

# Cerebellar involvement in semantic memory: evidence from brain stimulation

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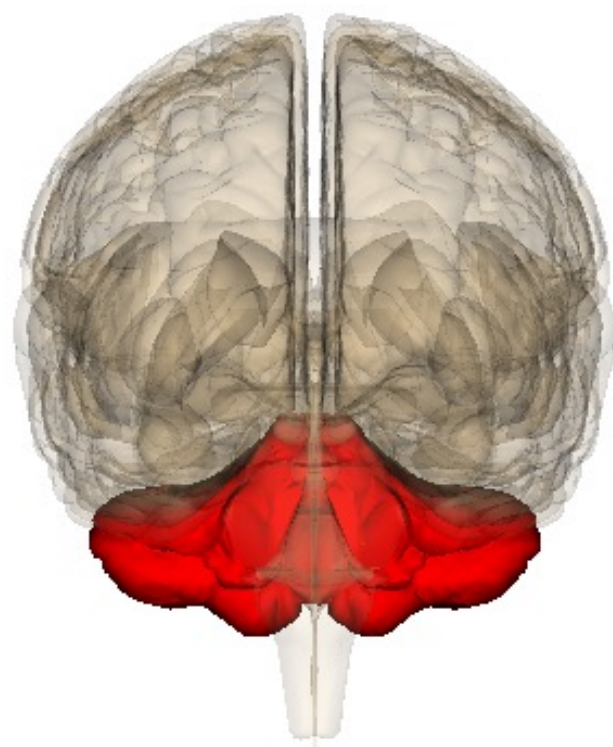
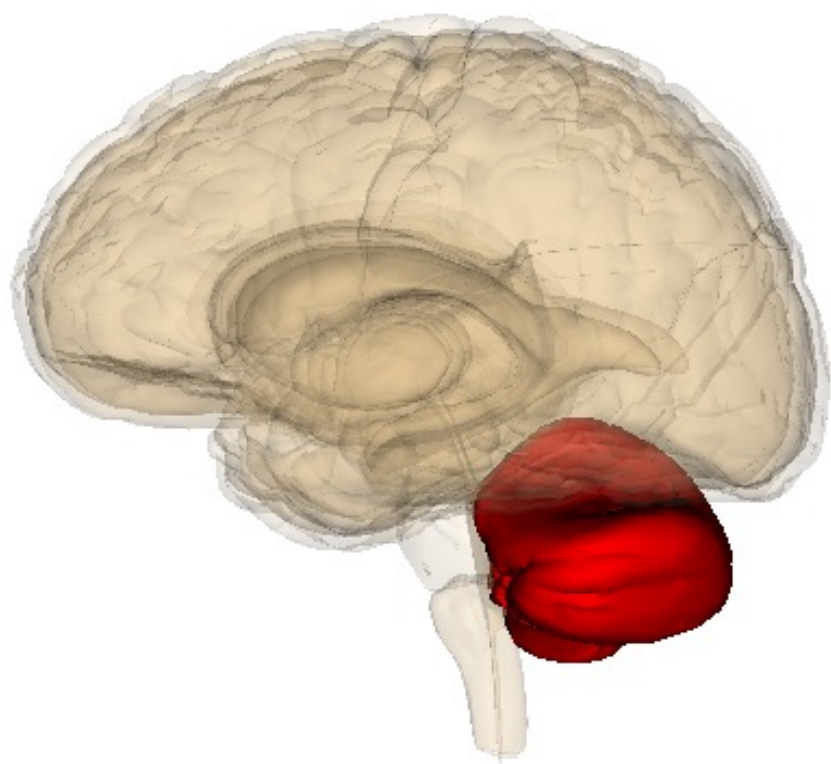
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Palermo – 30 Settembre 2021



## Introduction

- Cerebellum (100 mld) vs. Cerebrum (21-26 mld)

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- Cerebellum (100 mld) vs. Cerebrum (21-26 mld)
- Homogeneous structure
- Wide cerebro-cerebellar connections
- Motor and cognitive
- Procedural and associative processes
- Semantic memory?



## DRM task

- Encoding

**FUMO (SMOKE)**

Pipa (Pipe)

Sigaro (Cigar)

Sigaretta (Cigarette)

Tabacco (Tobacco)

Cenere (Ash)

Fumare (Smoke)

Nicotina (Nicotine)

Polmoni (Lungs)

Camino (Chimney)

Inquinamento (Pollution)

Cancro (Cancer)

Vapore (Steam)

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- Distracting task

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- Distracting task

- Recognition

Old / New judgements

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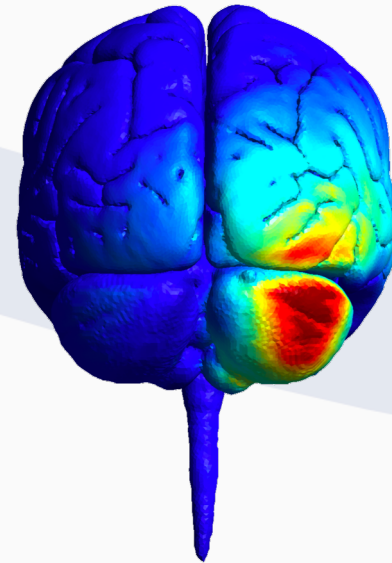
False memory

## DRM task

- Encoding
- Distracting task
- Recognition

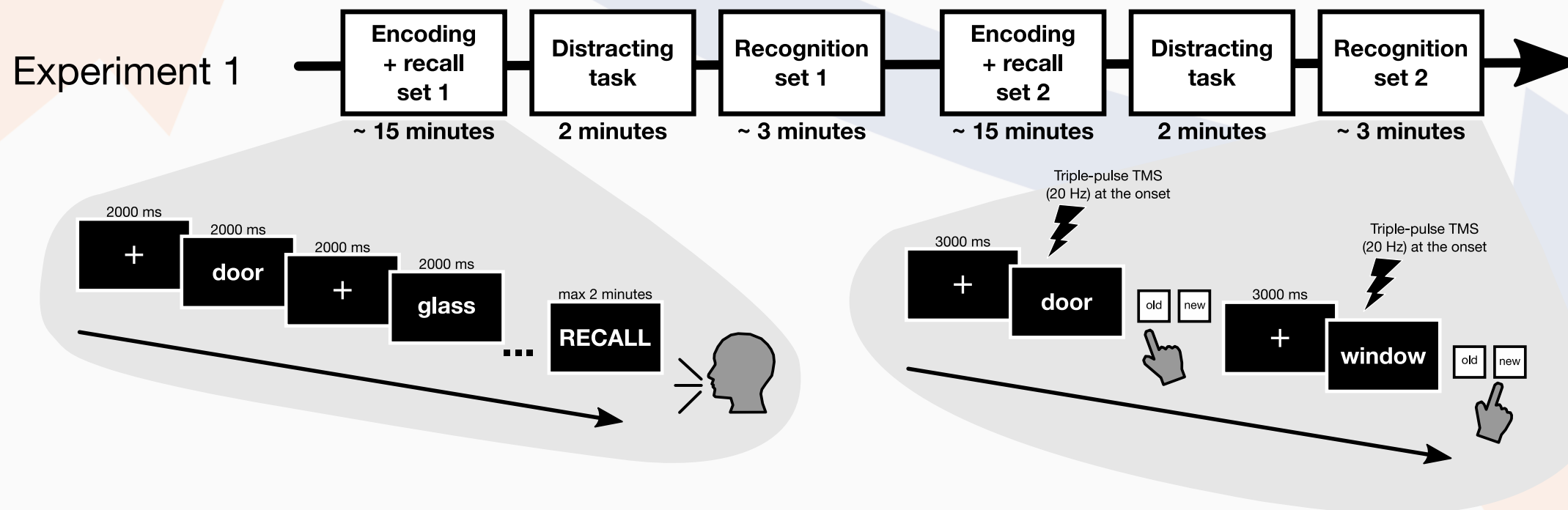


- Triple-pulse, 20Hz onset
  - Right Cerebellum vs. Vertex



# Experiment 1 – Method

- 24 participants
- DRM task across two sessions

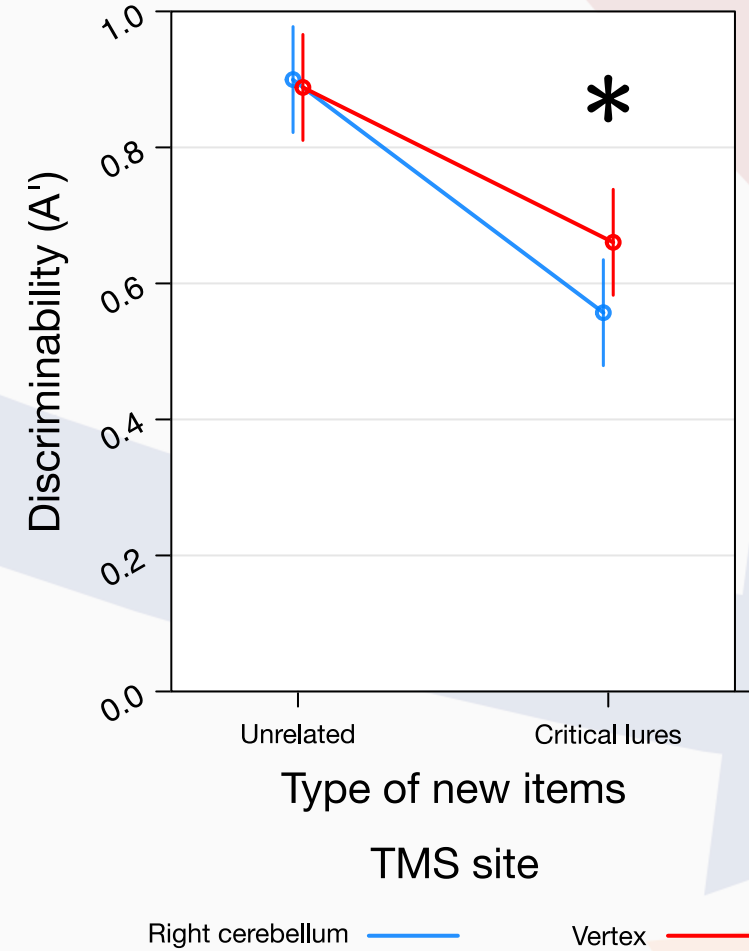


## Experiment 1 – Results and discussion

- Dependent variable: A'

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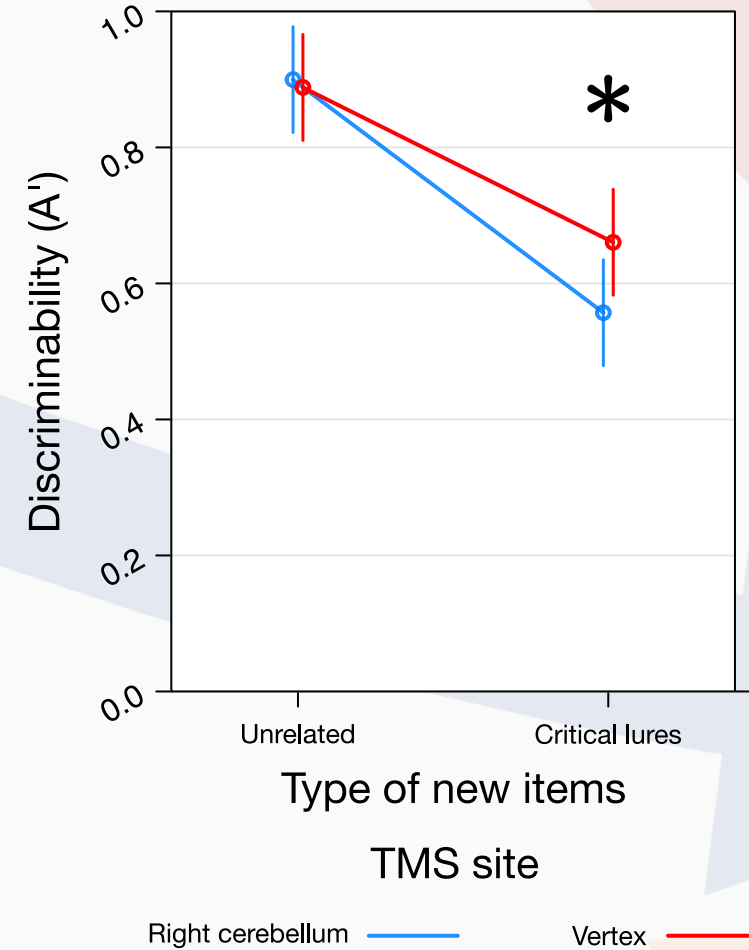
- Dependent variable:  $A'$





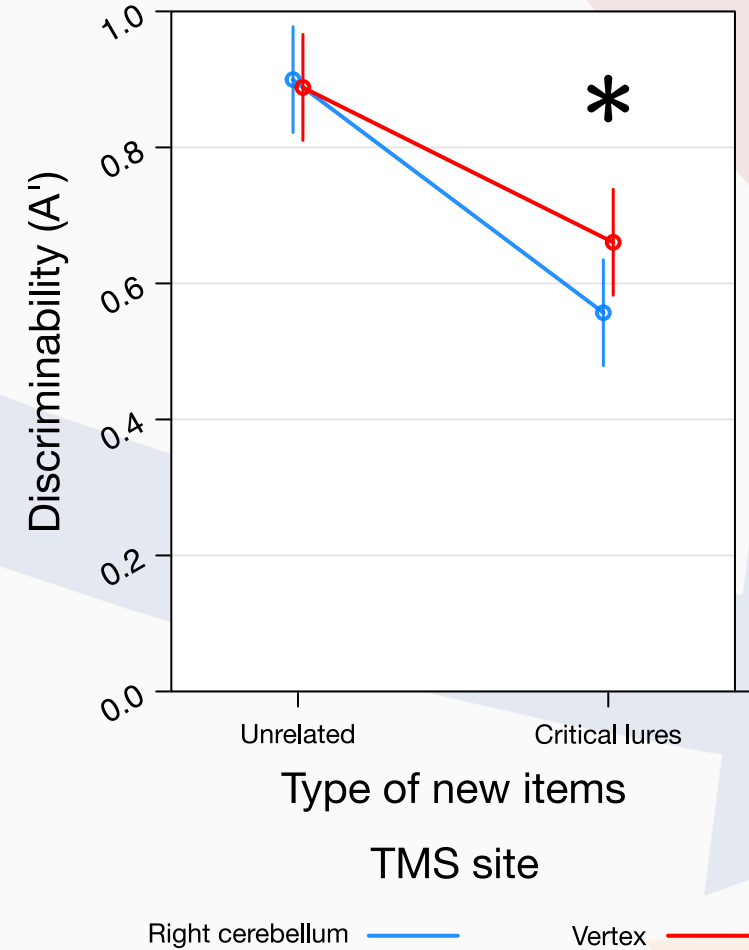
## Experiment 1 – Results and discussion

- Dependent variable:  $A'$
- Lower discriminability during right cerebellar TMS for critical lures



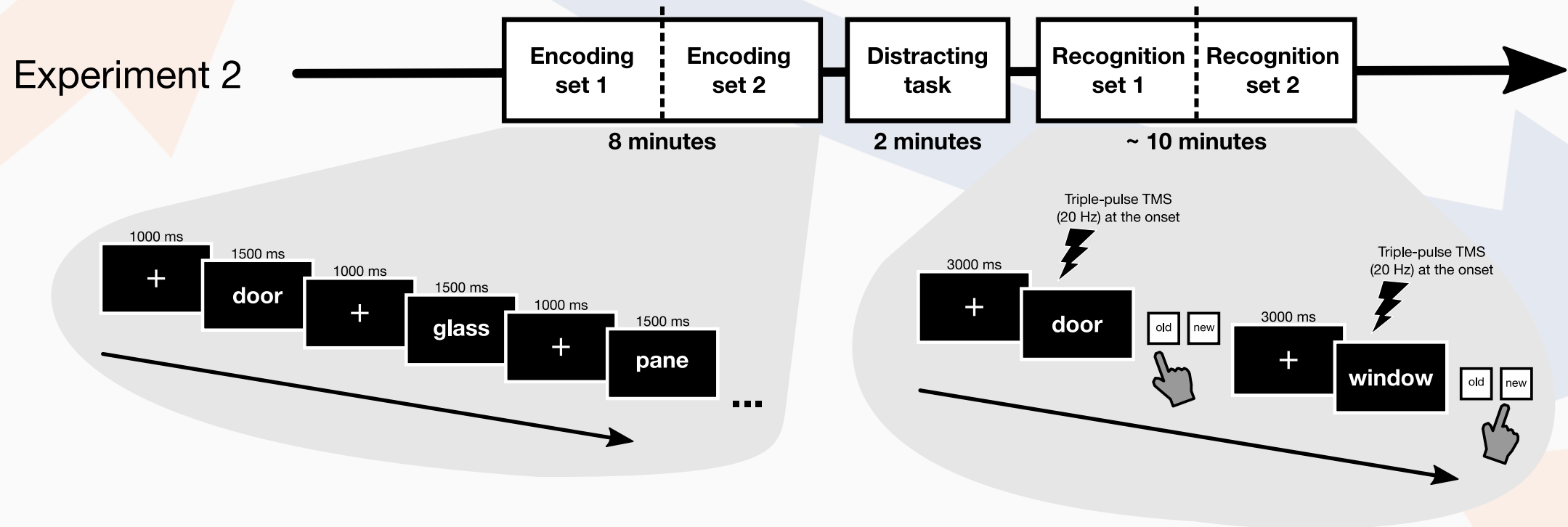
## Experiment 1 – Results and discussion

- Dependent variable:  $A'$
- Lower discriminability during right cerebellar TMS for critical lures
- Increased false memory



## Experiment 2 – Method

- 32 participants
- DRM task in one session



## Experiment 2 – Method

### **FUMO (SMOKE)**

Pipa (Pipe)

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**Puzza (Stink)**

**Accendere (To Light)**

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Distributional semantics

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### Distributional semantics

- Similar words occur in similar contexts
- The meaning of a word is its use in the language

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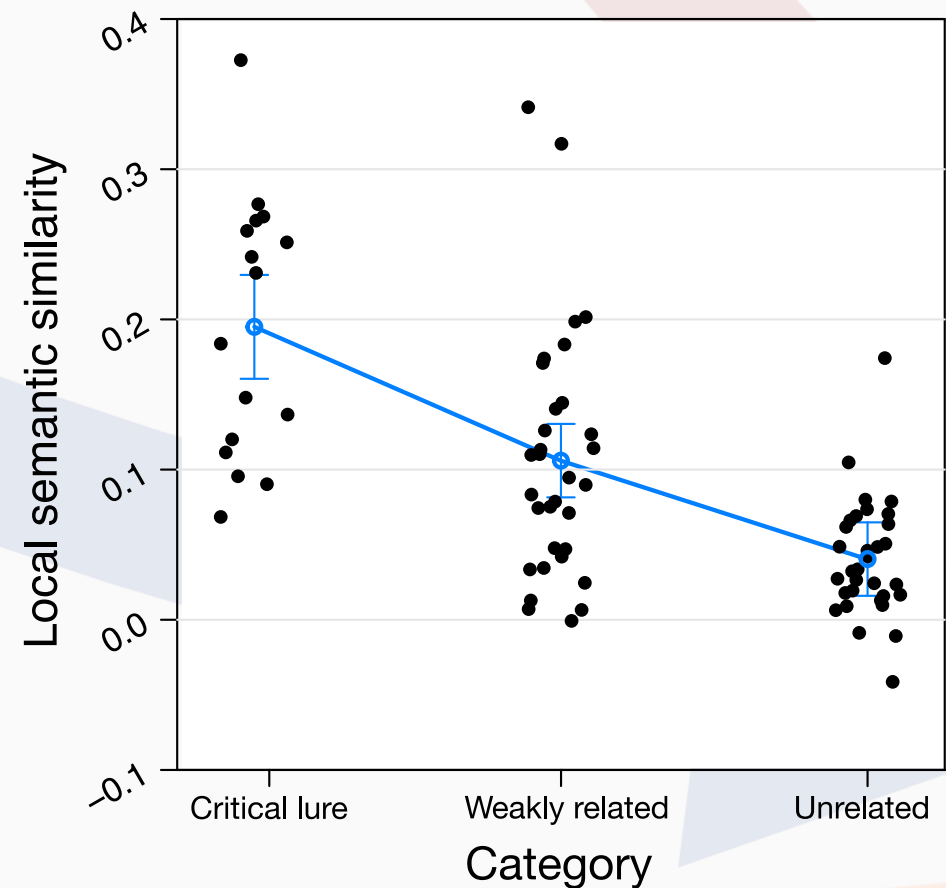
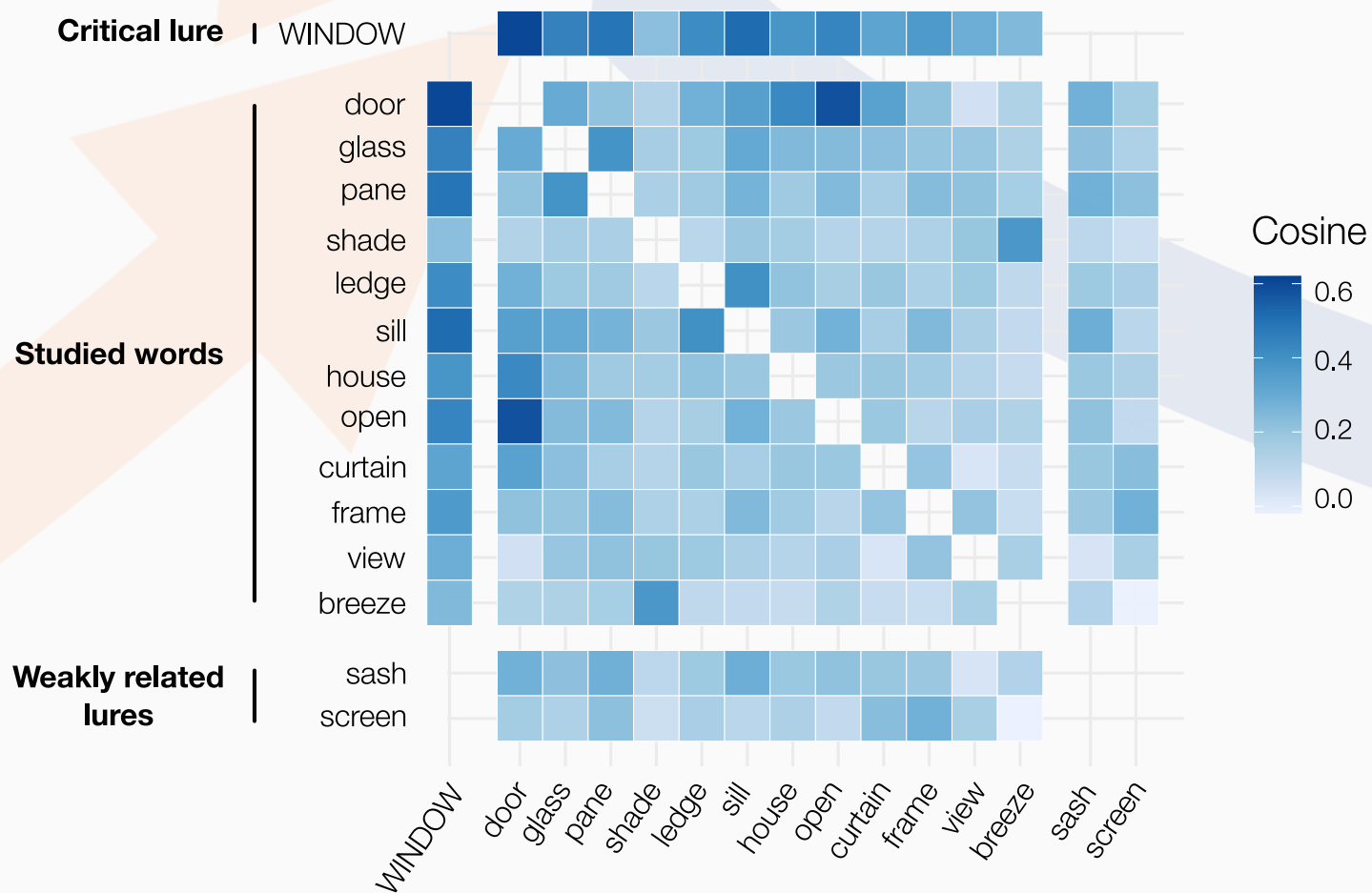


- Based on associative memory processes

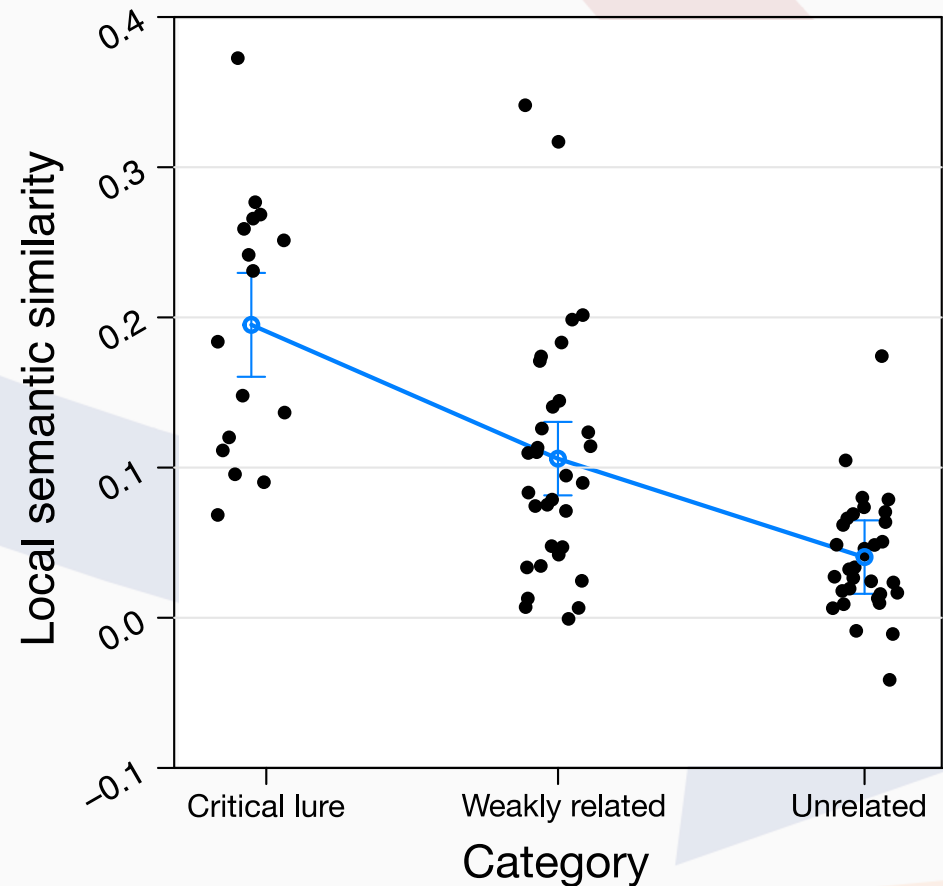
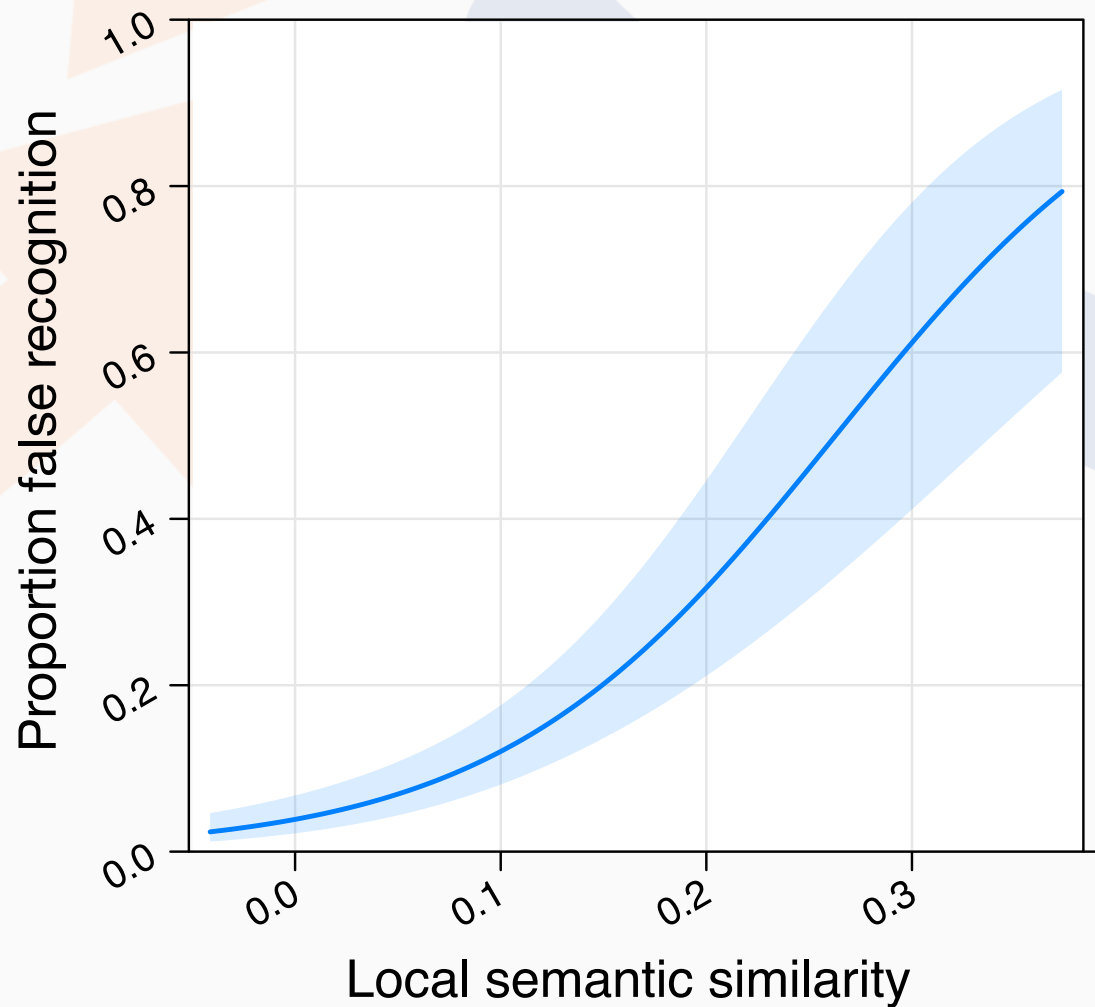




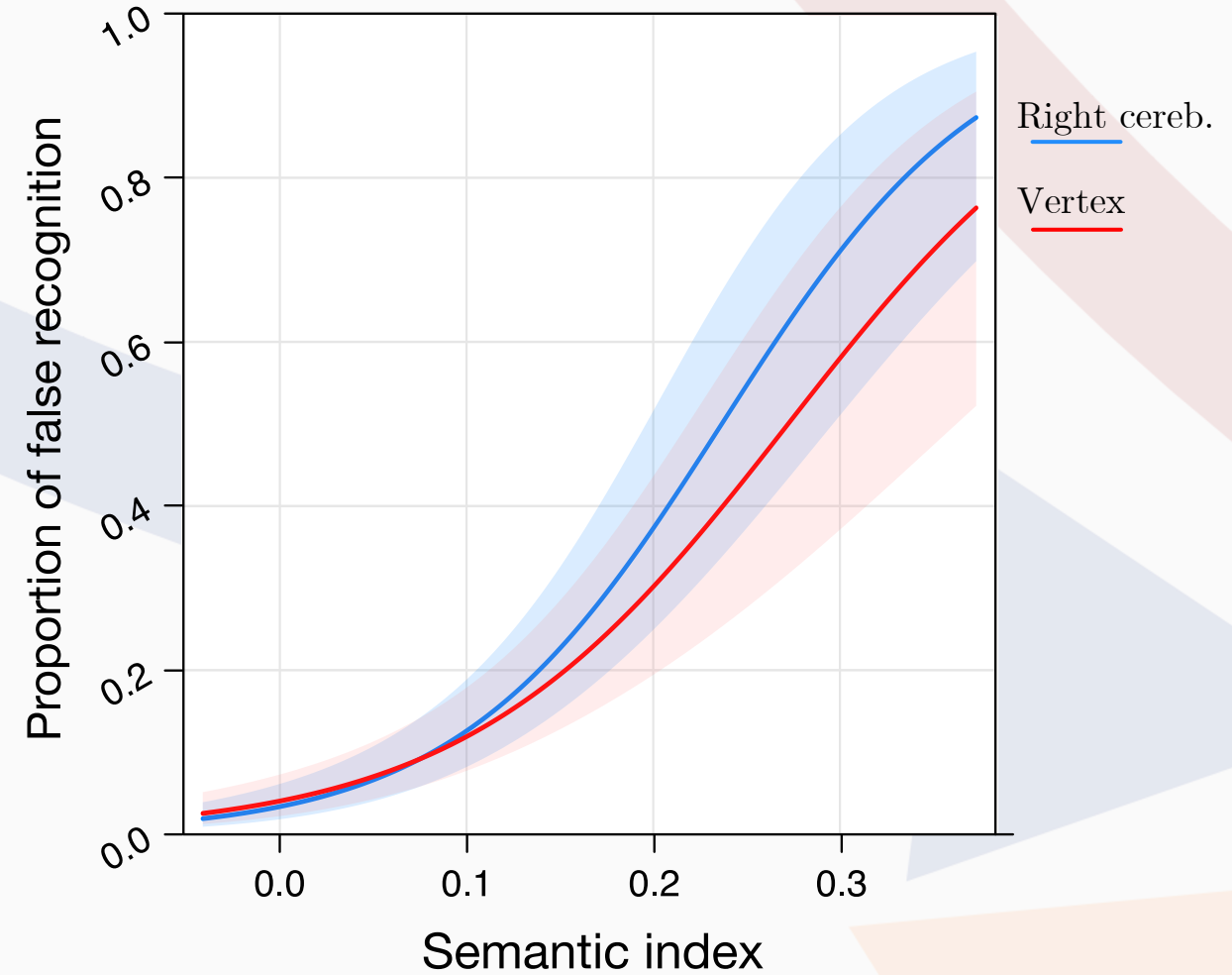
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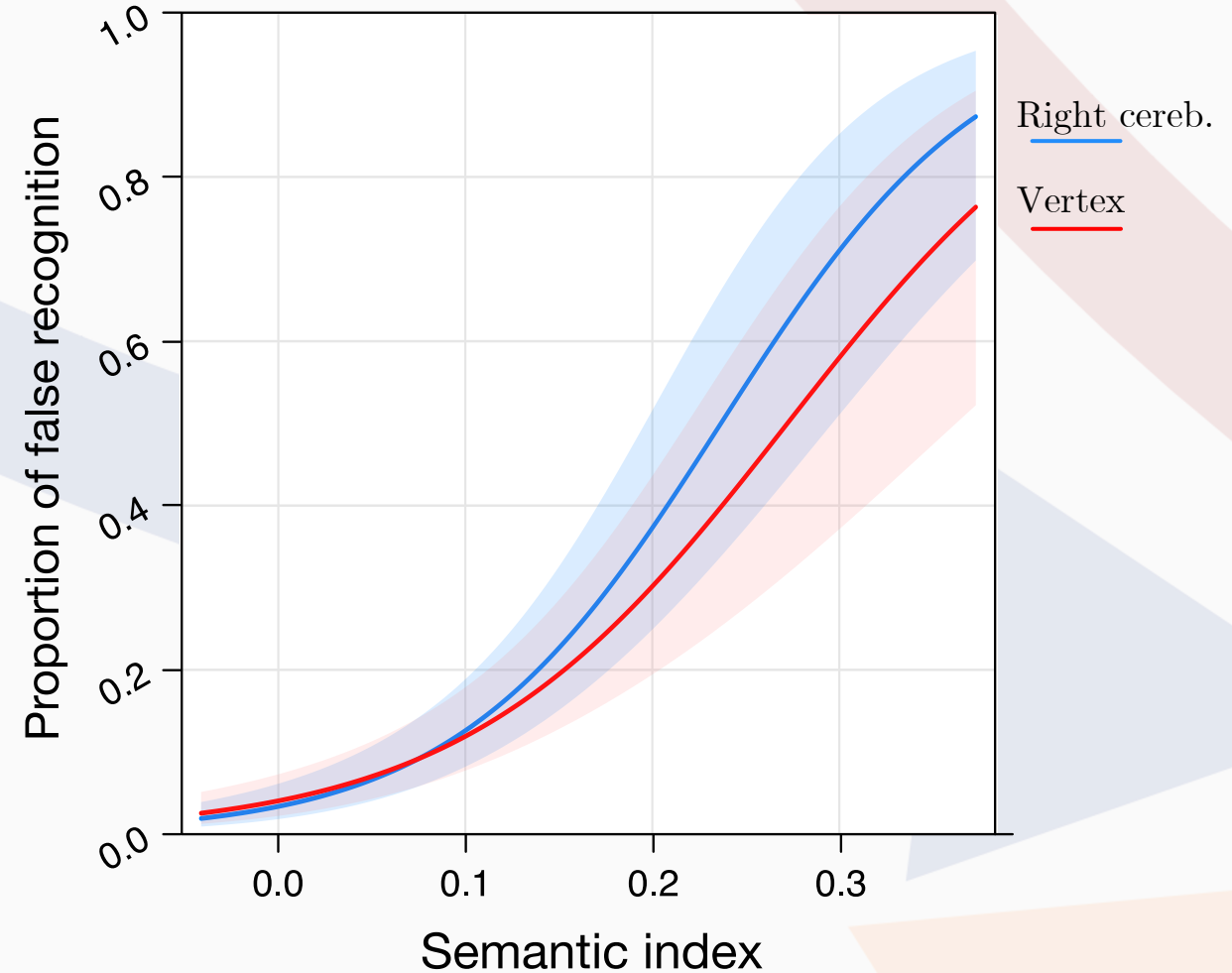


## Experiment 2 – Results and discussion



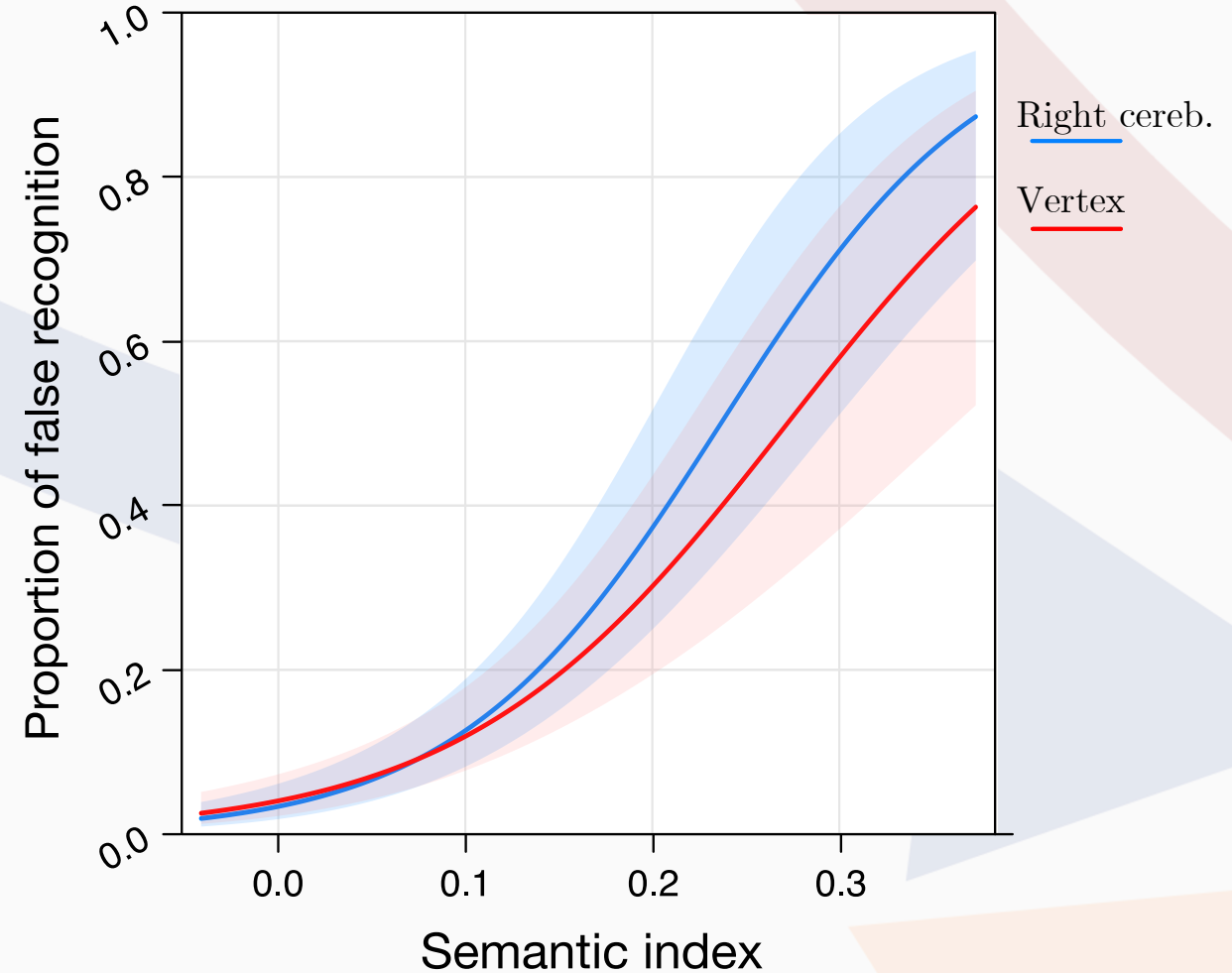
## Experiment 2 – Results and discussion

- The higher semantic index, the higher false memory during right cerebellar TMS



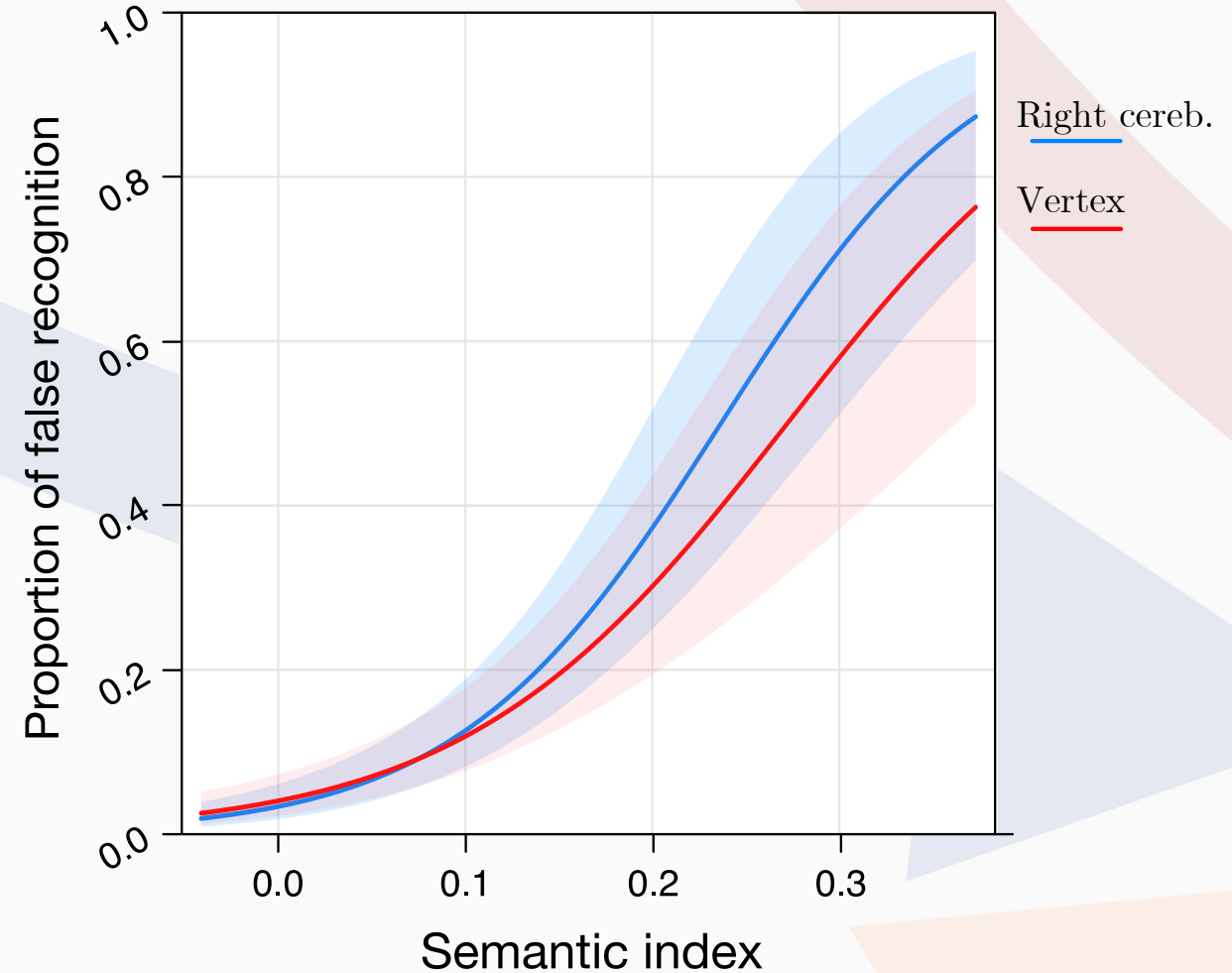
## Experiment 2 – Results and discussion

- The higher semantic index, the higher false memory during right cerebellar TMS
- Cerebellar involvement follows a continuous gradient



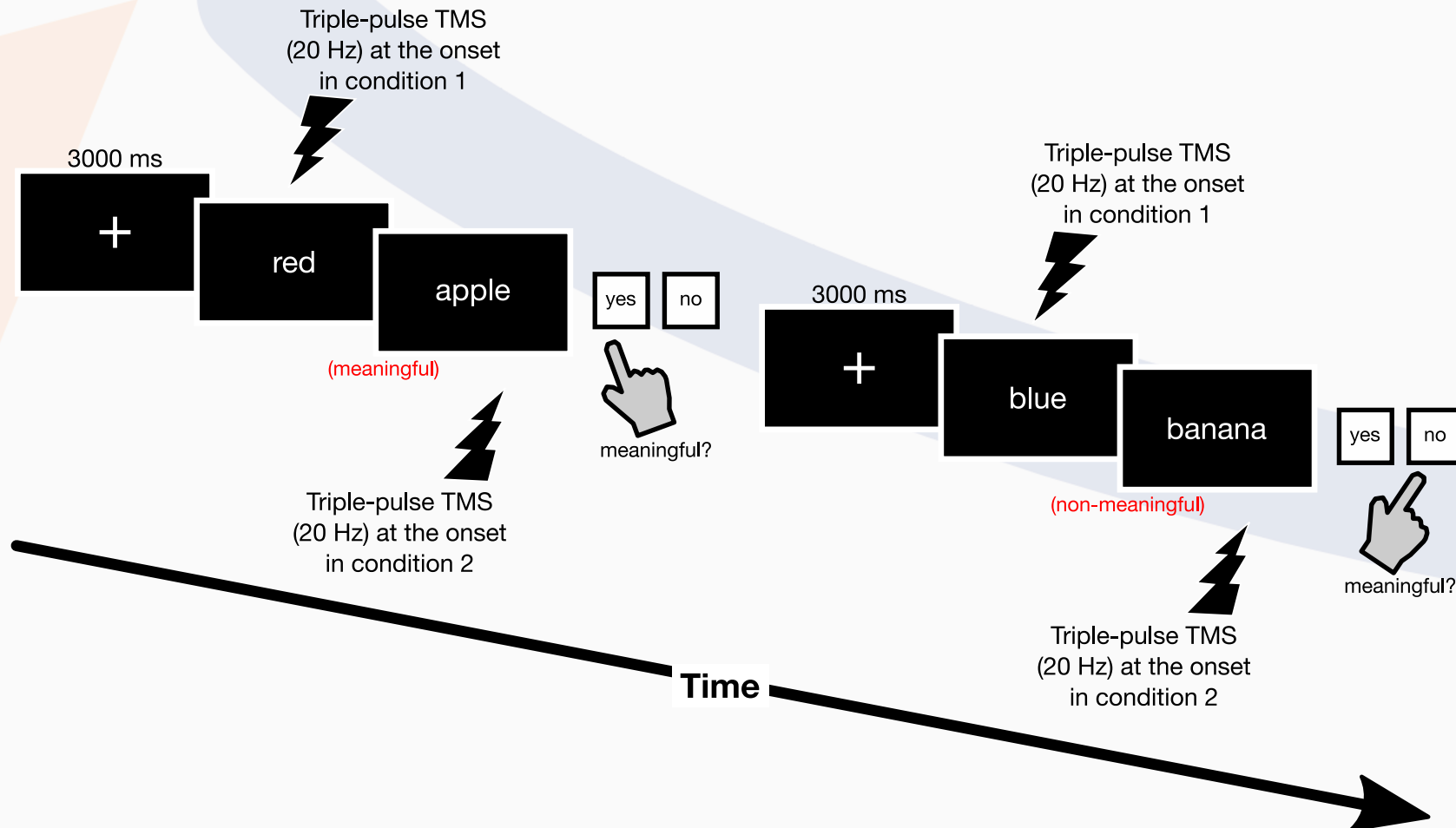
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- The higher semantic index, the higher false memory during right cerebellar TMS
- Cerebellar involvement follows a continuous gradient
- Associative processes

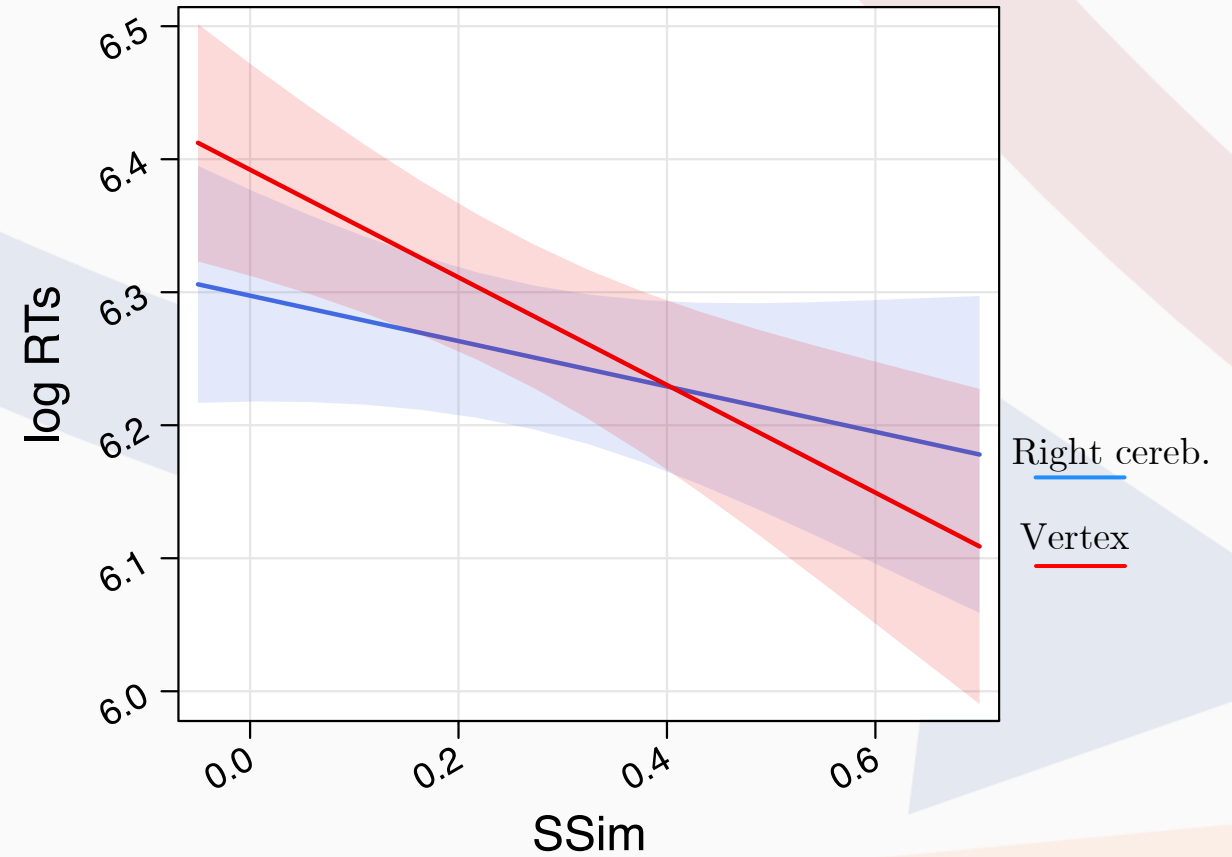


## Experiment 3 – Method

- 40 participants across two conditions



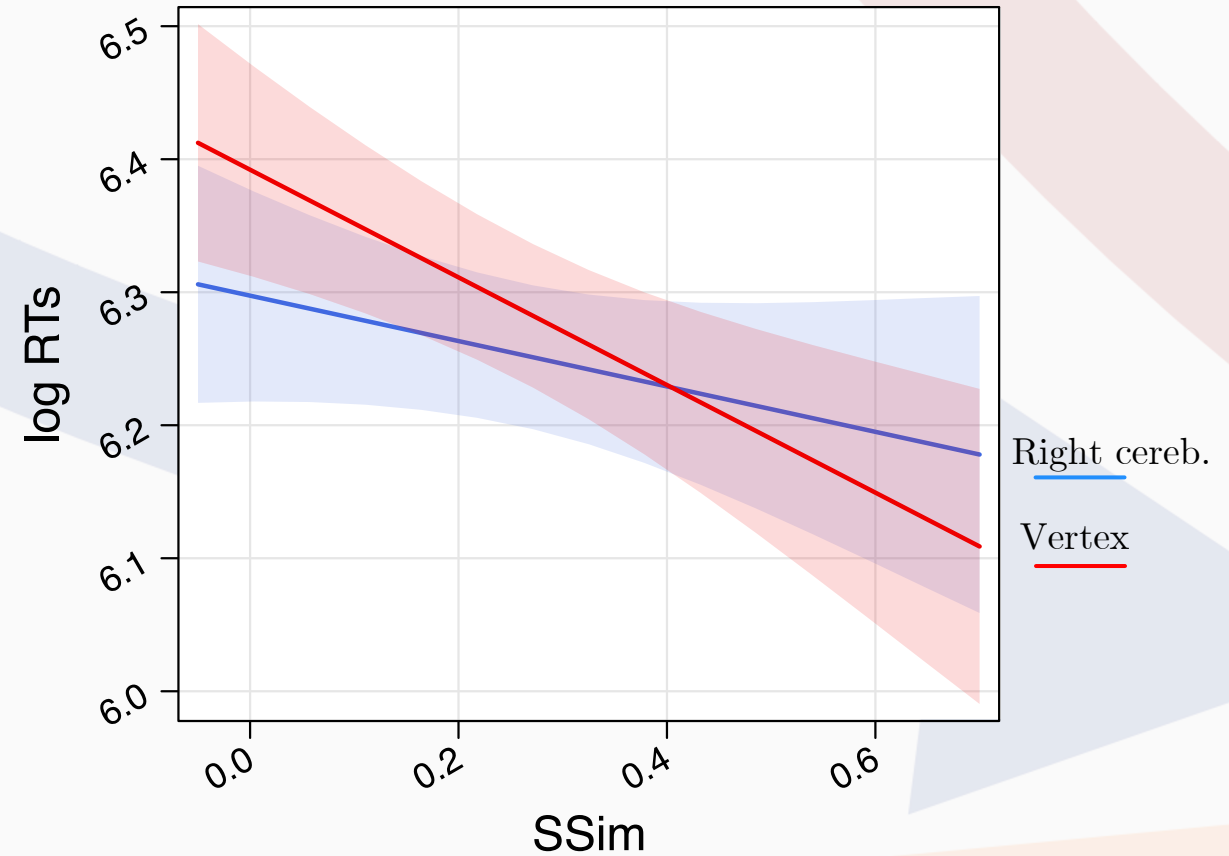
## Experiment 3 – Results and Discussion





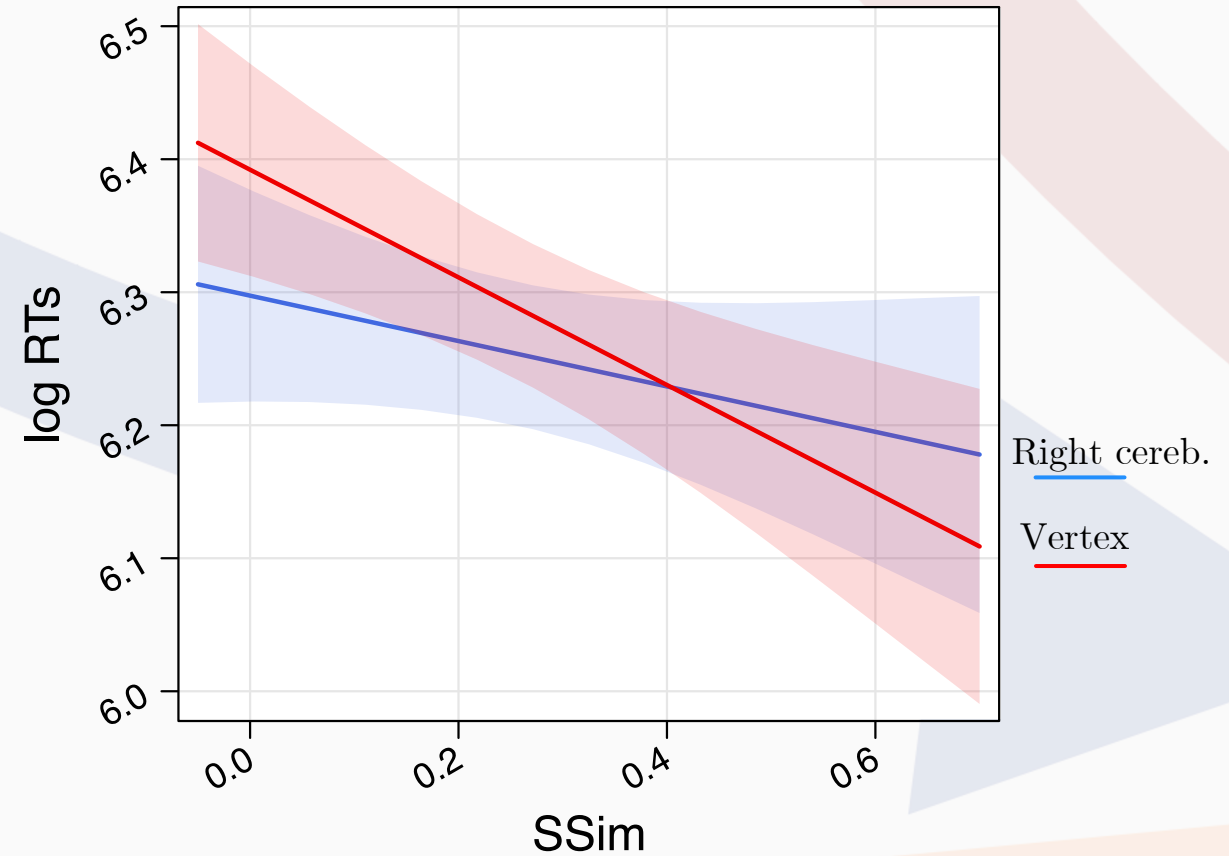
## Experiment 3 – Results and Discussion

- Cerebellar TMS impairs participants' reliance on semantic memory



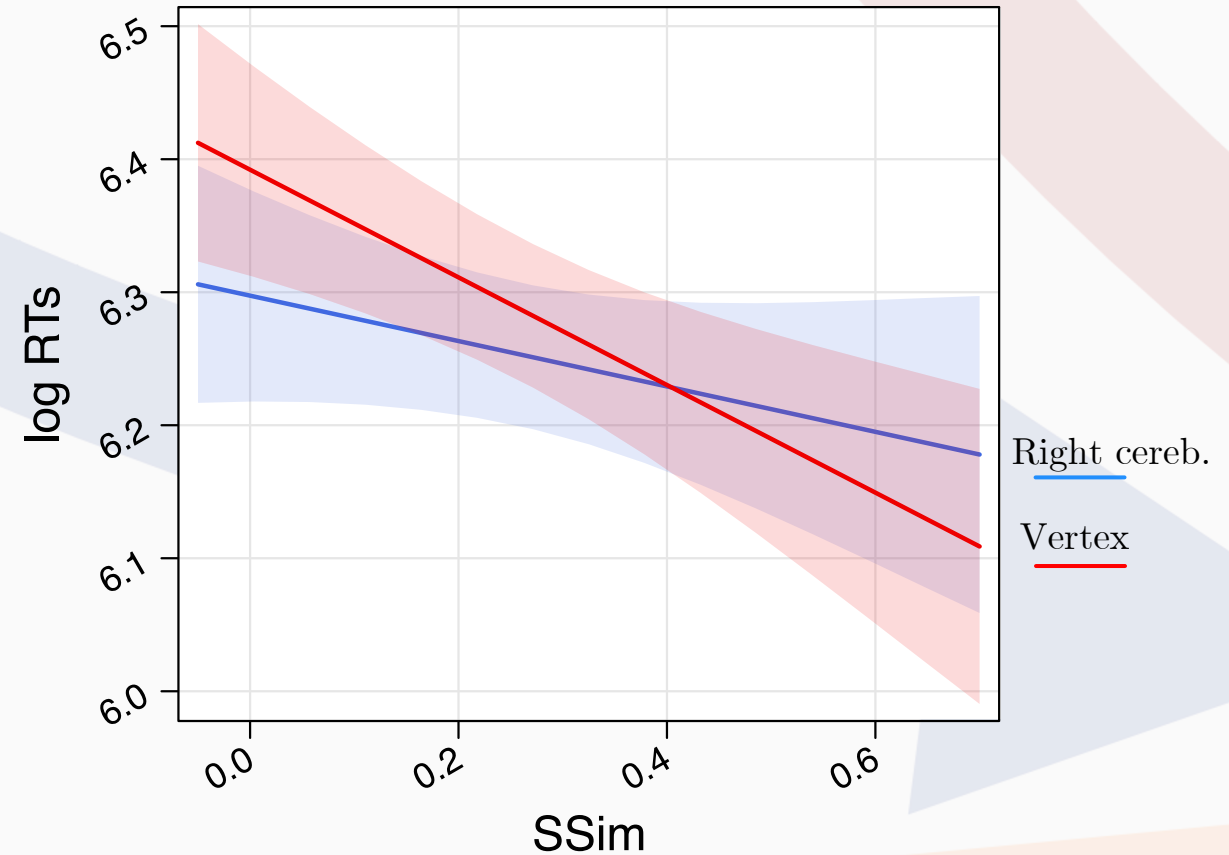
## Experiment 3 – Results and Discussion

- Cerebellar TMS impairs participants' reliance on semantic memory
- TMS timing not relevant



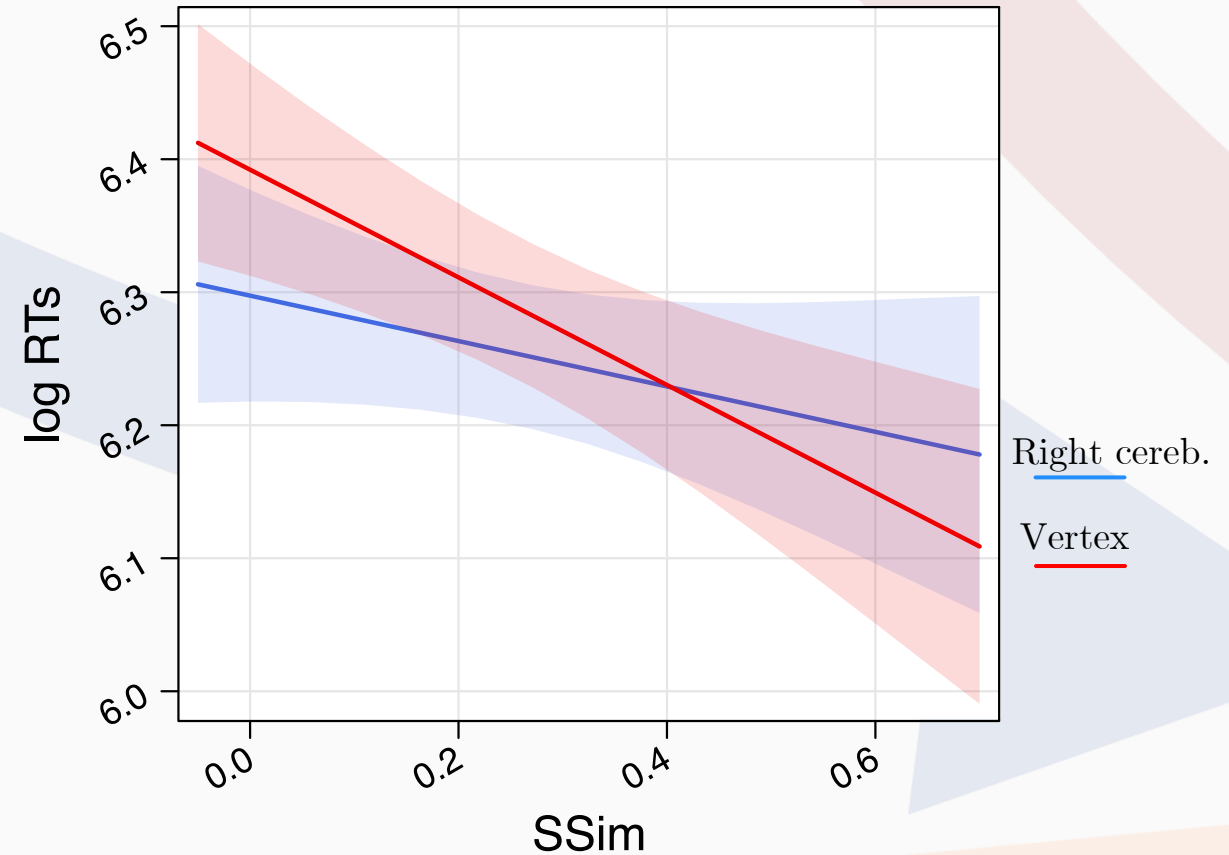
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- Cerebellar involvement in predictive processes



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- Cerebellar involvement in predictive processes
- Associative processes



## General discussion

- False memory production

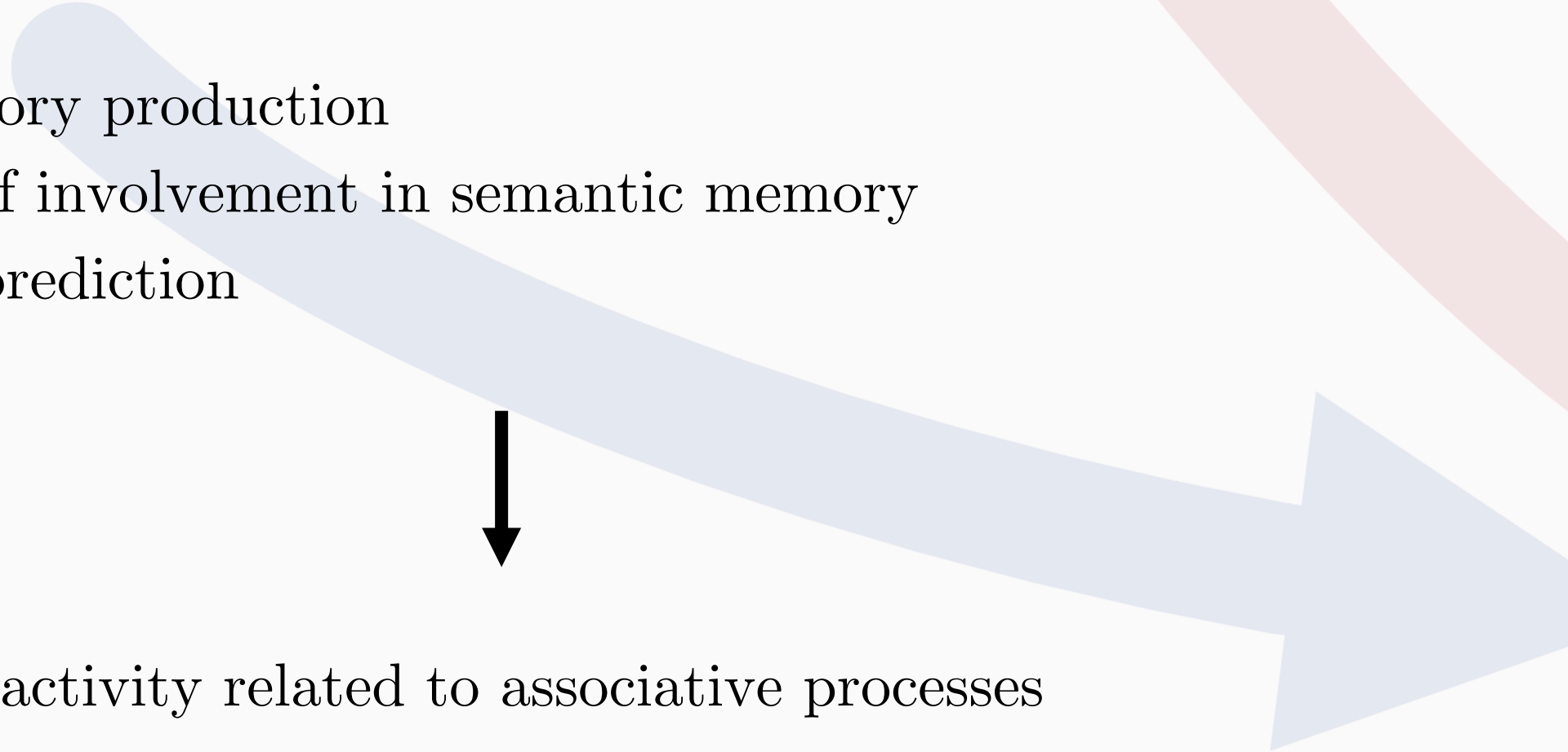

## General discussion

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- Gradient of involvement in semantic memory

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- 
- 
- Cerebellar activity related to associative processes





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DI PAVIA



Grazie per l'attenzione

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