An interactive activation model of verbal working memory: Simulating psycholinguistic effects

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Introduction

Linguistic knowledge impacts Working Memory (WM) performance

Psycholinguistic effects:

Phonological similarity effect. Phonologically similar vs. dissimilar words

Lexicality. Words vs. nonwords

Lexical frequency. High vs. low frequency words

Neighborhood density. Words drawn from dense vs. sparse lexical neighborhood

Semantic relatedness. Semantically related vs. unrelated words

Imageability. High vs. low imageability words

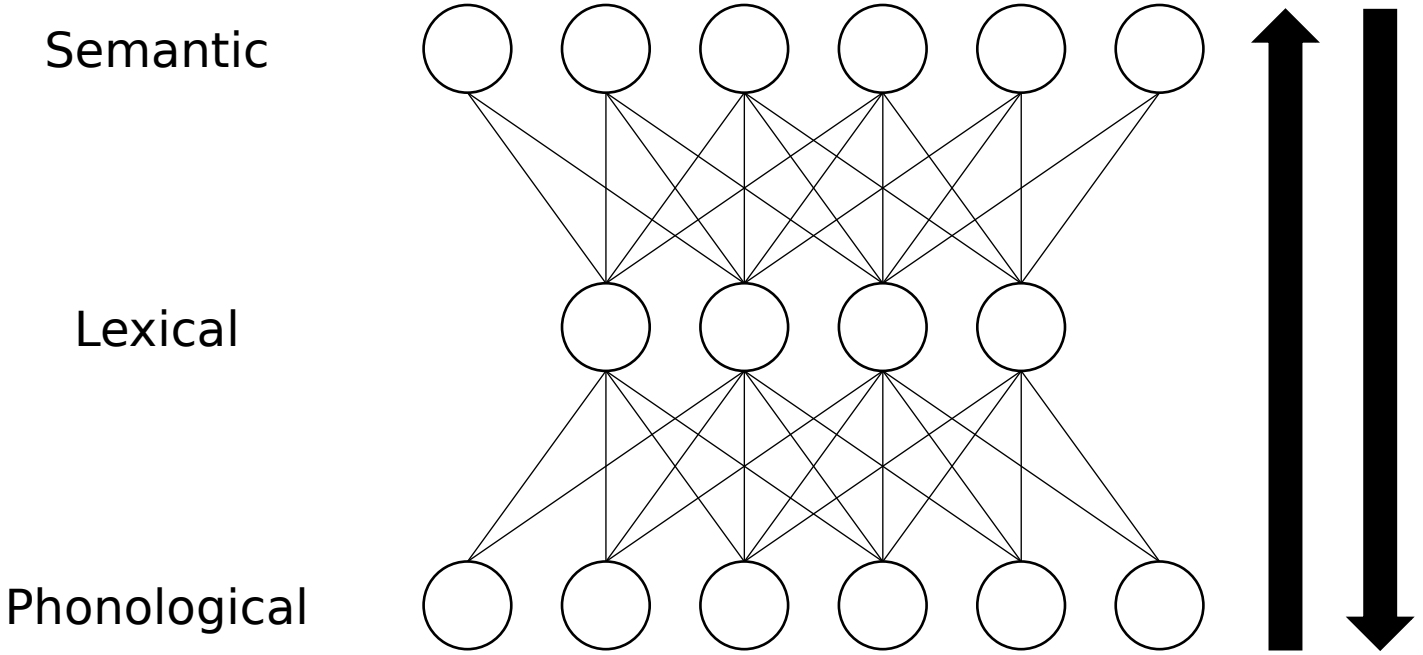
Introduction

These effects are robust **but**:

There currently exists no integrative architecture that explains all these effects at once.

Architecture

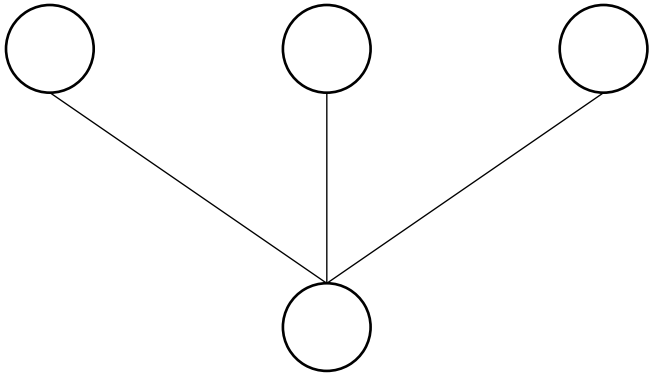
Interactive activation models of language processing.



Dell & et al. (1997)
McClelland & Elman (1981)

Architecture

Semantic

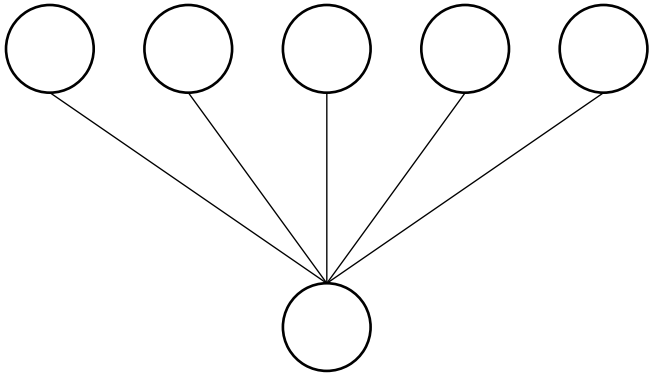


Lexical

Low imageability

Architecture

Semantic

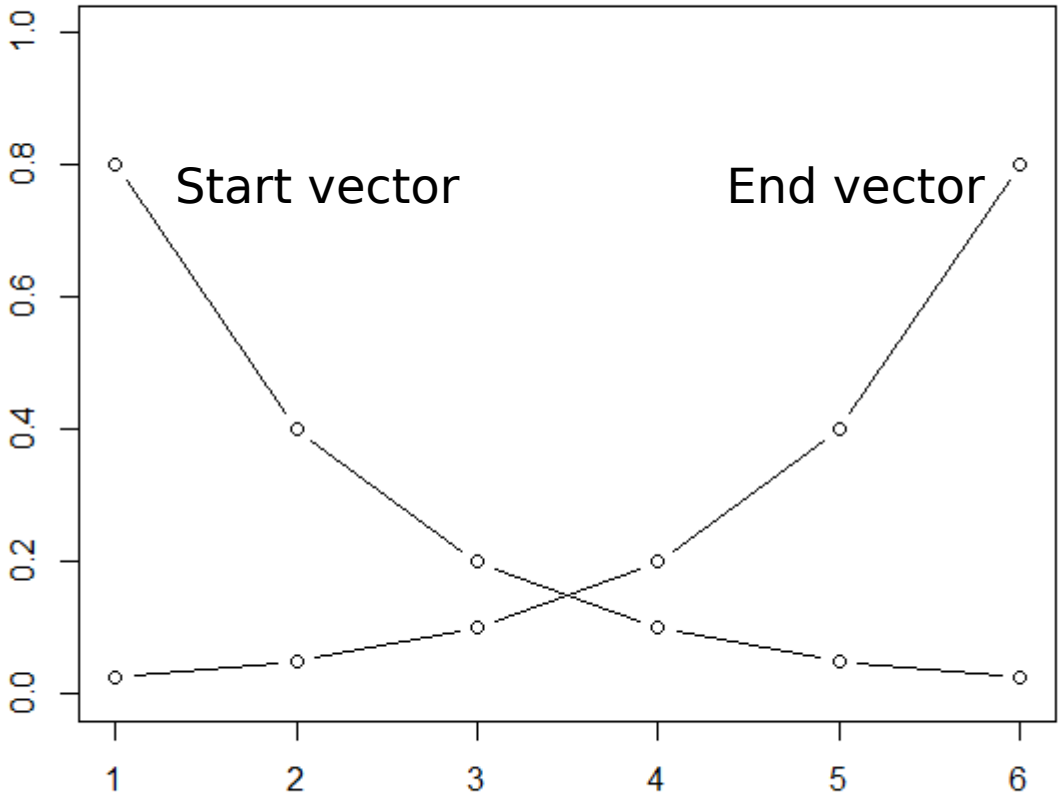


Lexical

High imageability

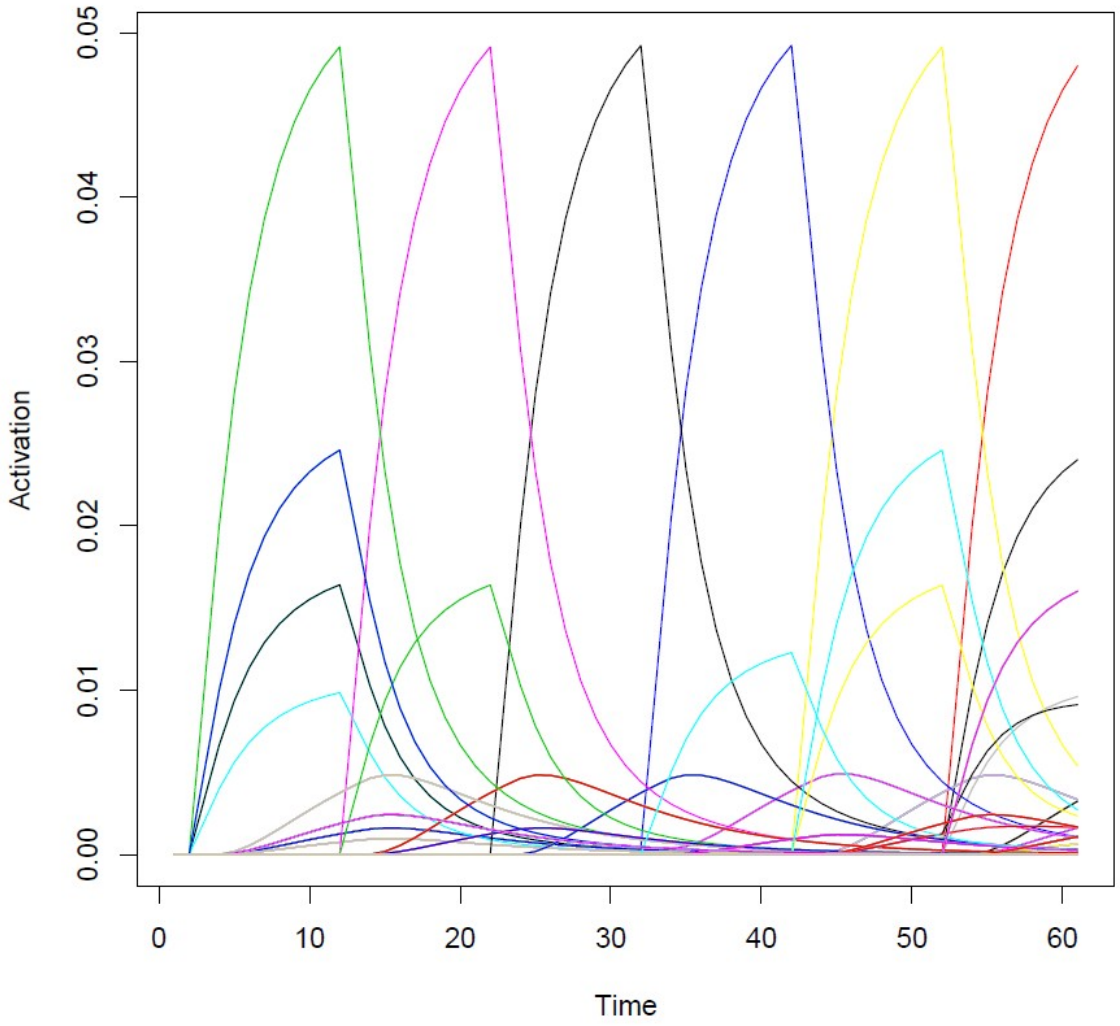
Architecture

The Stard-End Model (SEM)

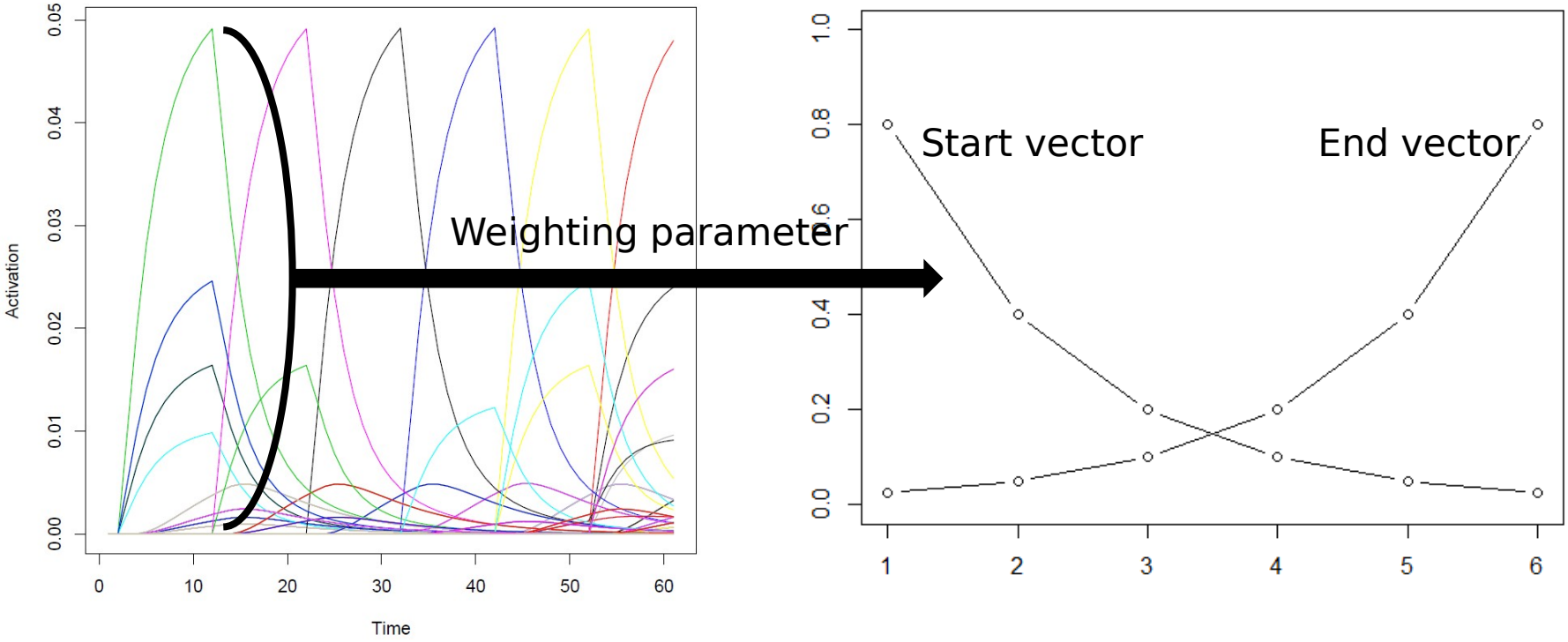


Henson (1998)

Architecture



Architecture



Architecture

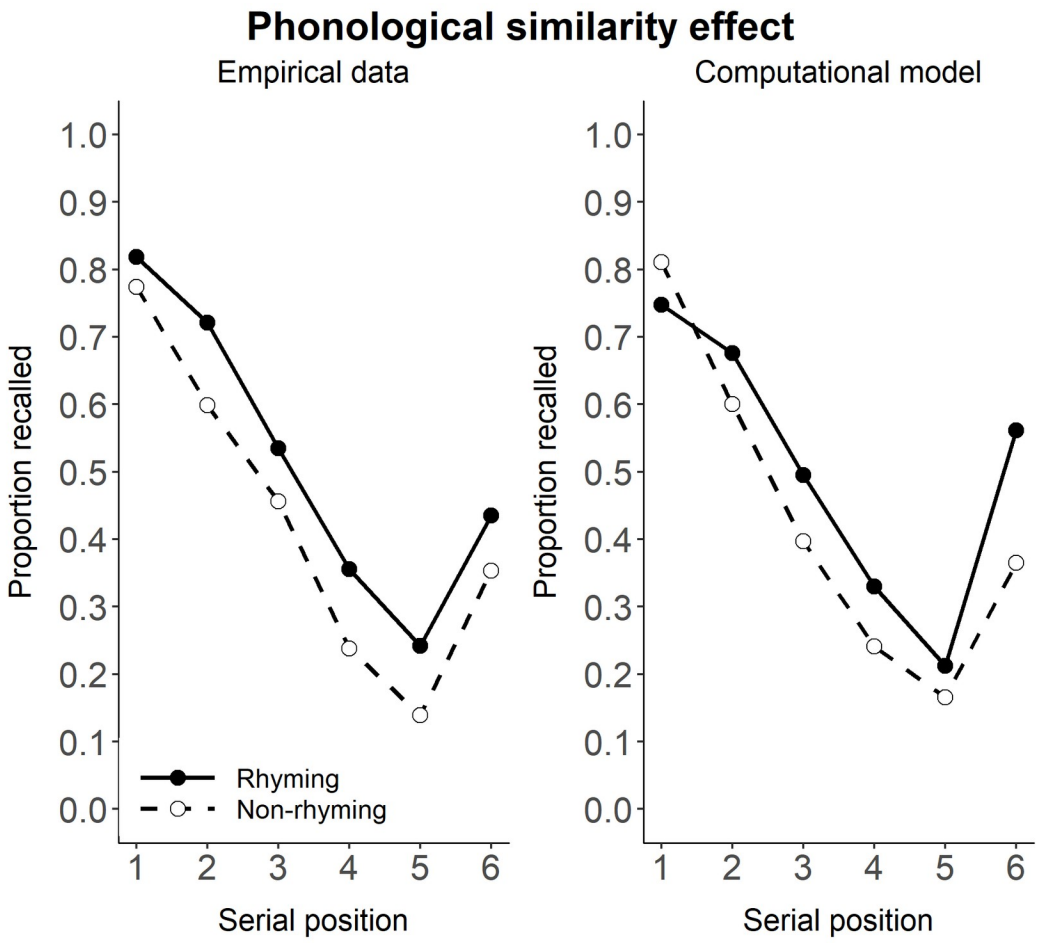
Simulated Annealing

Fitting the SEM model on the “weakest” condition
(e.g. low imageability)

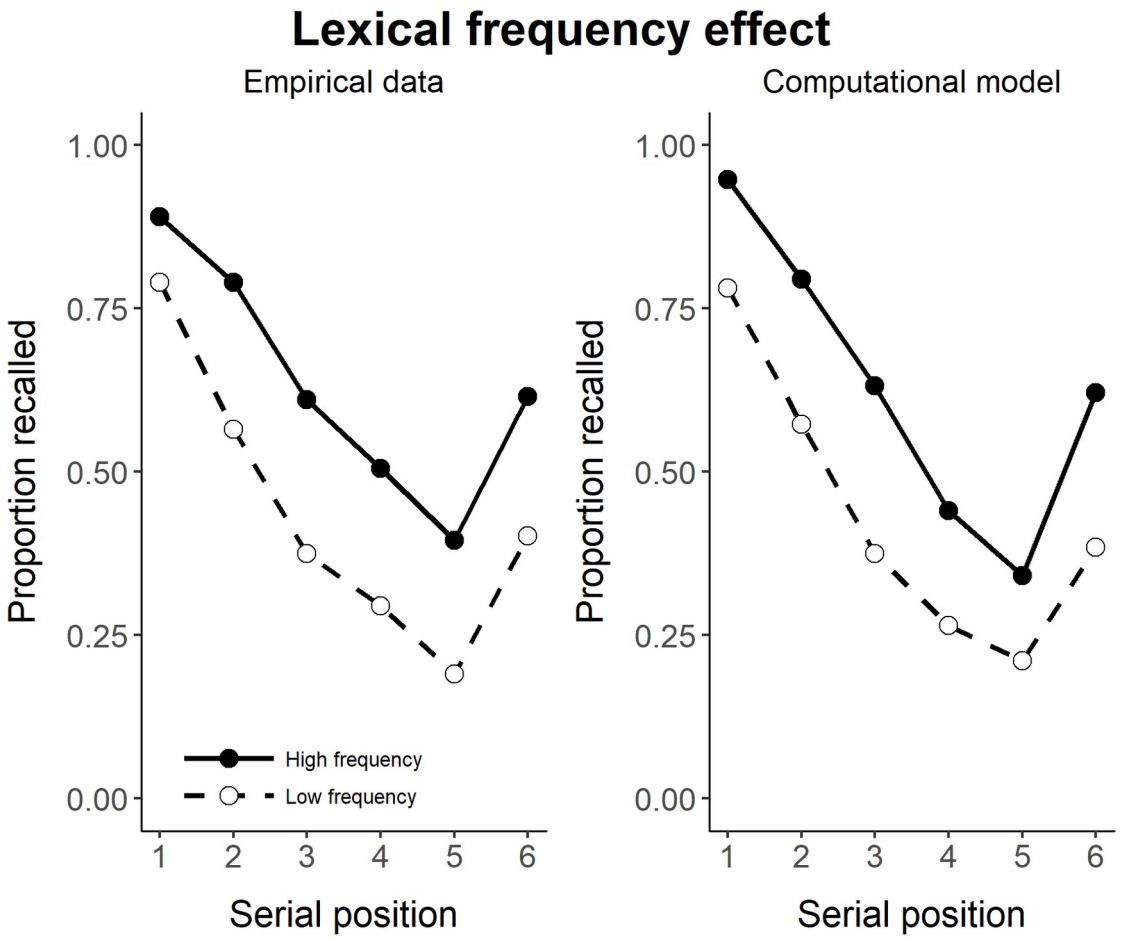
Modulating item’s linguistic properties
(e.g. number of semantic features)

Prediction

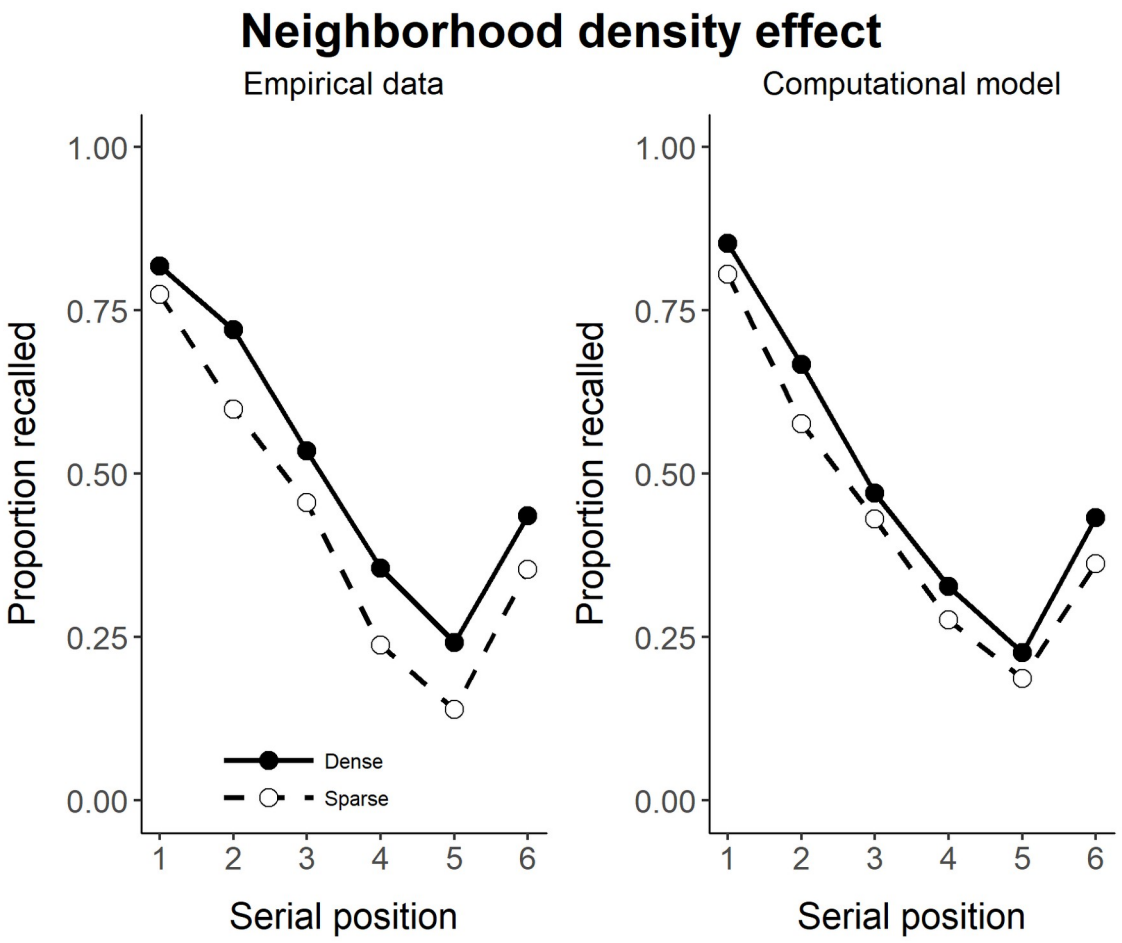
Results


Phonological similarity effect
Empirical data
Computational model
Proportion recalled
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
Serial position
Rhyming
Non-rhyming

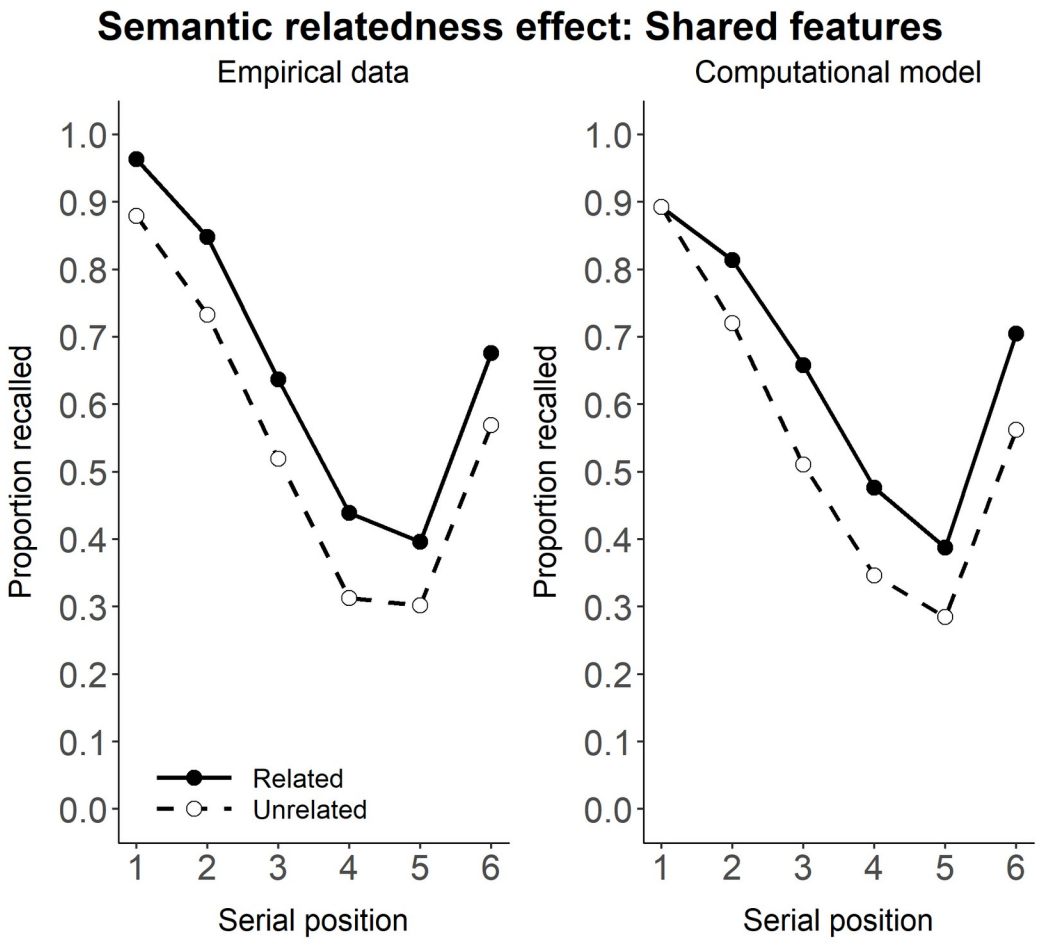
Results


Lexical frequency effect
Empirical data
Computational model
Proportion recalled
1.00
0.75
0.50
0.25
0.00
1
2
3
4
5
6
Serial position
High frequency
Low frequency

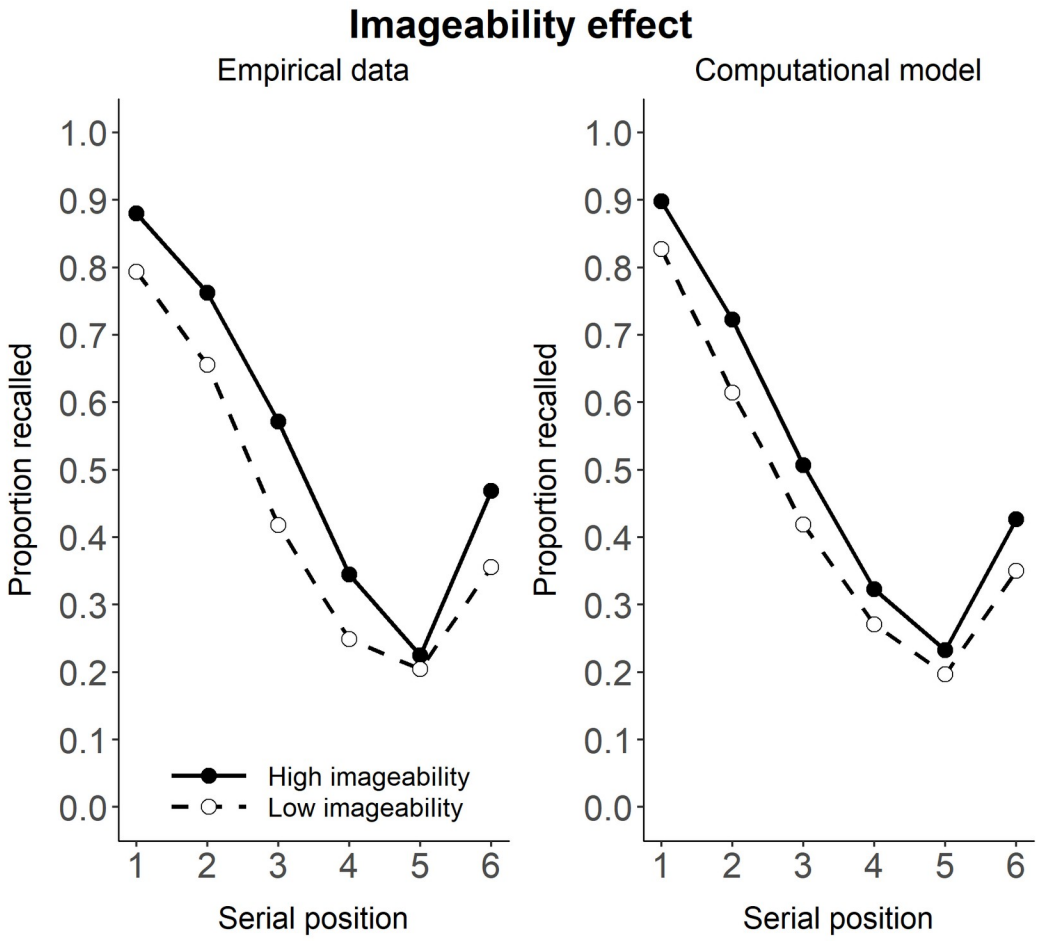
Results


Neighborhood density effect
Empirical data
Computational model
Proportion recalled
1.00
0.75
0.50
0.25
0.00
1
2
3
4
5
6
Serial position
Dense
Sparse

Results


Semantic relatedness effect: Shared features
Empirical data
Computational model
Proportion recalled
Serial position
Related
Unrelated
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6

Results


Imageability effect
Empirical data
Computational model
Proportion recalled
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
2
3
4
5
6
Serial position
High imageability
Low imageability

Results

Lexicality effect?

Requires strong assumptions as regards the way items are represented at the sub-lexical level. This remains unknown.

Conclusion

Interactive activation principles provide a **natural account** to explain the influence of linguistic knowledge on WM performance.

This using the same linguistic architecture.

Thank you for your attention