Neural patterns in linguistic cortices discriminate the content of verbal working memory

Benjamin Kowialiewski[1,2], Laurens Van Calster[1,3], Lucie Attout[1], Christophe Phillips[1,2], Steve Majerus[1,2]

[1] University of Liège, Liège, Belgium
[2] Fund for Scientific Research – F.R.S.-FNRS, Brussels, Belgium
[3] University of Geneva, Geneva, Switzerland

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Introduction

Verbal working memory: temporary maintenance of verbal information

« Recall »

Introduction

Psycholinguistic effects:

Increased recall performance for verbal items associated to richer or more robust linguistic representations.

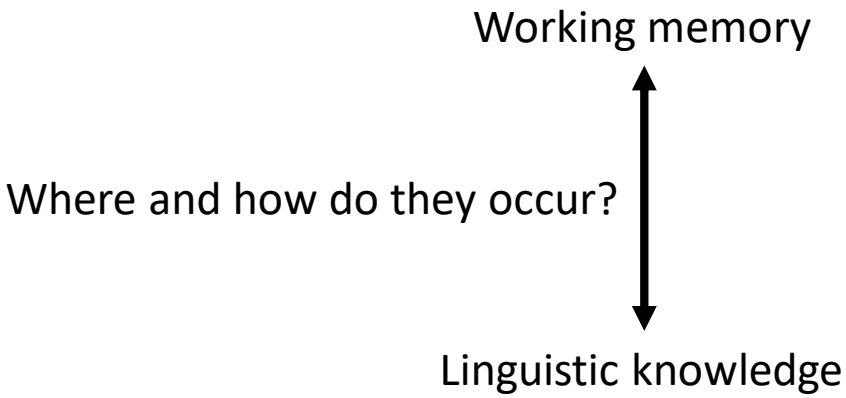
Introduction

Lexicality effect

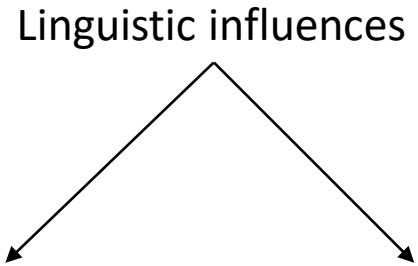
Words muscle – phase – ruche – doute – main

Nonwords mique – zisse – jousse – raibe – fanle

Introduction



Introduction



Encoding

Language-based models of WM
Martin, Saffran & Dell (1996)
Majerus (2013, 2019)

Recall

Reconstruction models of WM
Hulme, Maughan & Brown (1991)
Schweickert (1993)

Introduction

Language-based models: these influences should be observed already at the moment of encoding.

Reconstruction models: these influences should NOT be observed at this stage.

Procedure

Procedure

N = 29

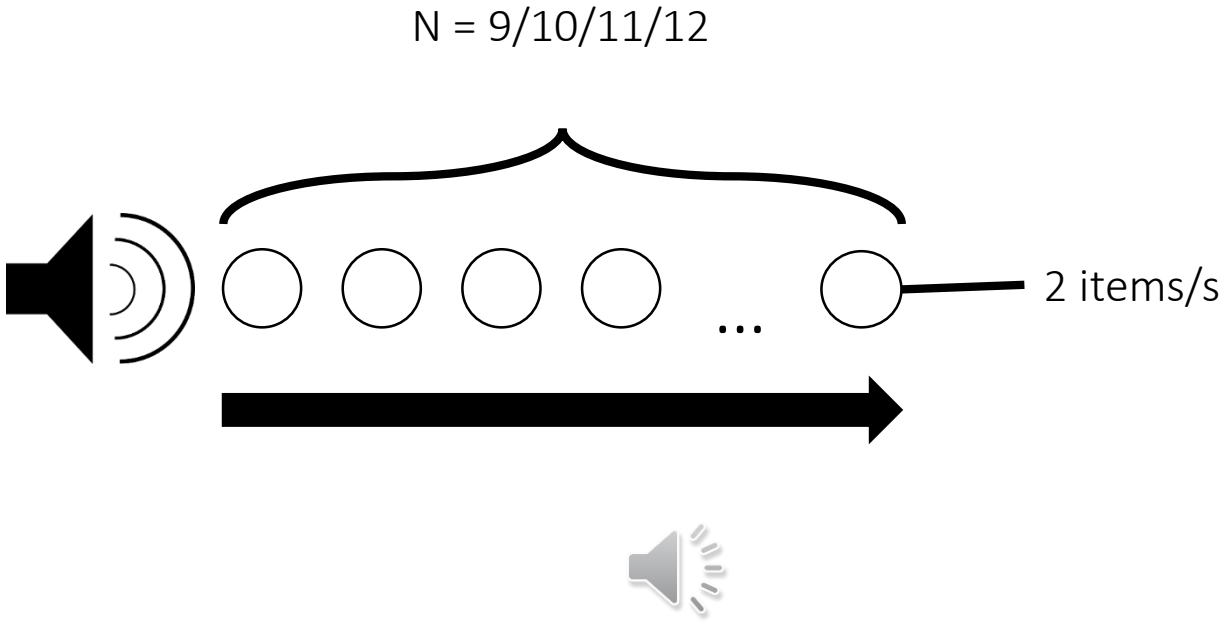
3 Tesla MRI scan

LIÈGE université
GIGA institute

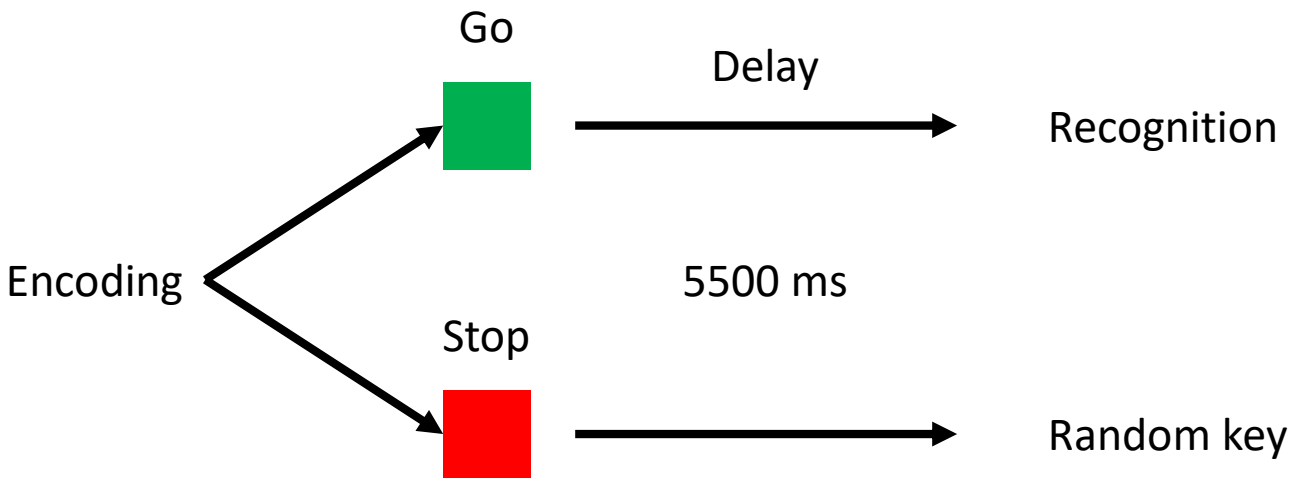
Cyclotron
research centre

Procedure

Encoding conditions minimizing the opportunity to use reconstruction mechanisms.

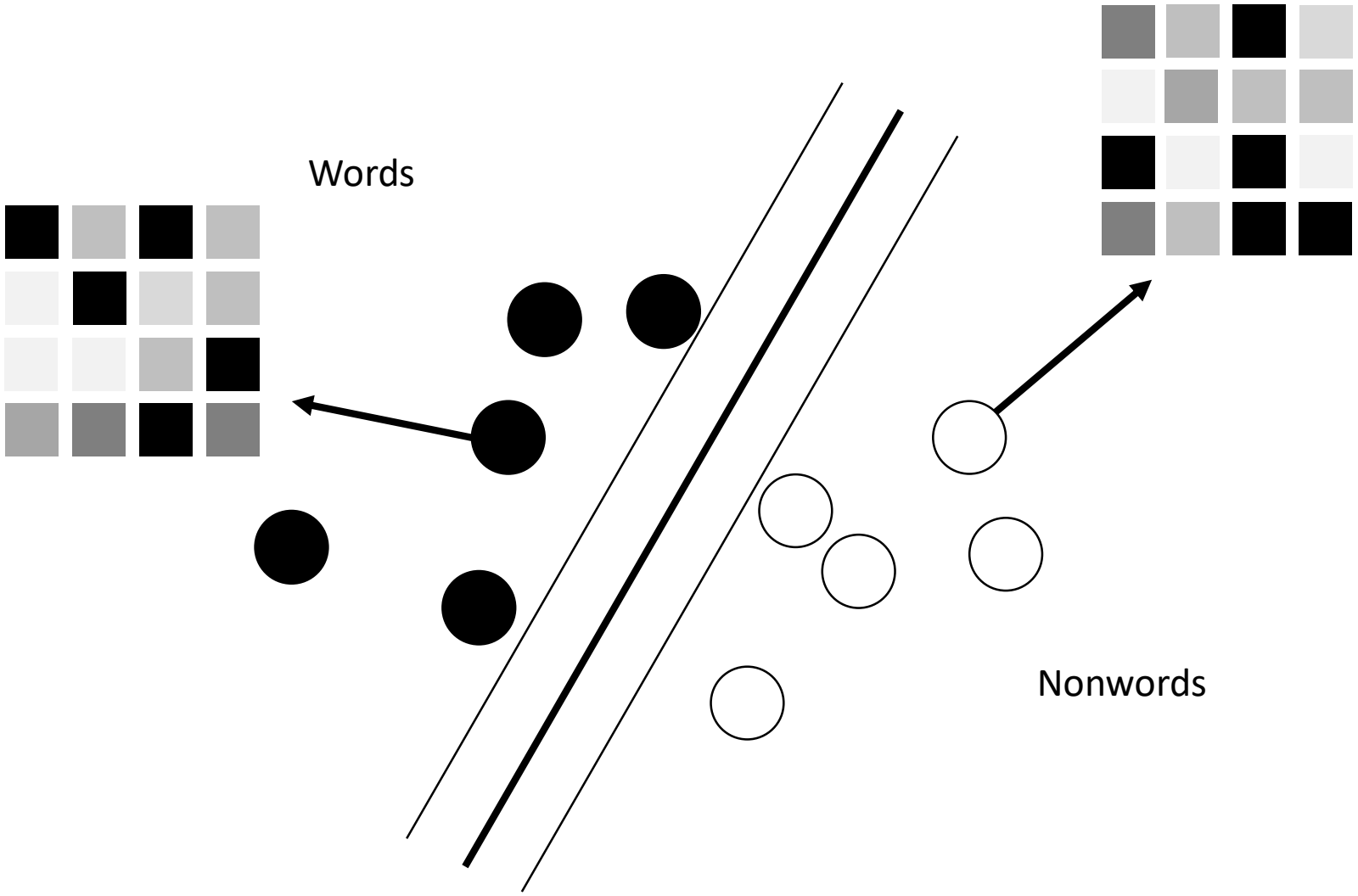


Procedure



Support vector machine

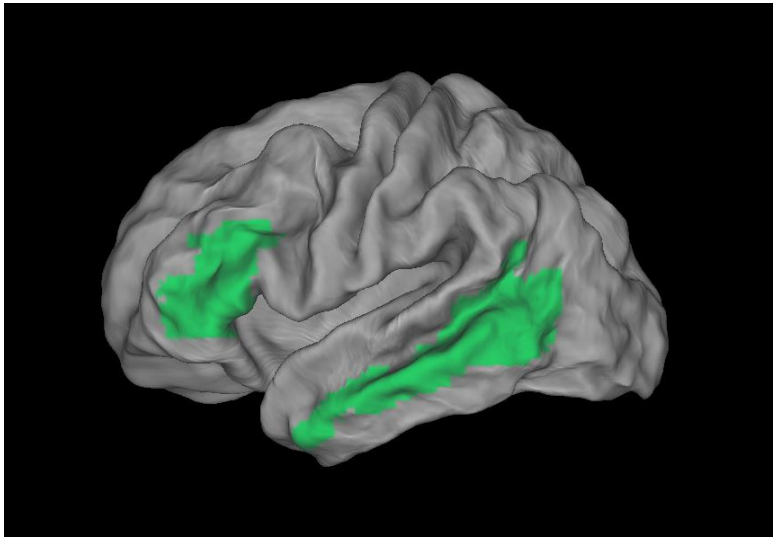
Leave-one-out cross-validation procedure



Results

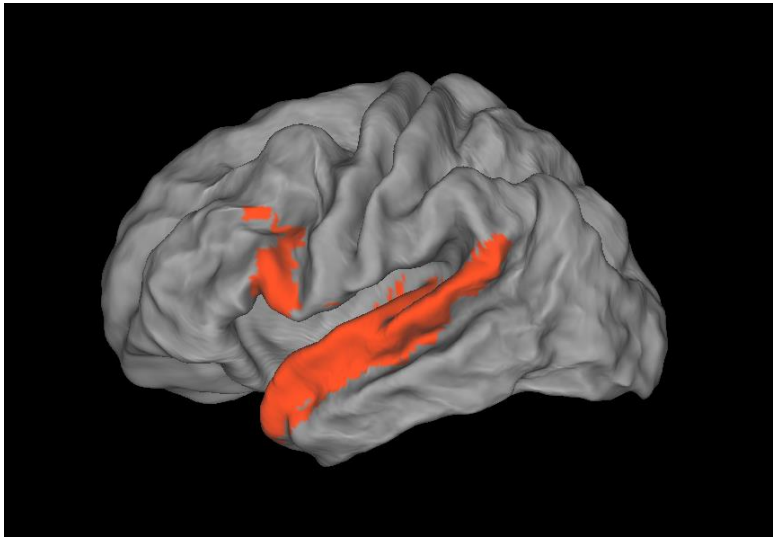
Ventral language pathway

Semantic processing



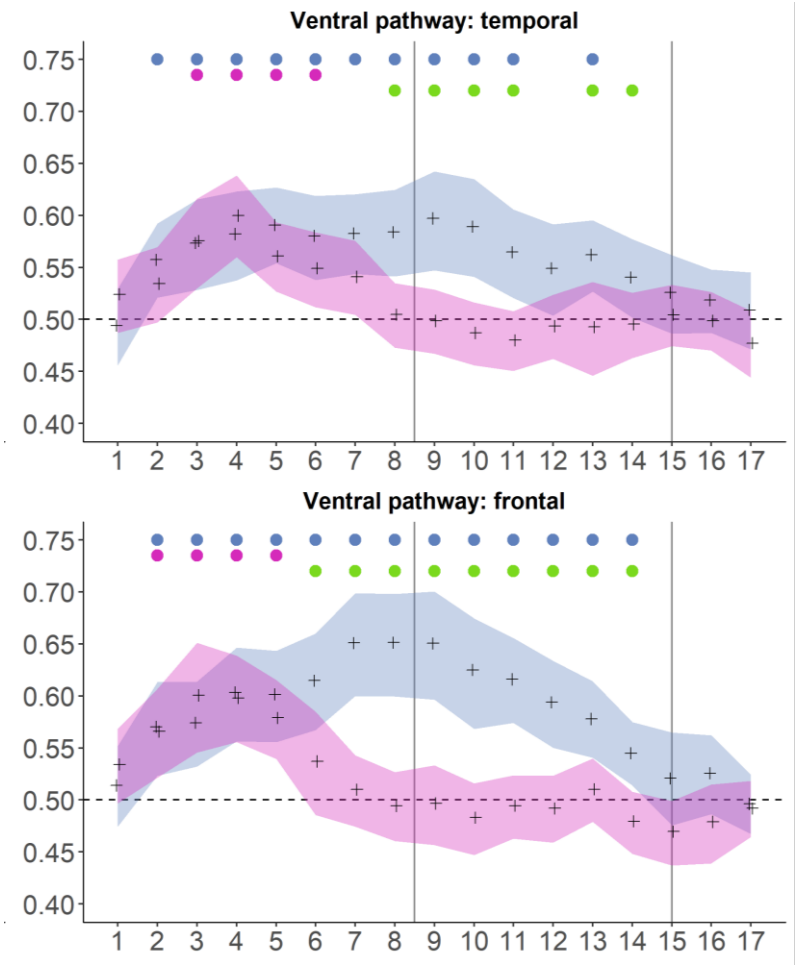
Dorsal language pathway

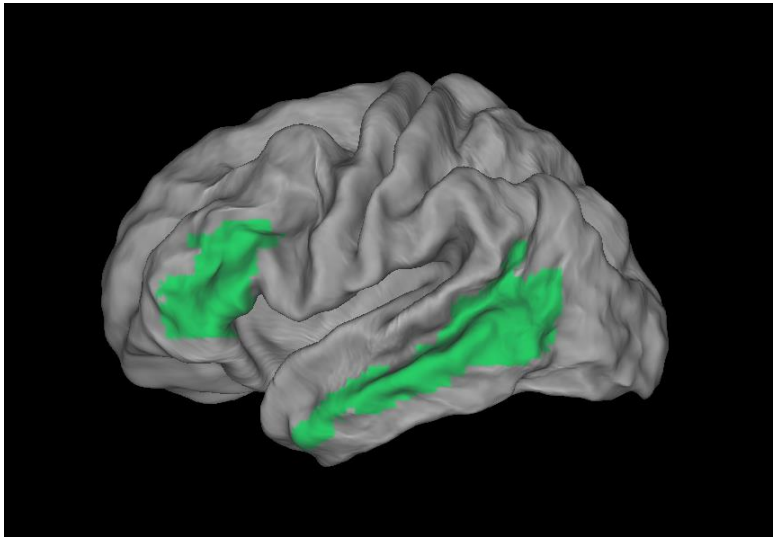
Phonological processing



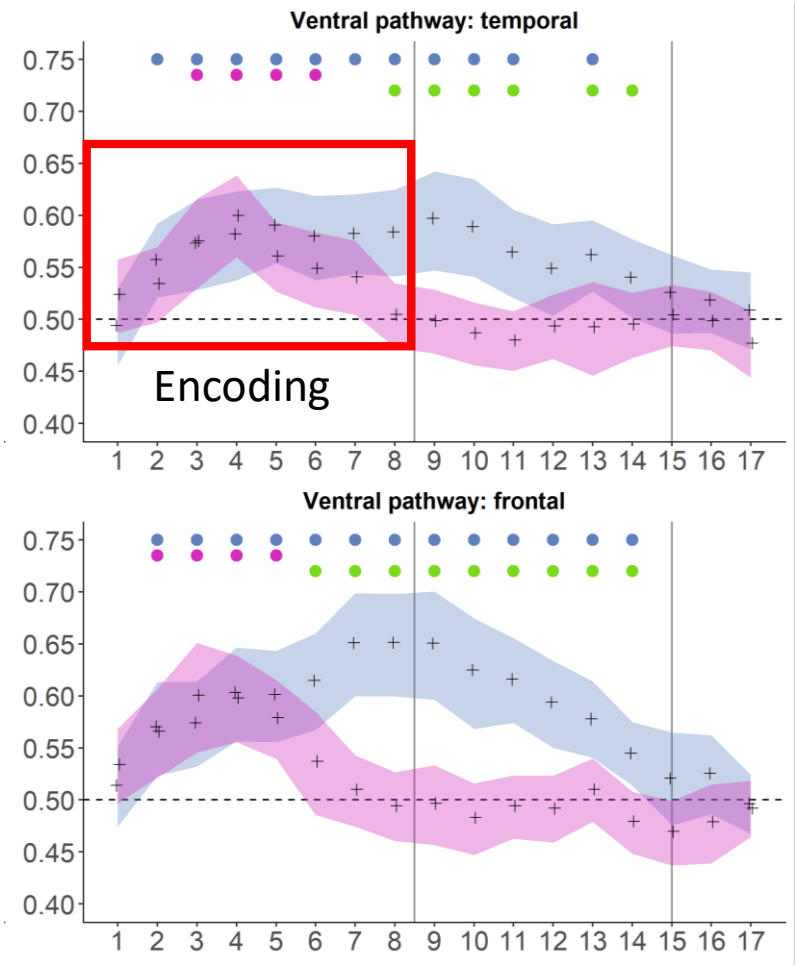
Friederici (2012)
Friederici & Gierhan (2013)
Hickok & Poeppel (2007)

Semantic processing

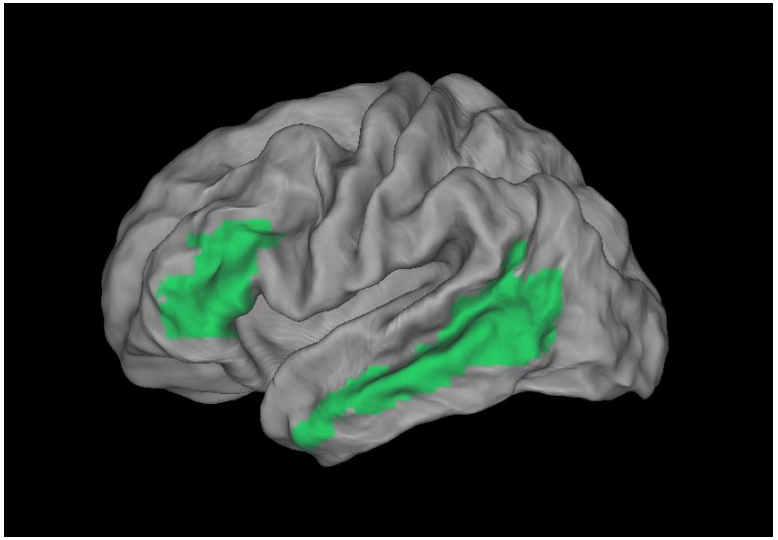




Note. The ribbons correspond to 95% credible intervals of the mean.



Semantic processing



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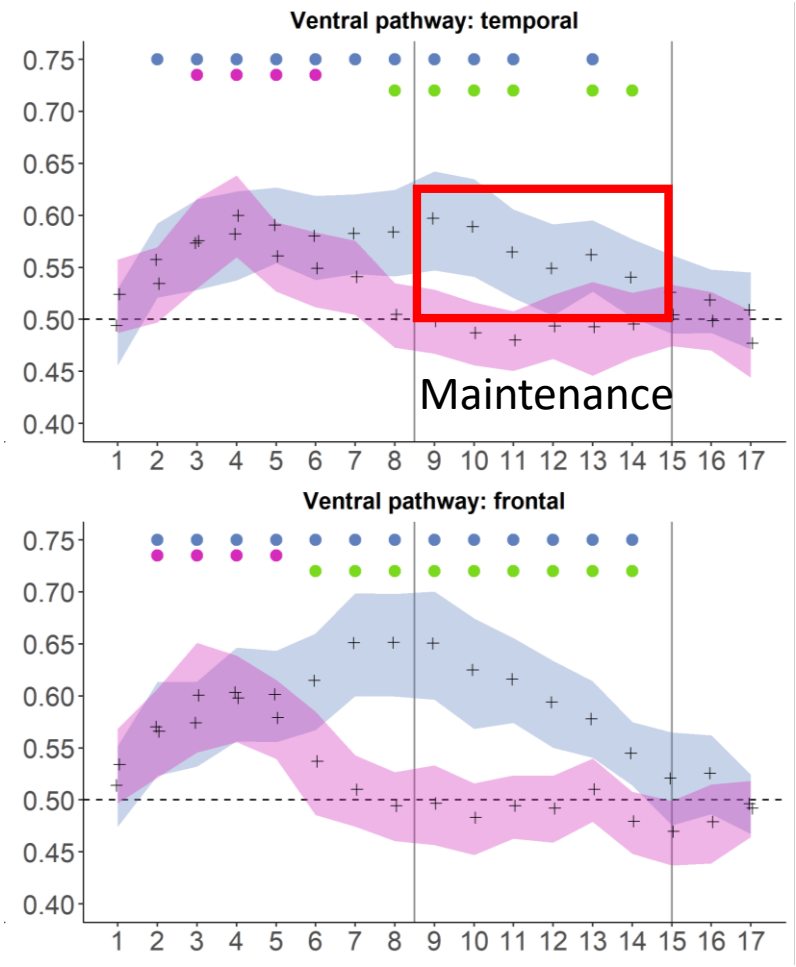
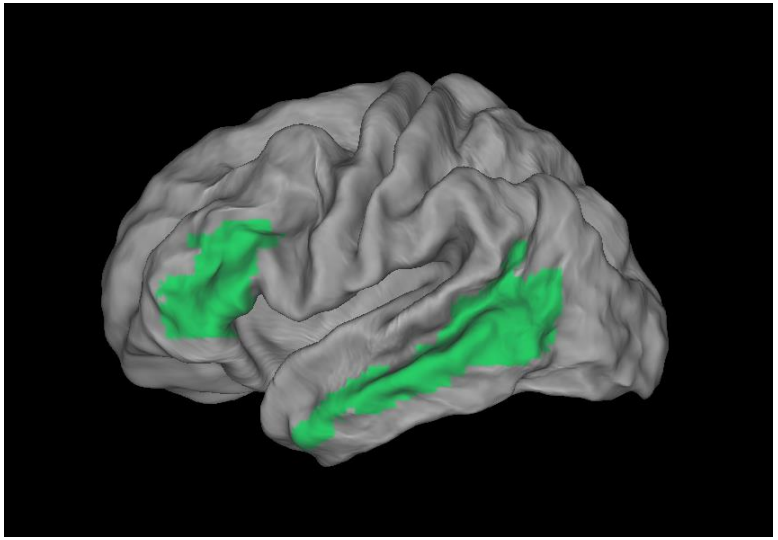
Semantic processing





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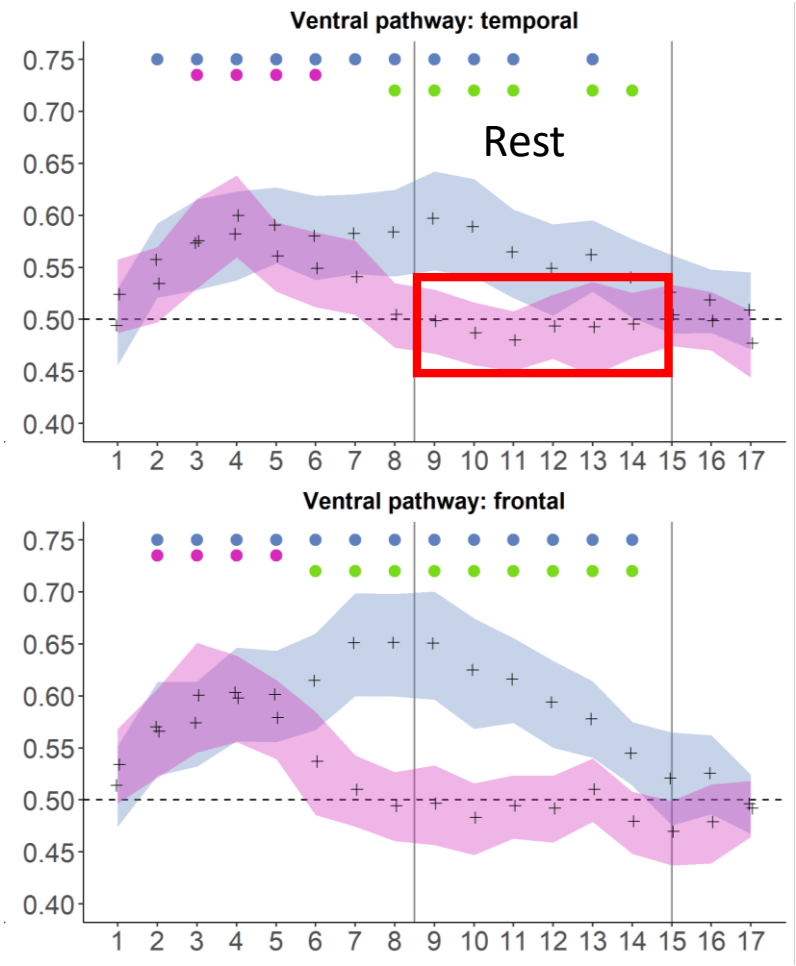
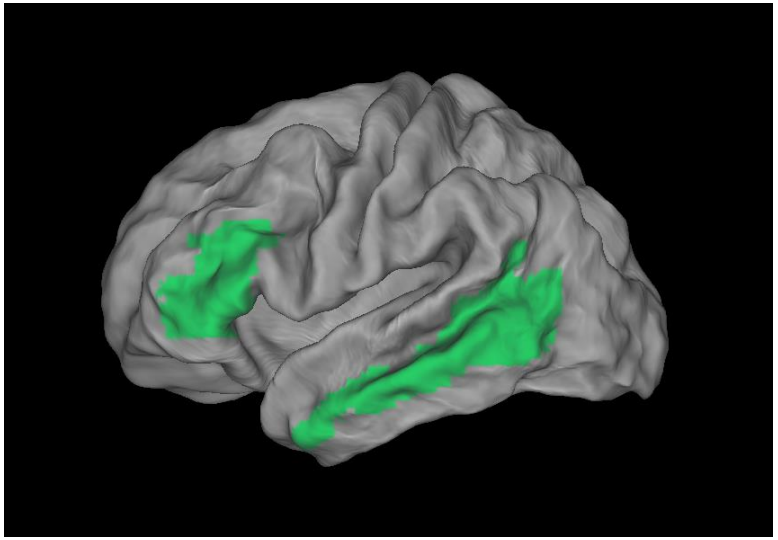
Semantic processing





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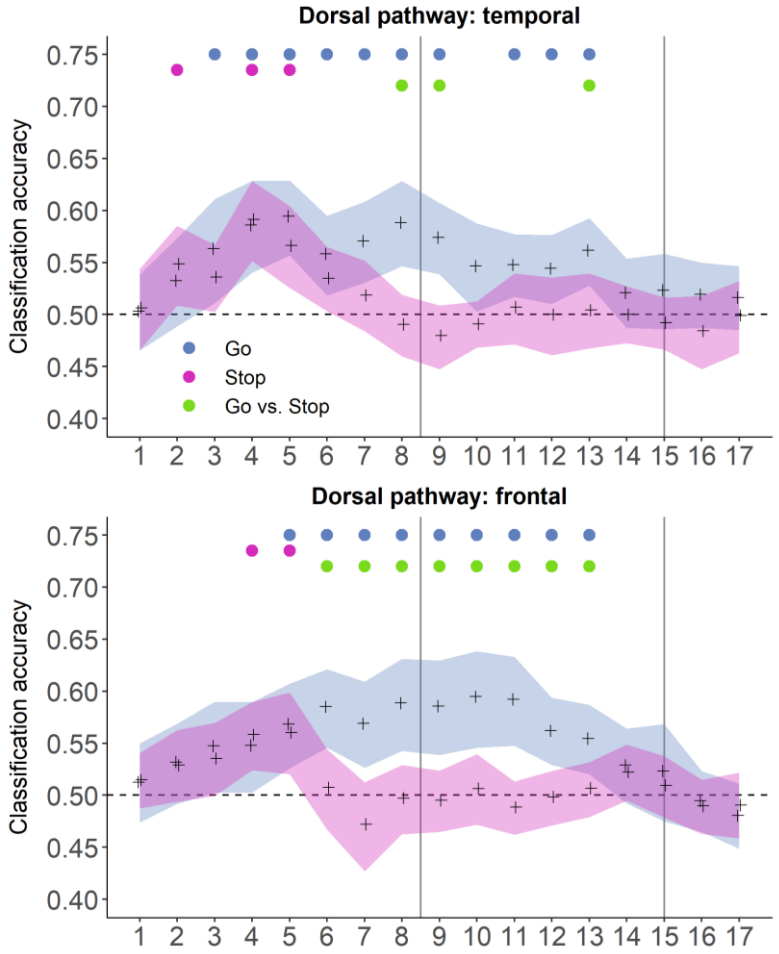
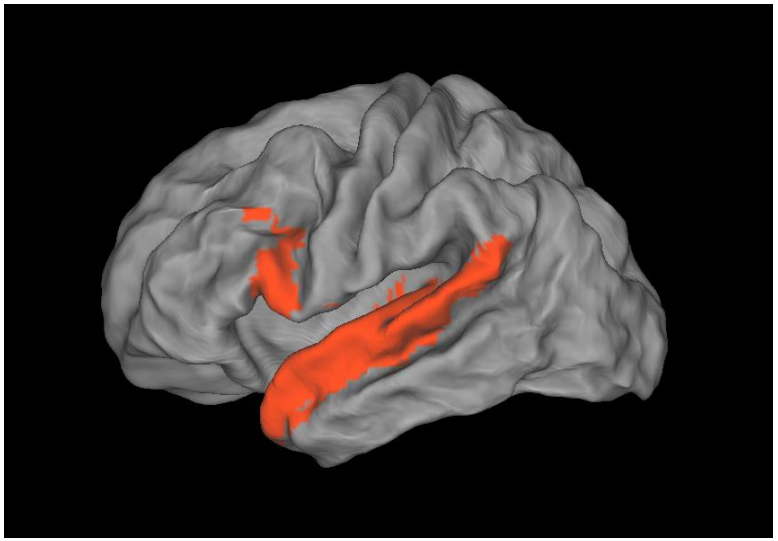


Phonological processing



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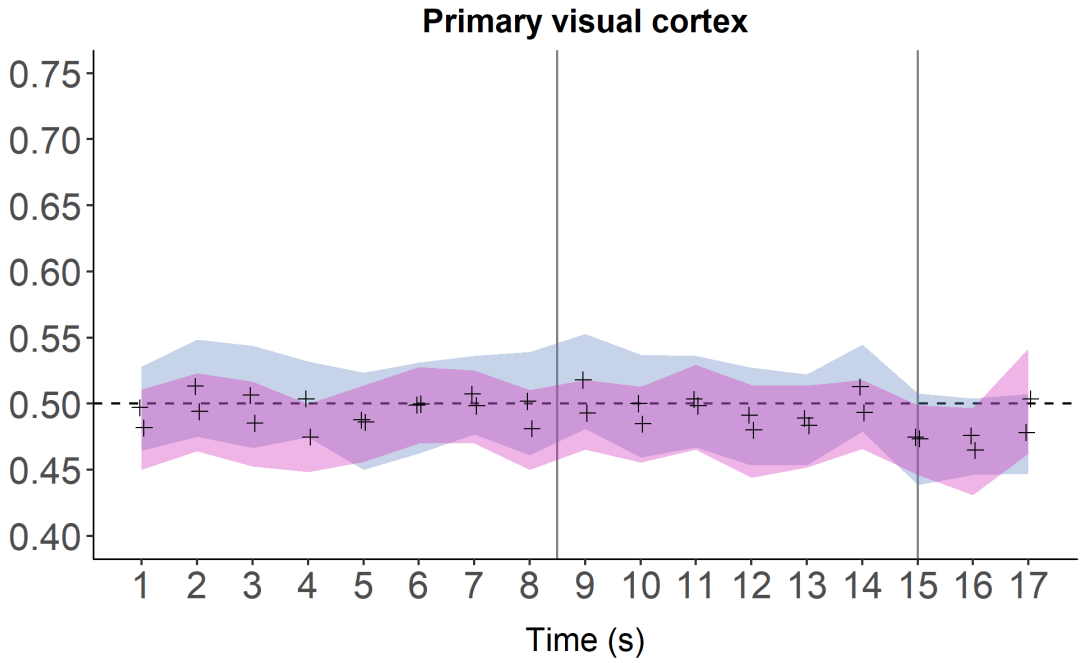
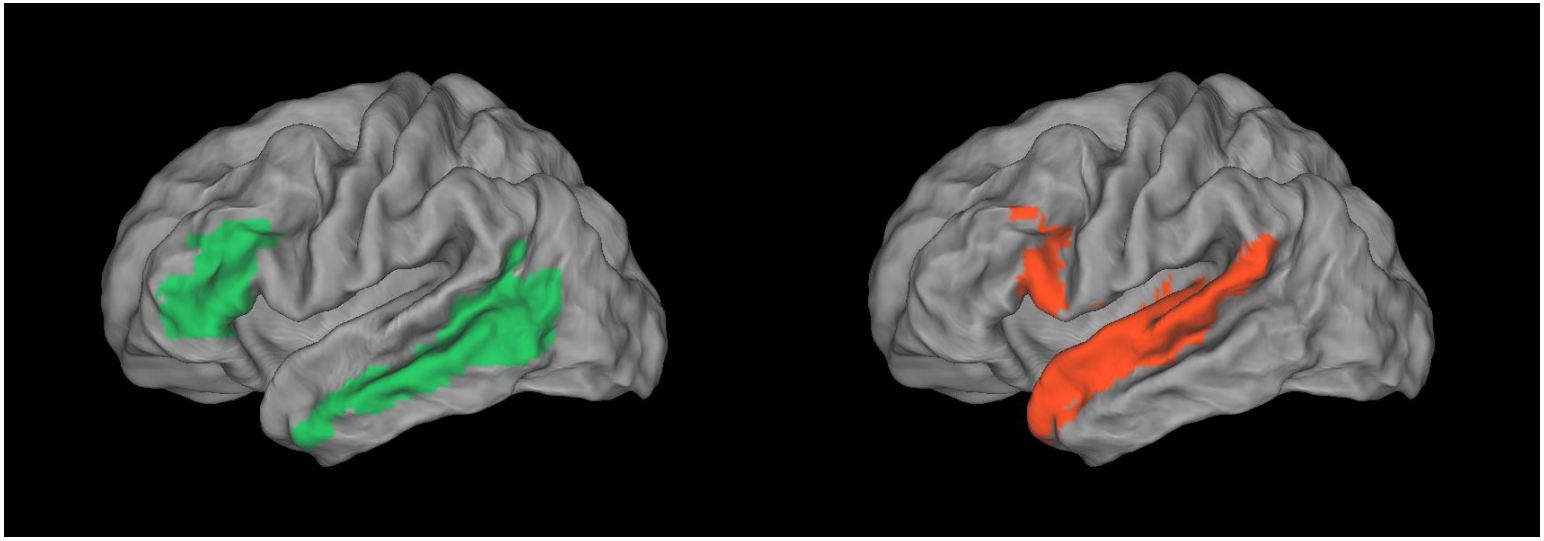

Primary visual cortex
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Time (s)

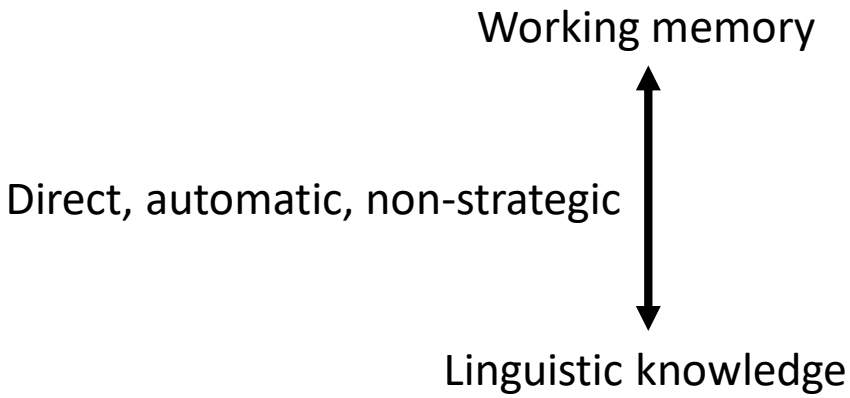
Discussion

Discussion

Provide evidence for a direct involvement of linguistic cortices to access linguistic knowledge during WM processing.



Discussion


Working memory
Direct, automatic, non-strategic
Linguistic knowledge

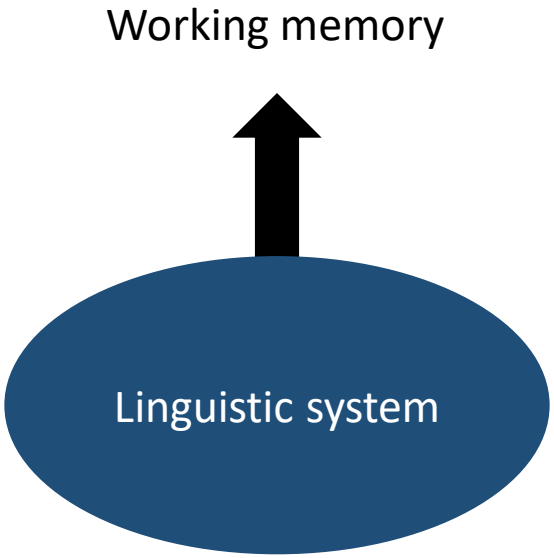
Discussion

These properties are also reflected in language processing.

The linguistic system is able to access linguistic knowledge very efficiently and rapidly, approximately around ~50 ms (MacGregor et al., 2012).

Discussion

Cowan (1995, 2001)
Martin, Saffran & Dell (1996)
Majerus (2013, 2019)



Conclusion

Theoretical models of verbal working memory need to consider the linguistic system as a core component.

Thank you your attention