test (Genoud, 2005)**
- **Questionnaire about use of language**
- **Language test: C-test (Grotjahn, 2002)**

METHOD

Working memory span task



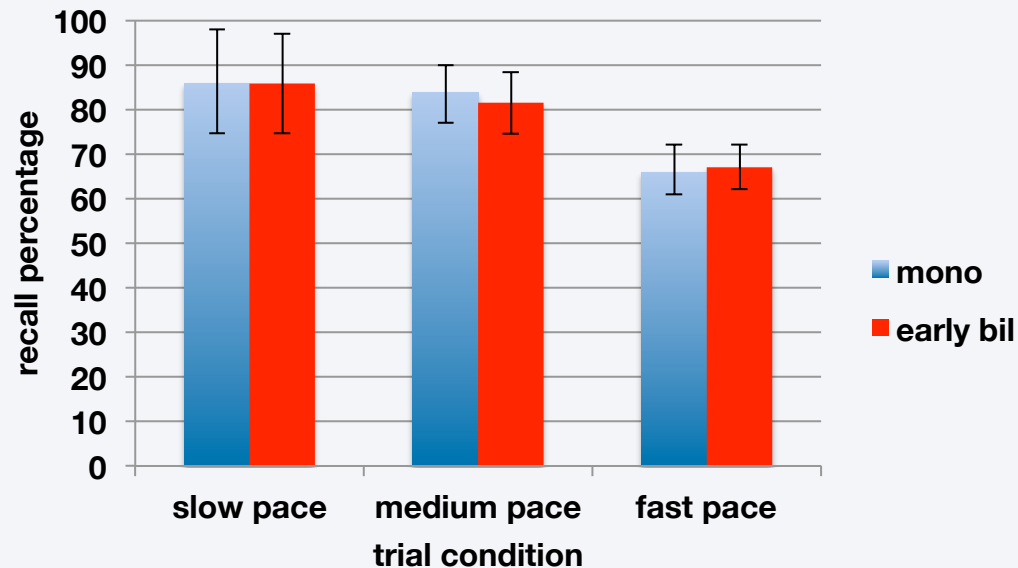
Memorizing 6 consonants.

Concurrent task: judging the parity of 4 digits.

3 different paces: 1600 ms (slow), 1200 ms (medium) or 800 ms (fast).

RESULTS

Working memory span task



- the faster the pace, the lower the recall.
- No significant difference on recall percentage between monolinguals and bilinguals, $F < 1$.
- No significant interaction.

AGE OF LANGUAGE ACQUISITION: WHAT ABOUT LATE BILINGUALS?

What about late bilinguals?

Individuals who learned a second language after 10 years old.

Assumptions:

**SWITCH OF LANGUAGES IS NOT AS “AUTOMATIC” AS IT IS FOR
EARLY BILINGUALS.**

CONSTANT TRAINING IN SWITCHING OF LANGUAGES

EXPERIMENT 2

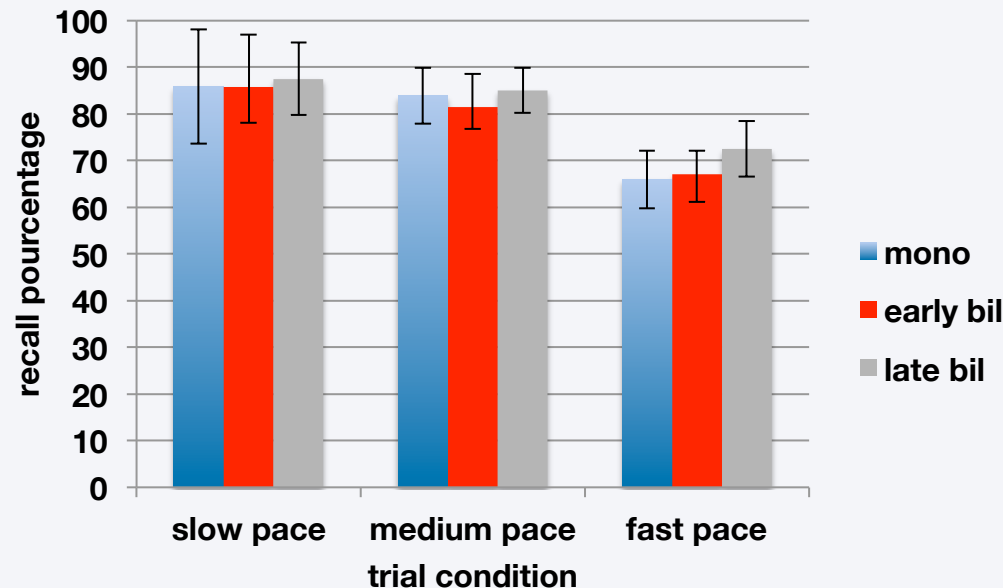
- **Work with participants that use on a daily basis a second language learned after 10 years old.**
- **Namely: German students from the university of Fribourg.**

METHOD EXPERIMENT 2

- **N= 16 late bilinguals**
- **Same material and procedure**

RESULTS

Working memory span task



- the faster the pace, the lower the recall.
- No significant difference on recall percentage between monolinguals and bilinguals, $F < 1$.
- No significant interaction.

RESULTS: INTERMEDIATE SUMMARY

Although the pace effect was replicated, monolinguals, early and late bilinguals show no difference in working memory span.

College students: high SES and level of education.

What if we assess the same experiment with lower SES participants?

EXPERIMENT 3

Assess the same tasks on monolinguals and bilinguals from different SES: apprenticeship

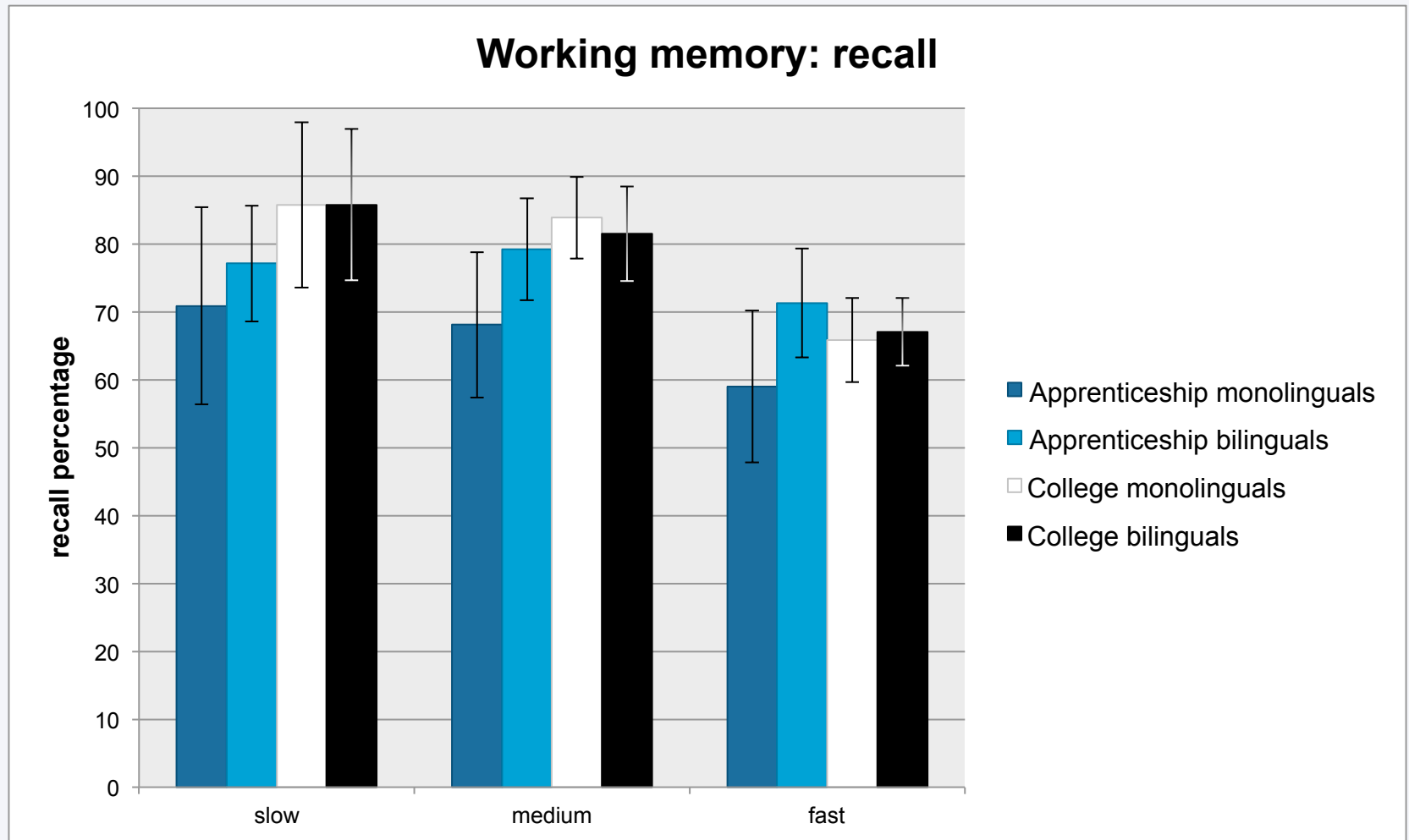
We have tested apprenticeship students N=57 (27 monolinguals, 30 bilinguals)

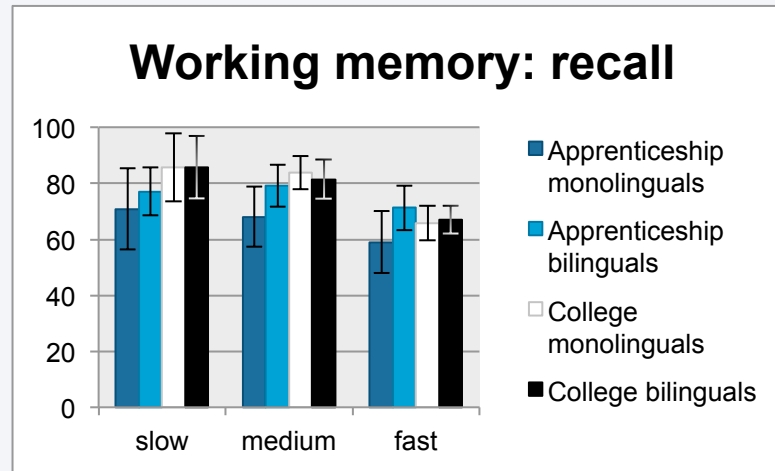
APPRENTICESHIP VS COLLEGE STUDENTS

Socioeconomic status: significantly lower

IPSE: THE HIGHER THE SCORE, THE LOWER THE STATUS

	Monolinguals	Bilinguals
Apprenticeship students	53.6	53.0
College students	25.3	26.4





Apprenticeship students: monolinguals vs bilinguals

The slower the pace, the better the recall.

Bilinguals had a better recall percentage than monolinguals.

There was no interaction.

CONCLUSION & DISCUSSION

Apprenticeship bilinguals showed a significantly higher working memory capacity than apprenticeship monolinguals.

There could be an effect of selection in college students results: as these participants had a high SES and level of education, monolinguals score were similar to bilinguals.

On the contrary, apprenticeship bilinguals could have benefited from a bilingual advantage, not hidden by a high SES/education level.

CONCLUSION & DISCUSSION

Bialystok (2009) in her response paper to Morton & Harper: SES is not influencing the results in her studies on the bilingual advantage (namely Bialystok et al., 2004 in her response paper).

Our result make us propose that SES has an influence on the so-called bilingual advantage.

Therefore, we suggest that bilingual participants with a low SES benefit from an advantage on a complex span task.

Thank you for your attention!

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Thank you to the students who helped me collect data!