

# The impact of spatial and verbal working memory load on semantic relatedness judgements

Dmytro Khanzhyn<sup>1</sup>, Walter van Heuven<sup>2</sup>, Karolina Rataj<sup>1</sup>

<sup>1</sup> Adam Mickiewicz University in Poznan, Poland

<sup>2</sup> University of Nottingham, United Kingdom

## Introduction

- The ability of high-order executive functions to influence semantic processing has been investigated in a number of studies using lexical decision tasks with related and unrelated word primes and manipulating working memory (WM) load (Heyman et al., 2015; Heyman et al., 2017). However, the results of these studies have been mixed.
- The semantic relatedness judgement task is more natural and involves more extensive meaning processing than the lexical decision task (Balota & Paul, 1996). Several studies that used indirectly related pairs in a relatedness judgement task have also found mixed results (Kuperberg et al., 2008; Ortu et al. 2014). However, these studies did not investigate the impact of WM.
- The present study uses a relatedness judgement task to investigate the impact of WM load and the type of WM task on directly related, indirectly related and unrelated pairs.

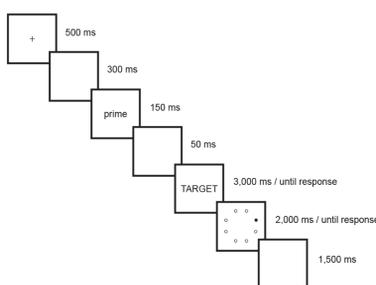
### Hypotheses:

- WM load will have an effect on relatedness judgements for directly and indirectly related pairs
- Indirectly related pairs will be particularly sensitive to the WM manipulation due to weaker semantic links between the words
- Verbal WM task will have a larger effect on relatedness judgements than the spatial WM task

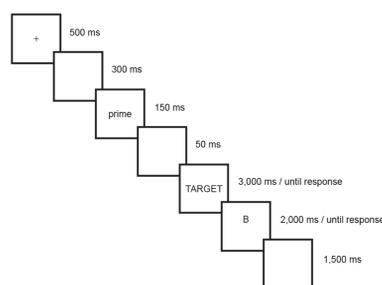
## Methods

### Experiment

- 66 native Polish speakers
- dual task: semantic relatedness judgement task combined with a WM task in each trial
- 216 Polish word triplets with target words preceded by directly related (e.g., thigh – KNEE), indirectly related (e.g., fist – KNEE) or unrelated (e.g., office – KNEE) words
- WM task (within subject): spatial vs. verbal (2 sessions)
- WM load (within subject): low (1-back task) vs. high (2-back task)



A spatial WM trial



A verbal WM trial

### Control experiment (no WM task)

- 52 native Polish speakers
- only semantic relatedness judgement task

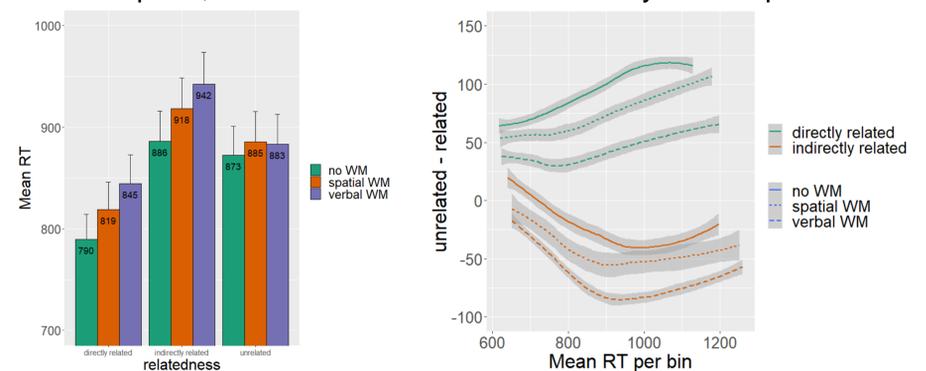
## Results

### Experiment

- Main effect of Relatedness:** facilitation effect for directly related pairs, inhibition effect for indirectly related pairs
- Main effect of Load:** 2-back WM task significantly more demanding than 1-back WM task
- Task x Relatedness interaction:** verbal WM task reduced facilitation effect for directly related pairs and enhanced inhibition effect for indirectly related pairs as compared to spatial WM task.
- No 3-way interaction between Task, Load and Relatedness

### Control experiment (no WM task)

- Main effect of Relatedness:** only facilitation effect for directly related pairs, no inhibition effect for indirectly related pairs



Left panel shows mean response times depending on WM task type (collapsed over WM load). Right panel shows differences between reaction times to unrelated and related words as a function of quantile (.1, .2, ..., .9), WM task type and relatedness.

## Discussion

- Verbal WM task impacts relatedness judgement task more than spatial WM task
- Overall effect of WM Load, but no interactions with Relatedness and Task (cf. Heyman et al., 2017)
- Inhibitory effect for targets preceded by indirectly related words (consistent with Kuperberg et al., 2008), which was absent in the control experiment
- Verbal WM task reduces facilitation for directly related words and causes inhibition for indirectly related pairs

## References

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