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Semantic and syntactic predictions in reading aloud and visuo-motor statistical learning: an fMRI study in dyslexic students

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1 BACKGROUND

- The predictive brain has become a key concept in language research and a dominant theoretical framework for understanding how the brain works. Psycholinguistic and neuroimaging research highlights the importance of anticipatory mechanisms in language comprehension, language production, and reading.
- In addition, a growing number of studies have used statistical learning (SL) paradigms to investigate whether SL abilities can explain inter-individual differences in language processing and reading abilities.

OBJECTIVES

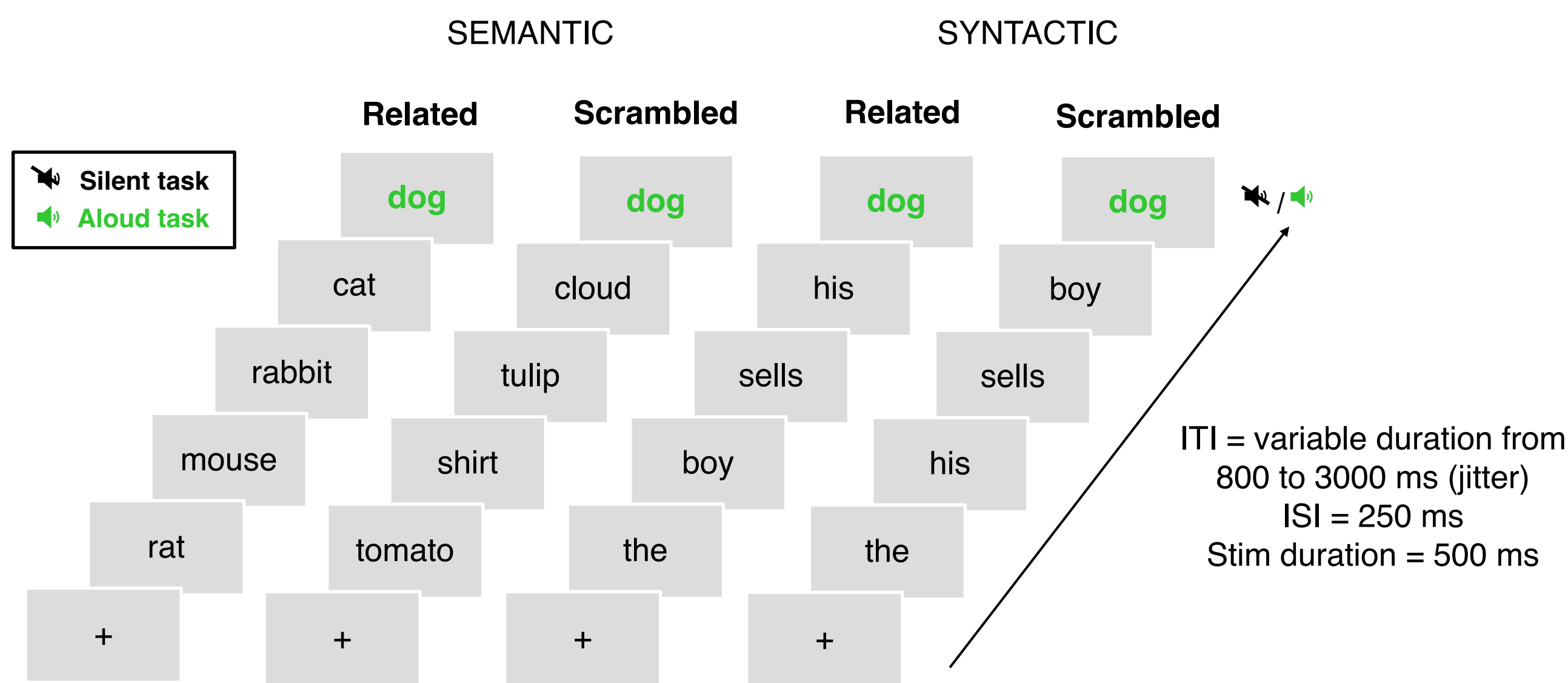
- To focus specifically on the neural network underlying semantic and syntactic predictive processing in reading
- To understand whether making semantic and syntactic predictions in reading relies on domain-general SL abilities AND whether people with reading impairments (dyslexia) show deficits in these domains.

2 METHODS

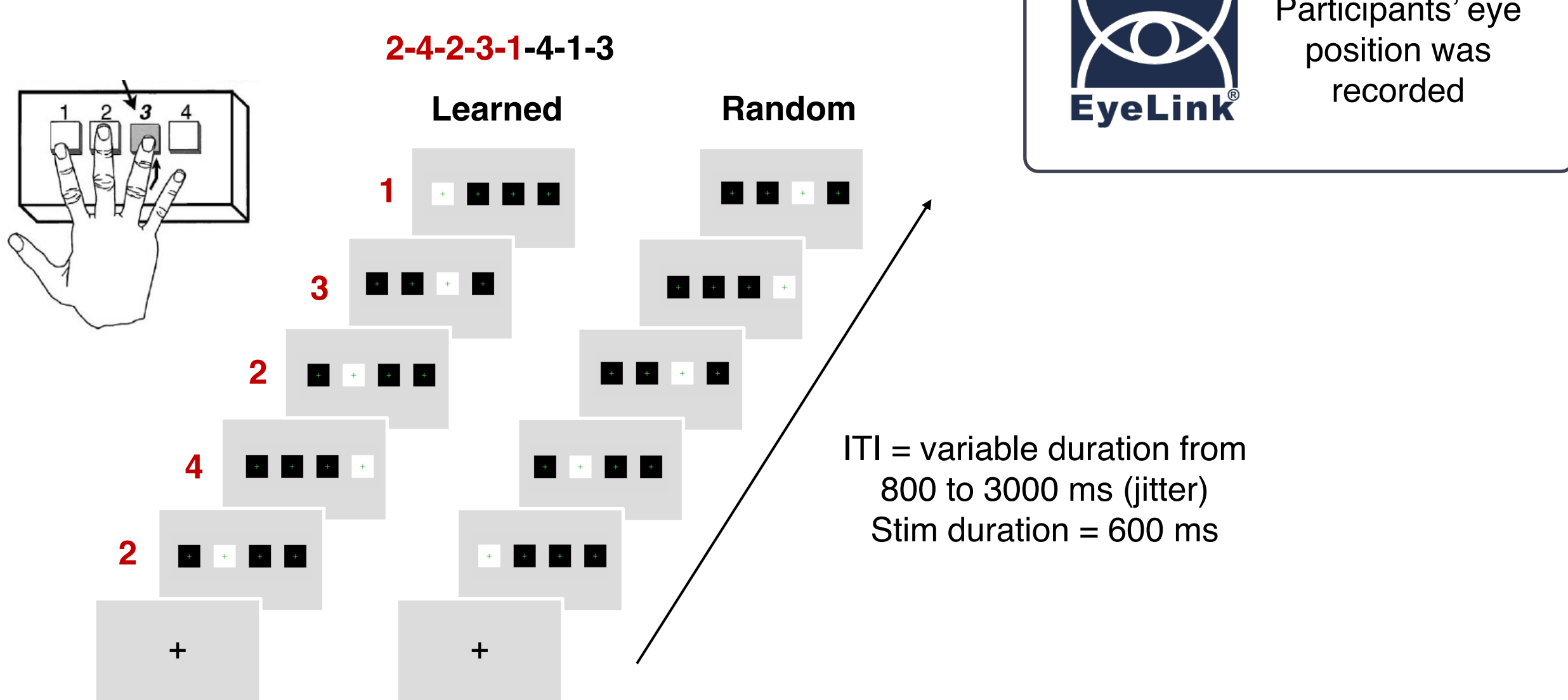
25 typical readers students (TR)
25 dyslexic students (DYS)

MRI Scanner 3T Tesla
Centre IRM-INT@CERIMED, Marseille

Predictive reading task



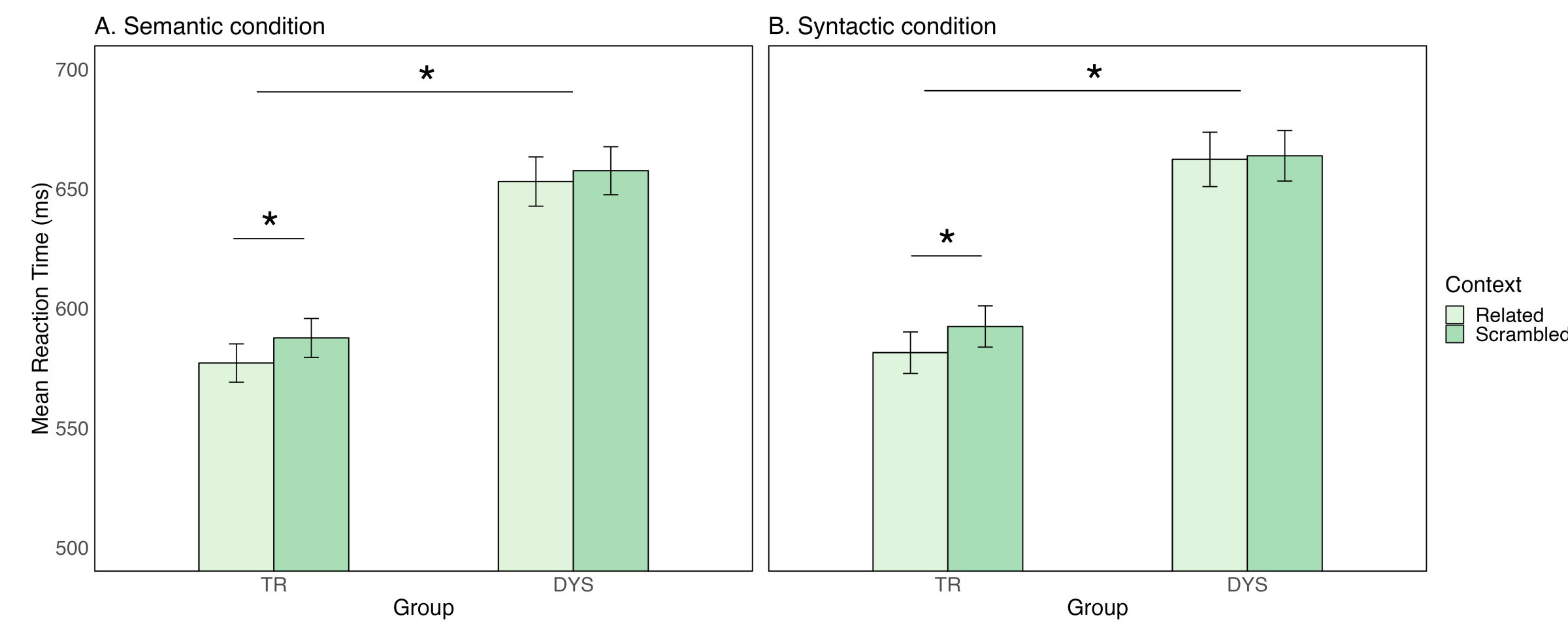
Serial reaction time task



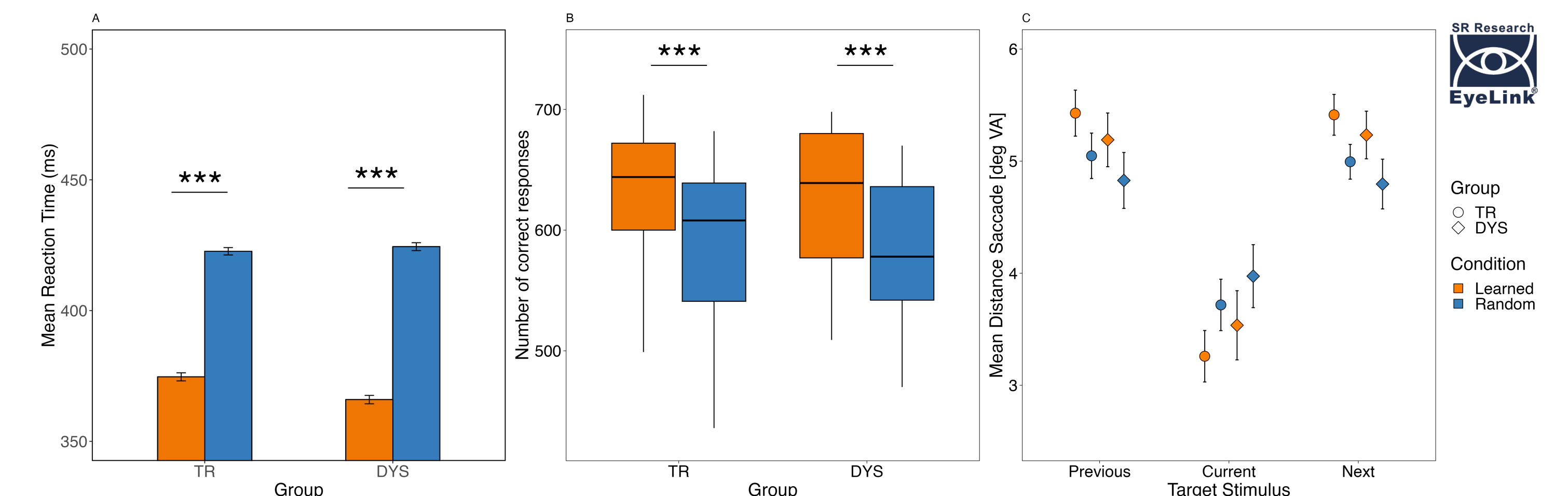
3 RESULTS

Behavioral results

Predictive reading task



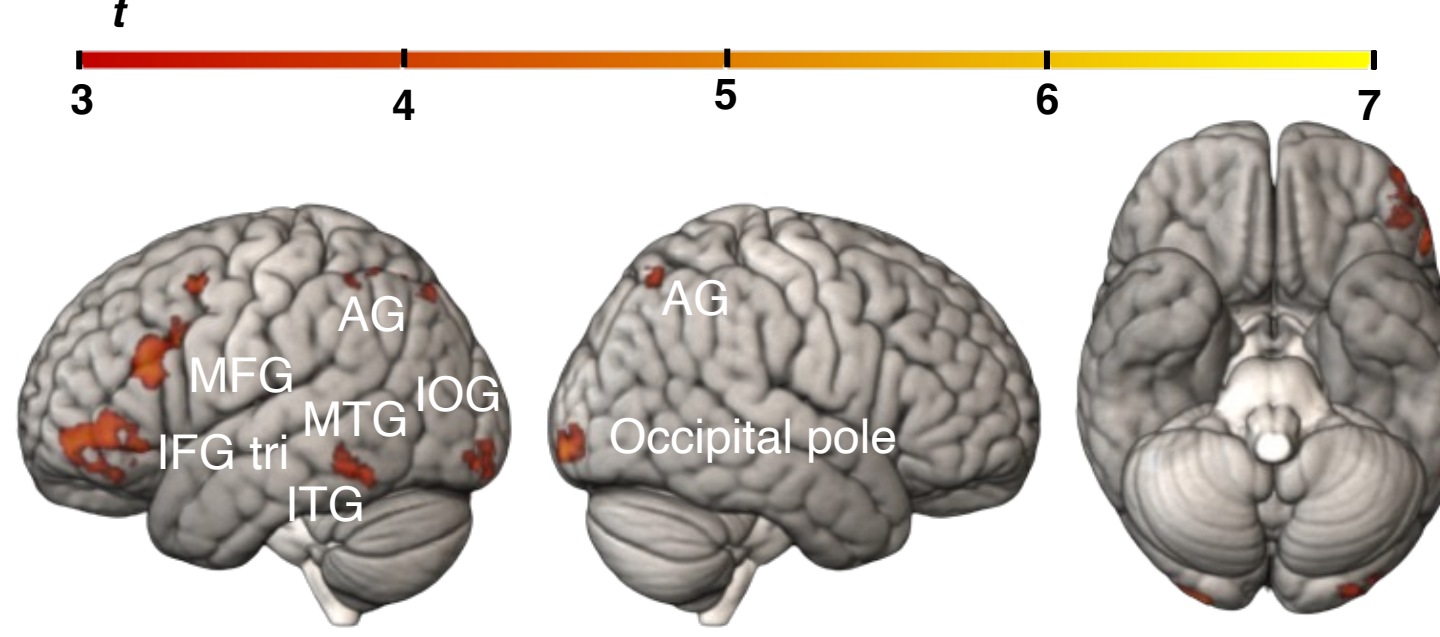
Serial reaction time task



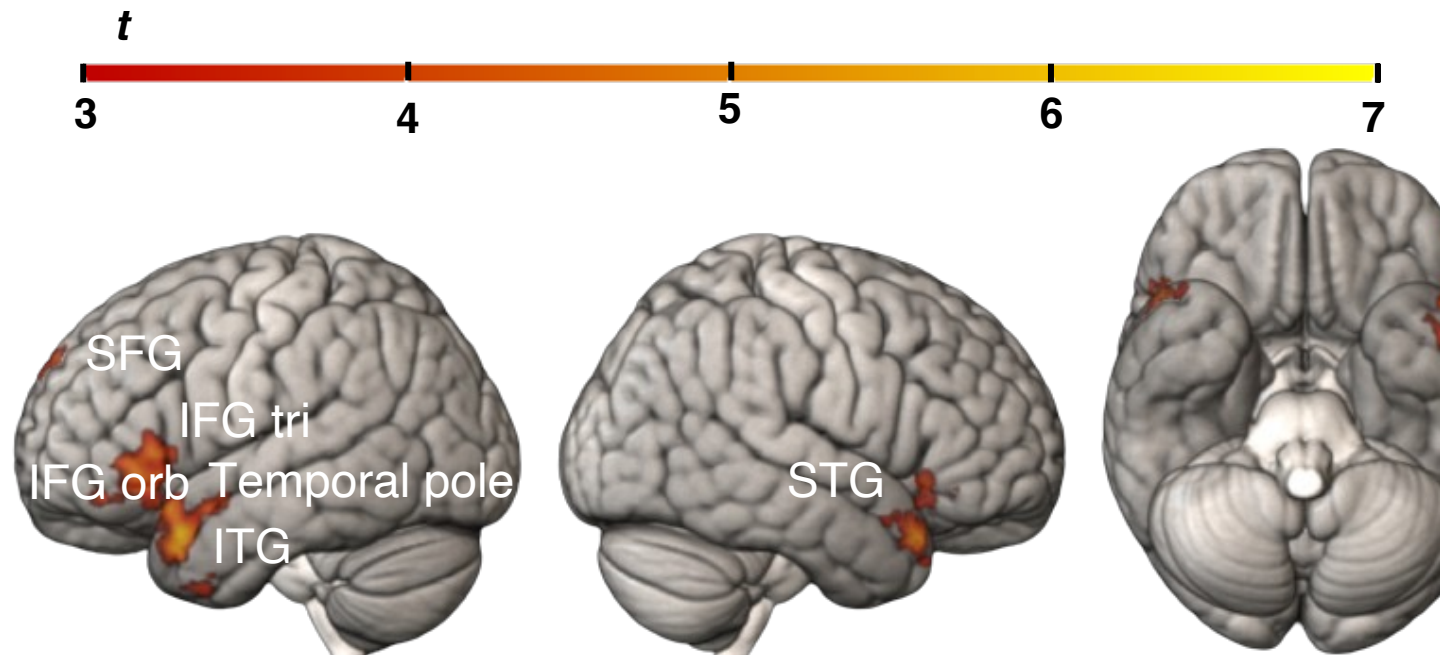
✓ Positive correlation between predictive reading or SL (SRT) and reading level.
✗ No correlation between predictive reading and SL (SRT).

Whole brain results

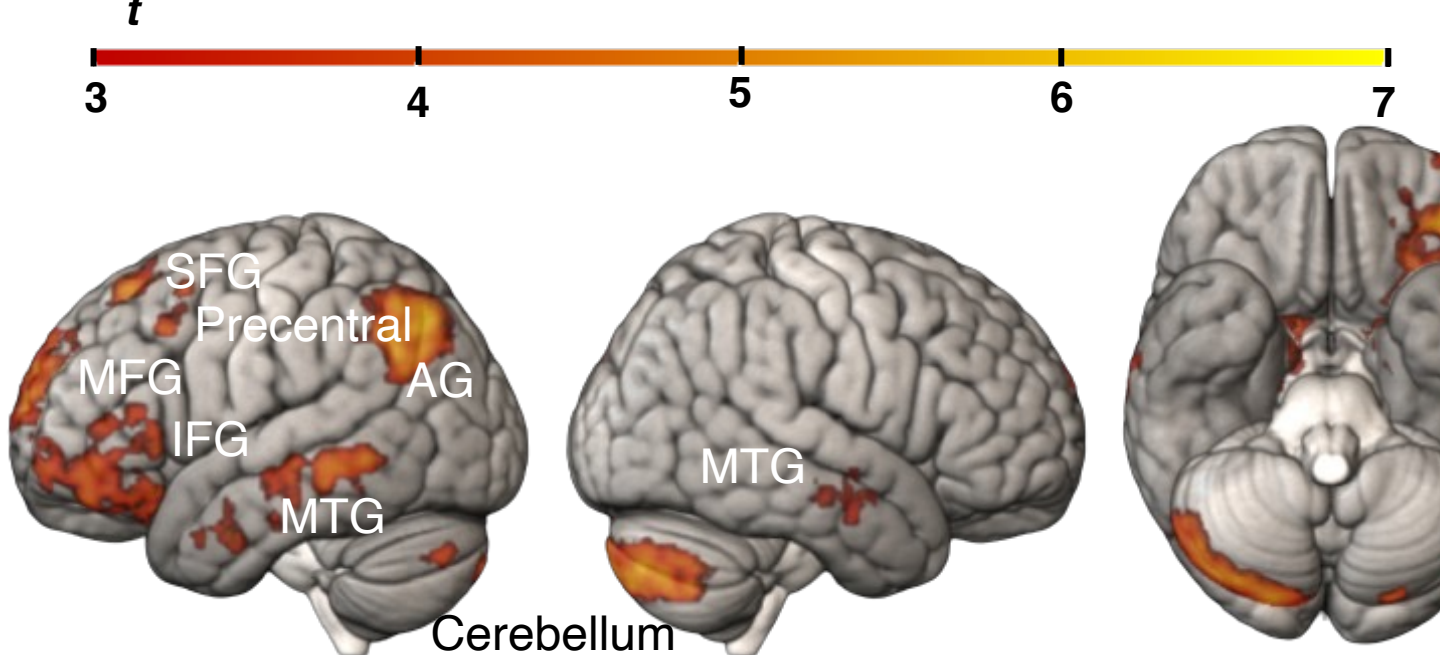
Semantic prediction (related-scrambled)



Syntactic prediction (related-scrambled)



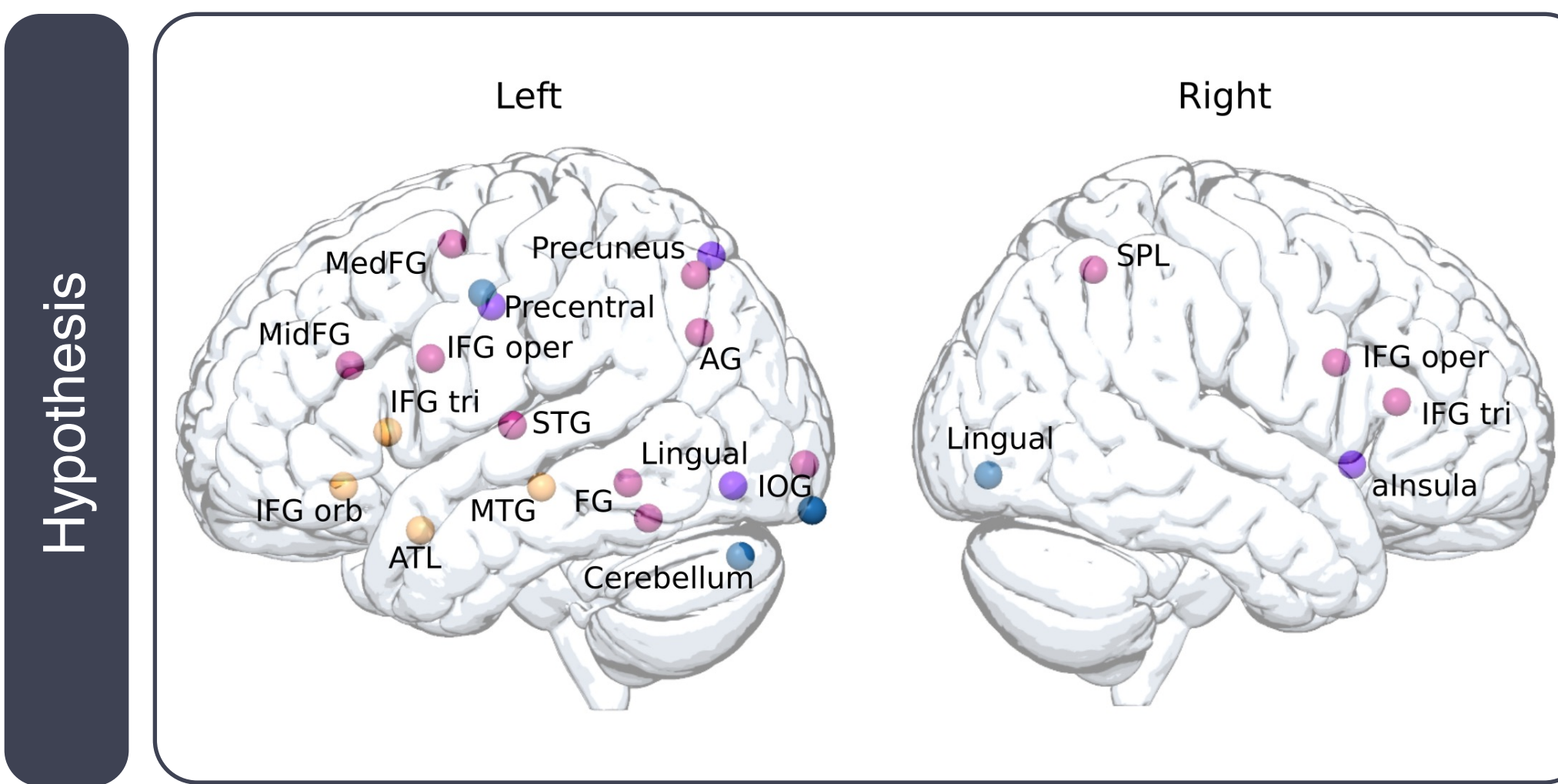
Serial reaction time task



No group differences

Region of interest results

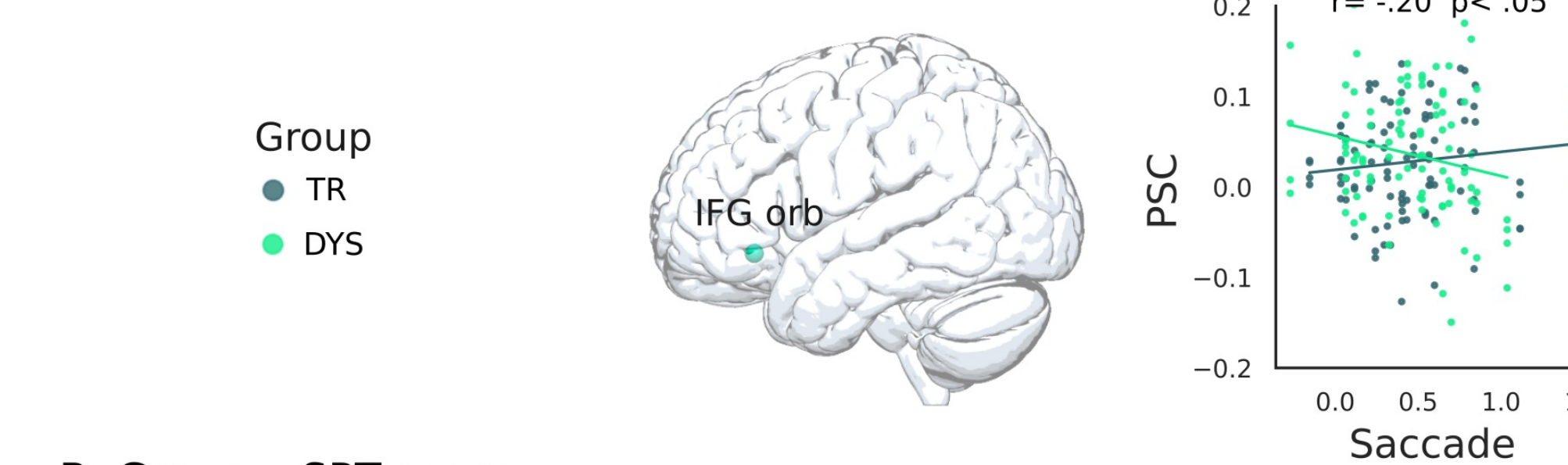
Predictive reading task



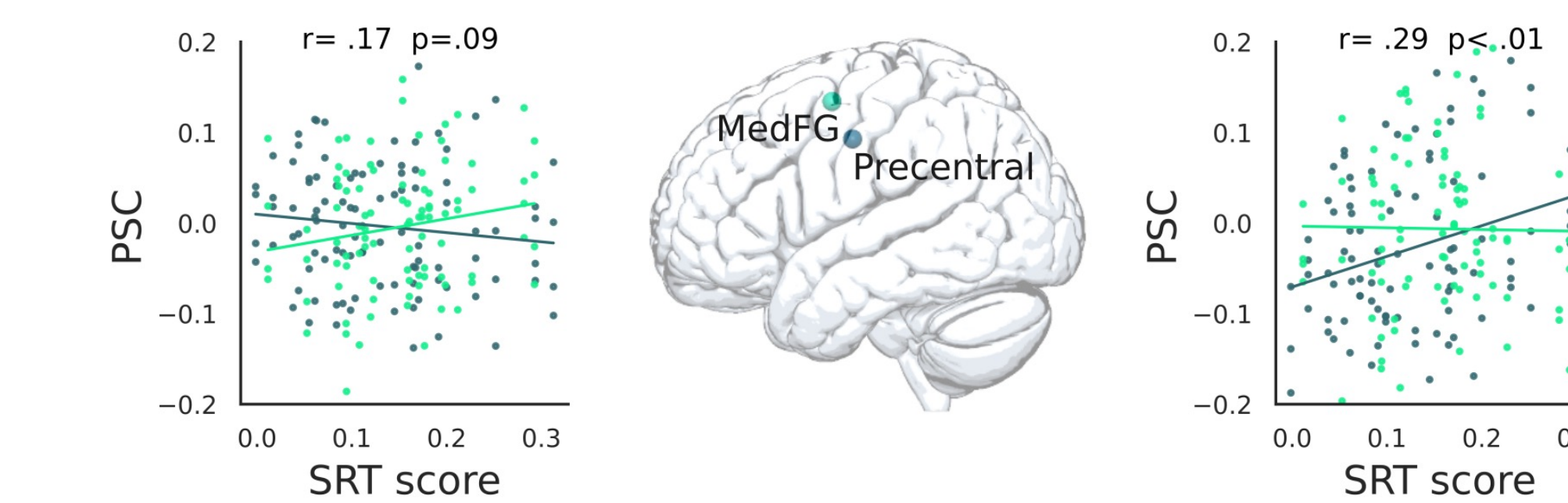
Carter et al. (2019) ; Murphy et al., (2019) ; Schuster et al. (2020)

The link between predictive reading and SL

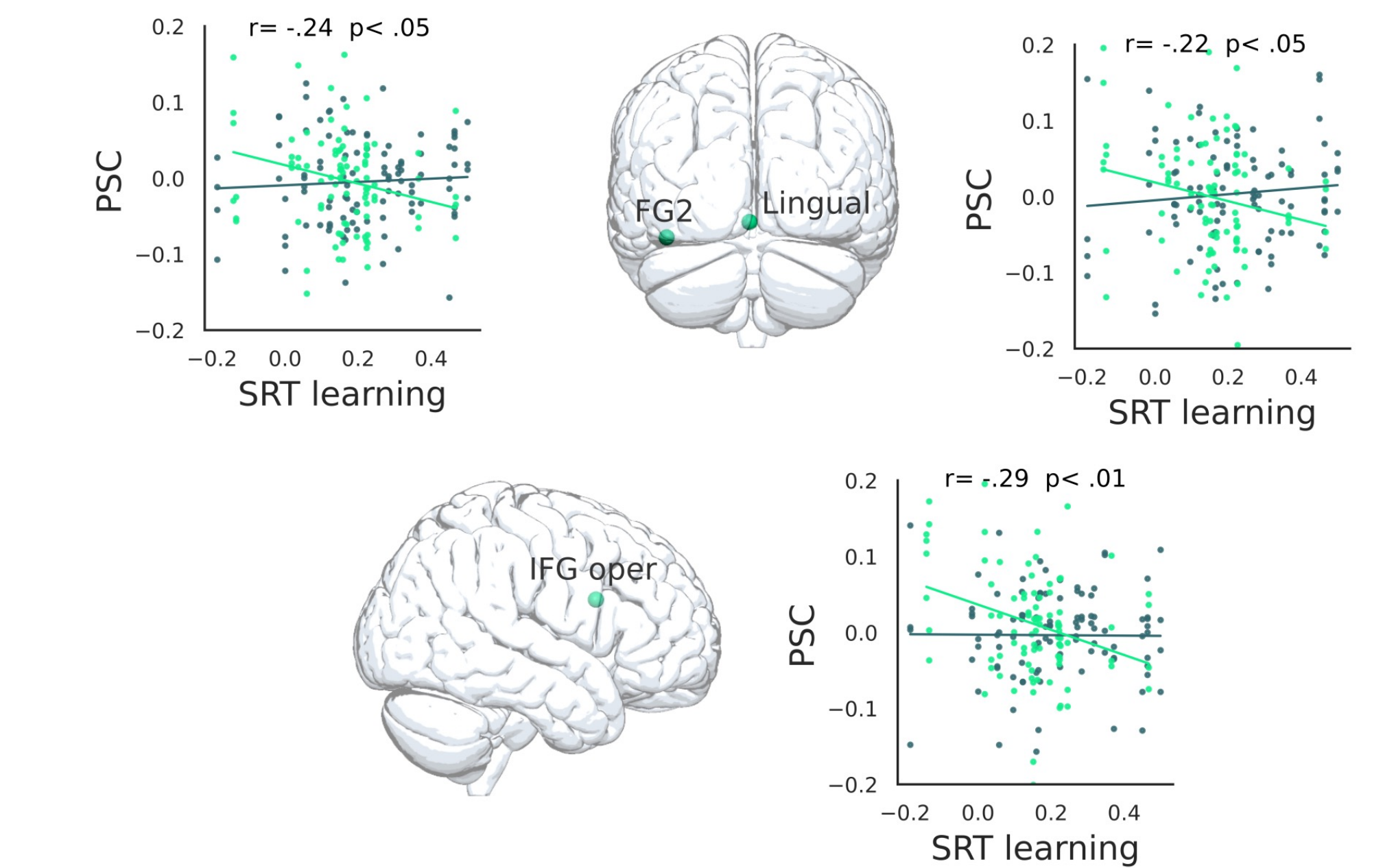
A. Group x Saccade



B. Group x SRT score

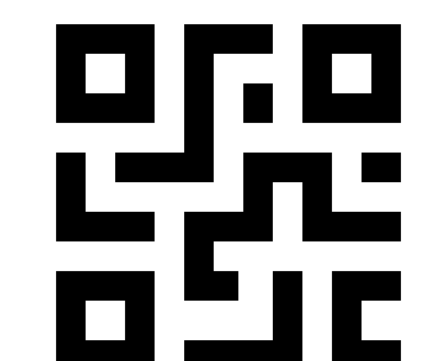


C. Group x SRT learning



4 TAKE HOME MESSAGE

- Students with dyslexia rely on brain structures involved in high-level linguistic prediction possibly to compensate for their low-level difficulties in single word perception and production, which is consistent with the compensatory hypothesis in dyslexia (Cavalli et al., 2024).
- Contrary to the literature, we did not find that students with dyslexia have problems with sequence learning and automatization (Ozernov-Palchik et al., 2023).
- Some brain areas activated during the SRT task seem to be also involved in our predictive reading task, especially for university students with dyslexia.



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