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GE2REC protocol for interactive mapping of language and memory processes in temporal lobe epilepsy



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Context

- The base of proper cognitive functioning is the dynamic interaction between different neuropsychological domains [1].
- There is anatomical evidence suggesting the connections between regions engaged in episodic memory and language [2].
- Lesions in language regions can manifest in memory domains [3].
- Language and memory networks converge towards integrative hubs mainly in the left temporal lobe [4] so joint language-and-memory deficits are especially common in temporal lobe epilepsy patients [5].

GE2REC protocol and the results

1. Sentence generation with implicit encoding run

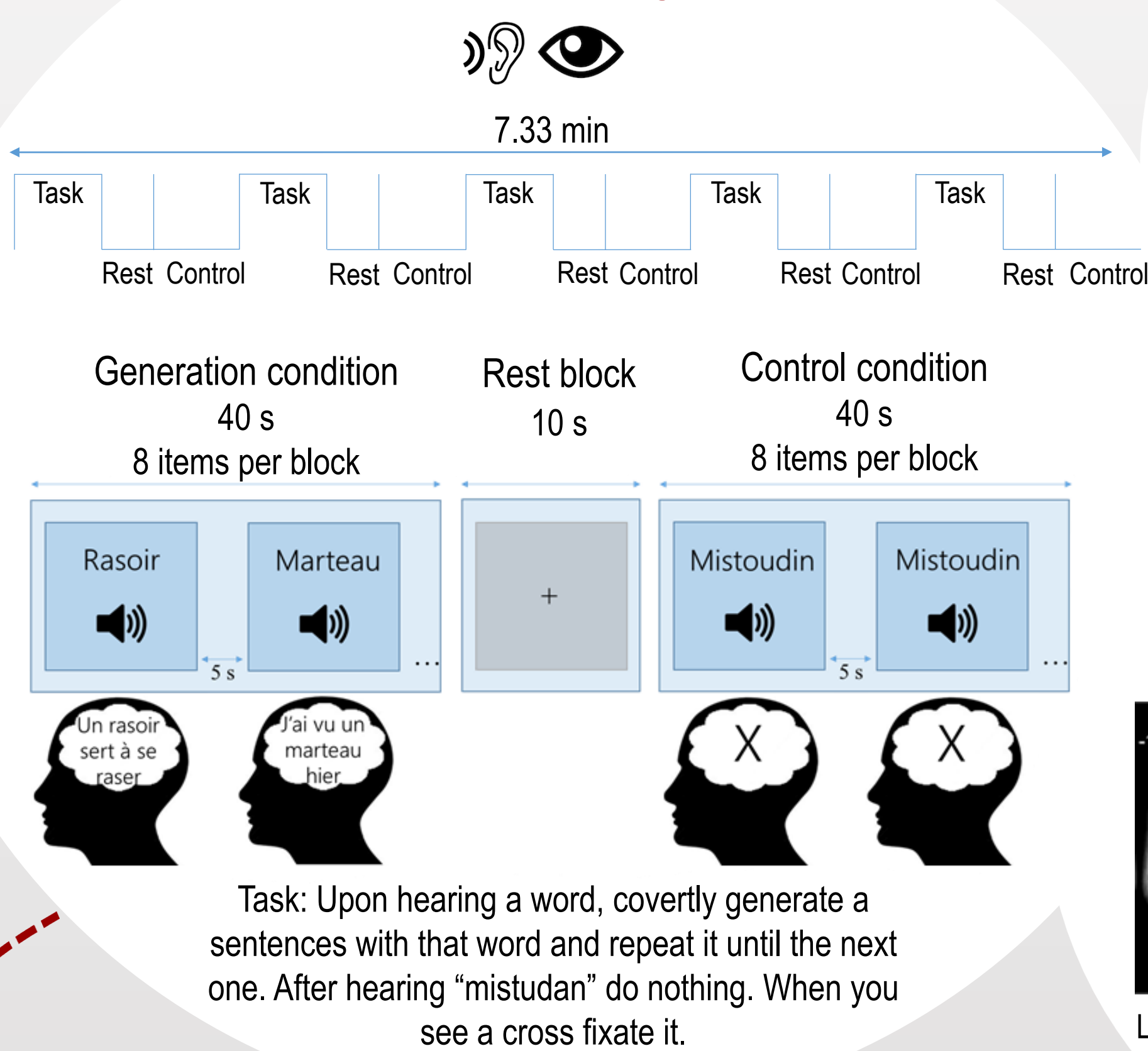


Fig.1: Activated regions for the contrast Sentence generation vs. Control ($p < .001$ uncorr.; $k > 10$)

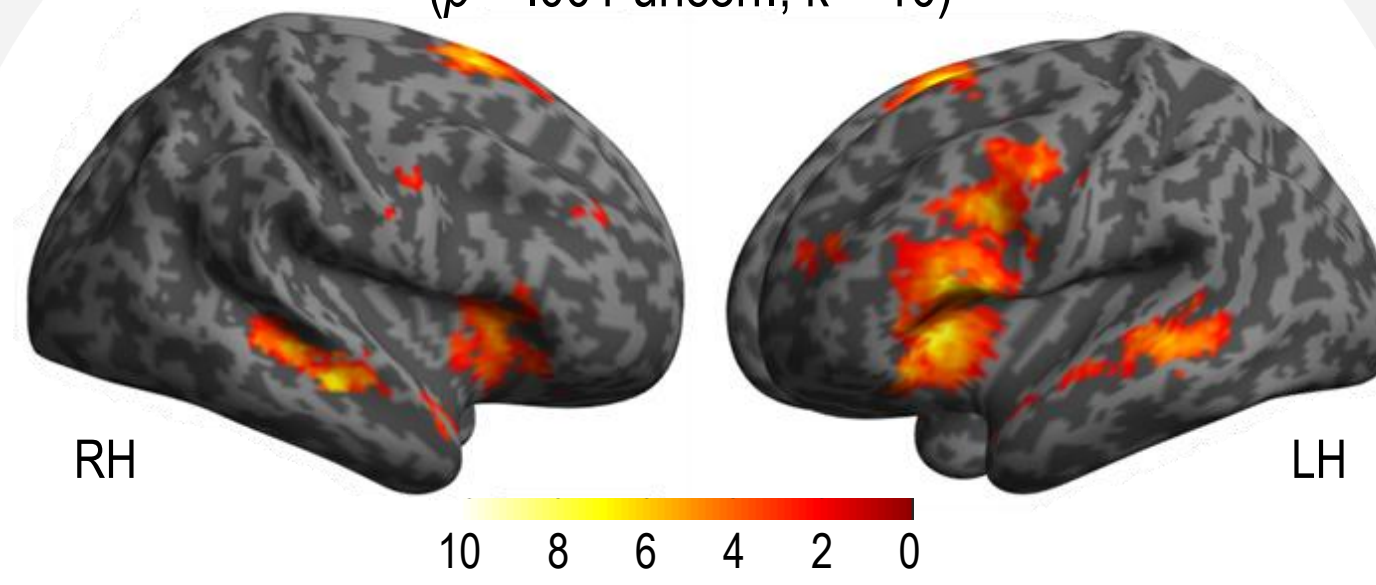
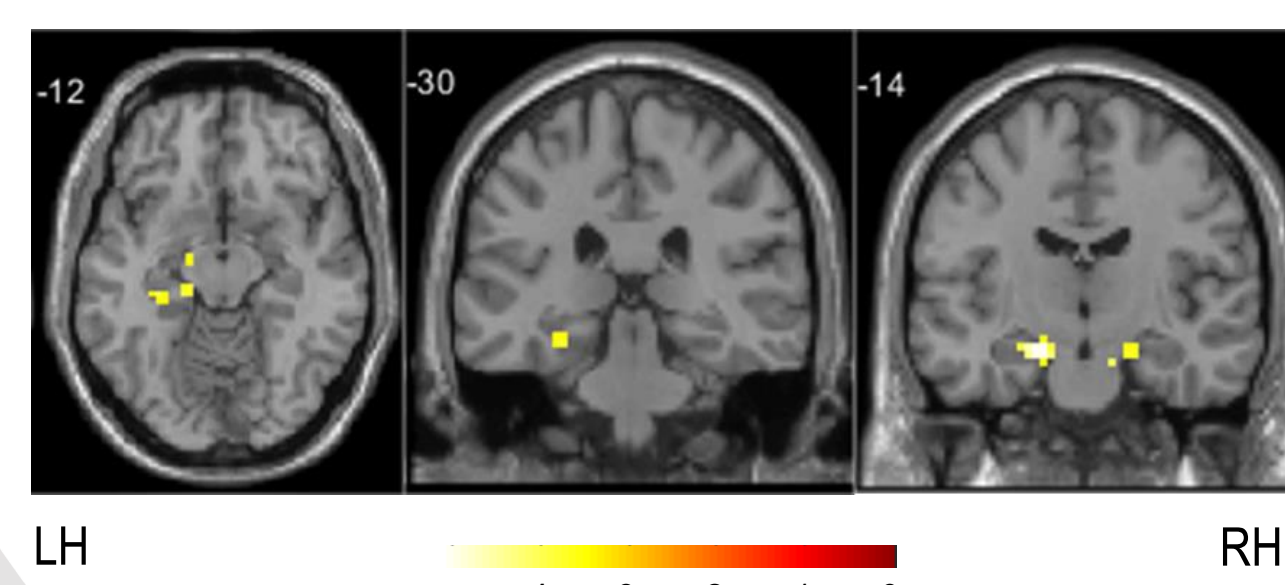


Fig.2: Activated regions for the Encoding - parameter modulation of generation activation with respect to correct recognition vs. baseline ($p < .001$ uncorr.; $k > 5$)



2. Recognition run

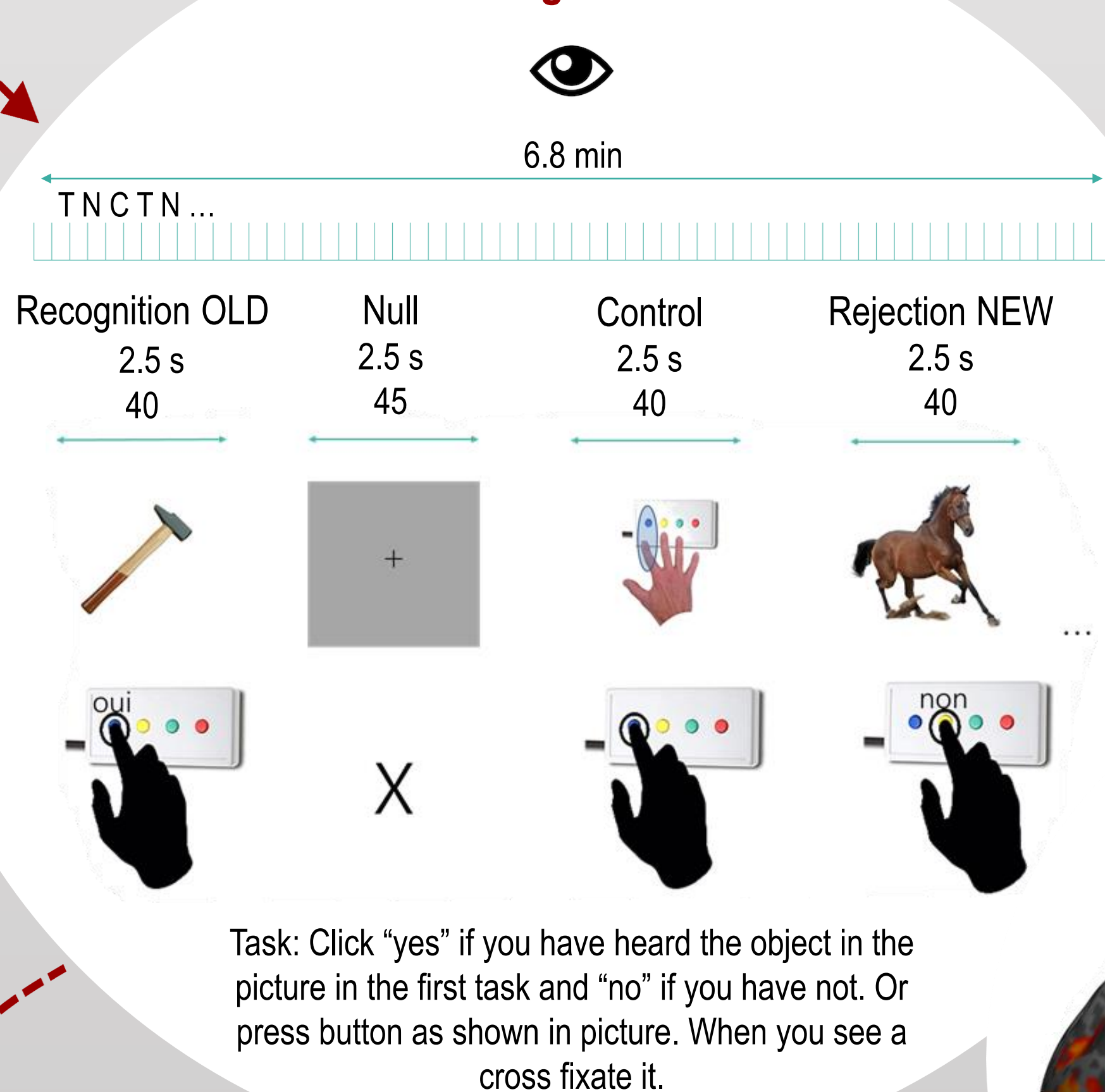
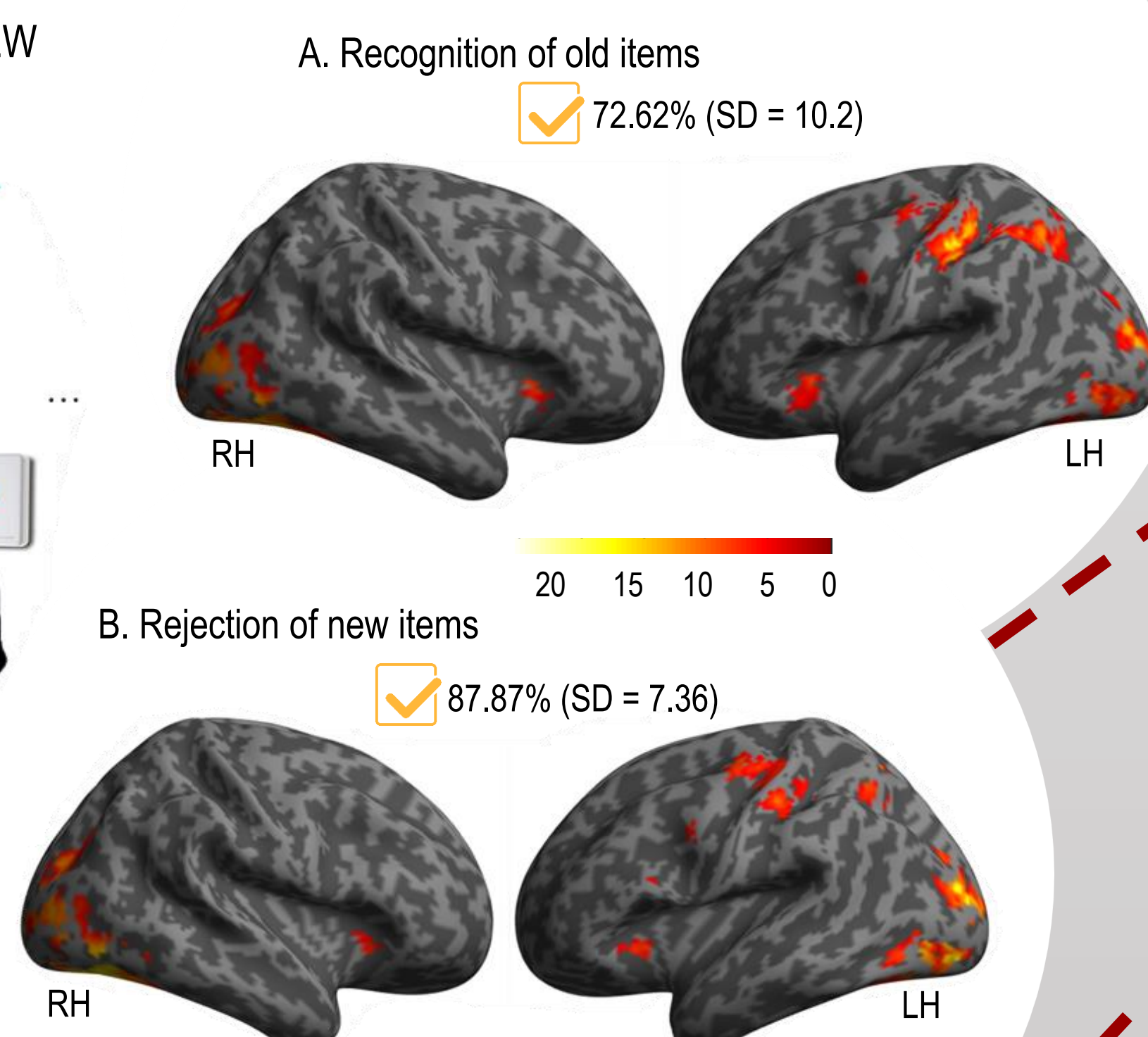


Fig.3: Activated regions for the contrast Recognition vs. Control ($p < 0.5$ FWE; $k > 5$)



3. Recall run

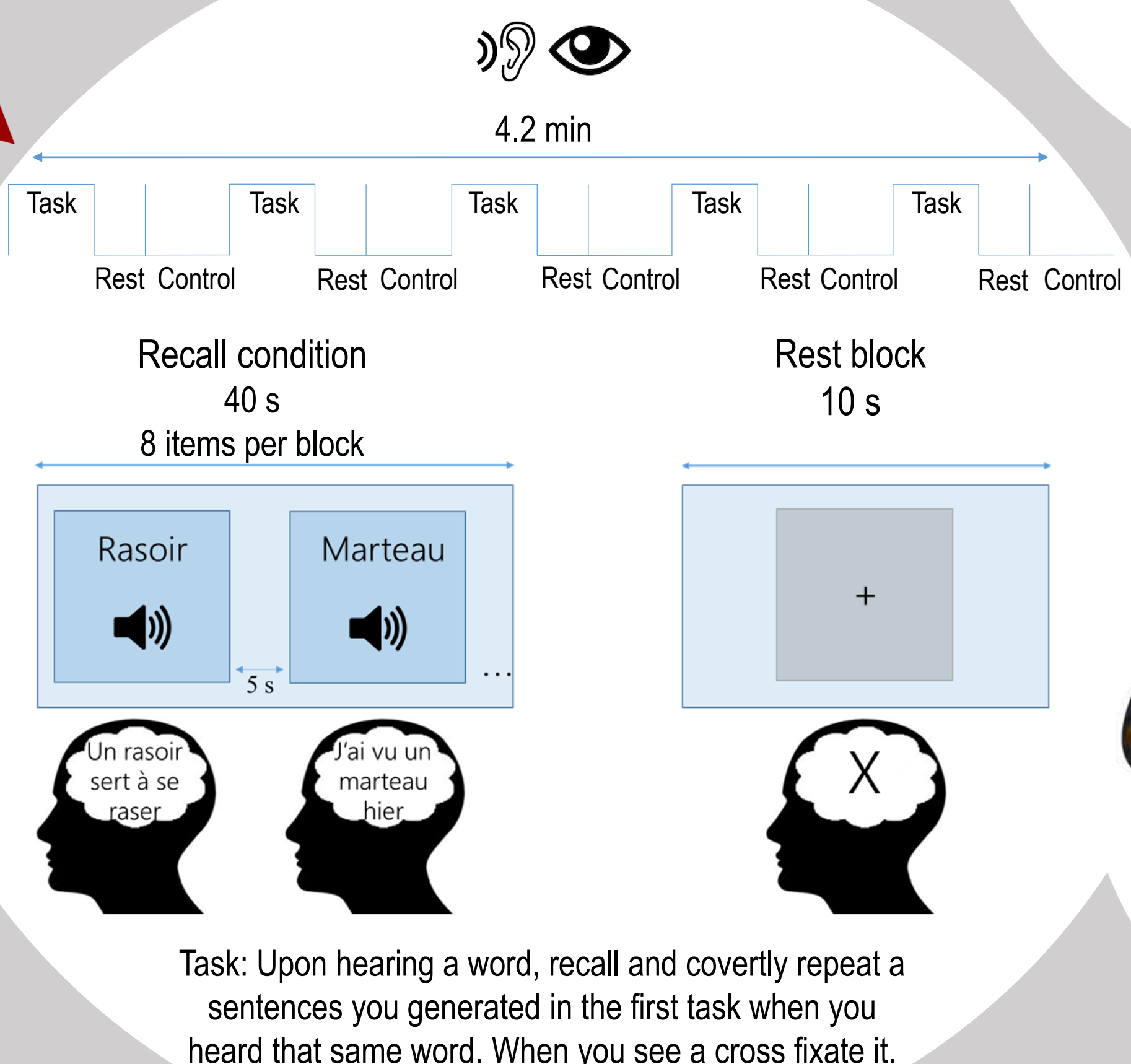
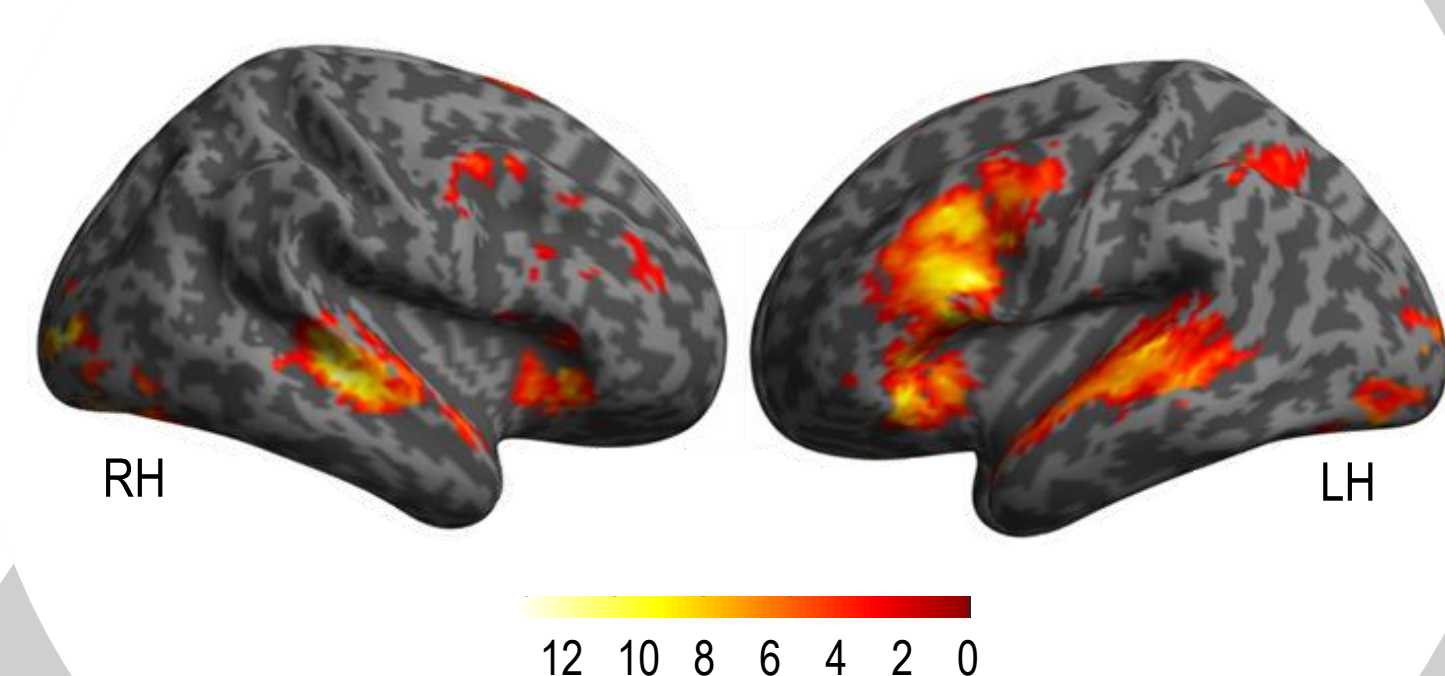


Fig.4: Activated regions for the contrast Recall vs. baseline ($p < .001$ uncorr.; $k > 10$)



Research objectives

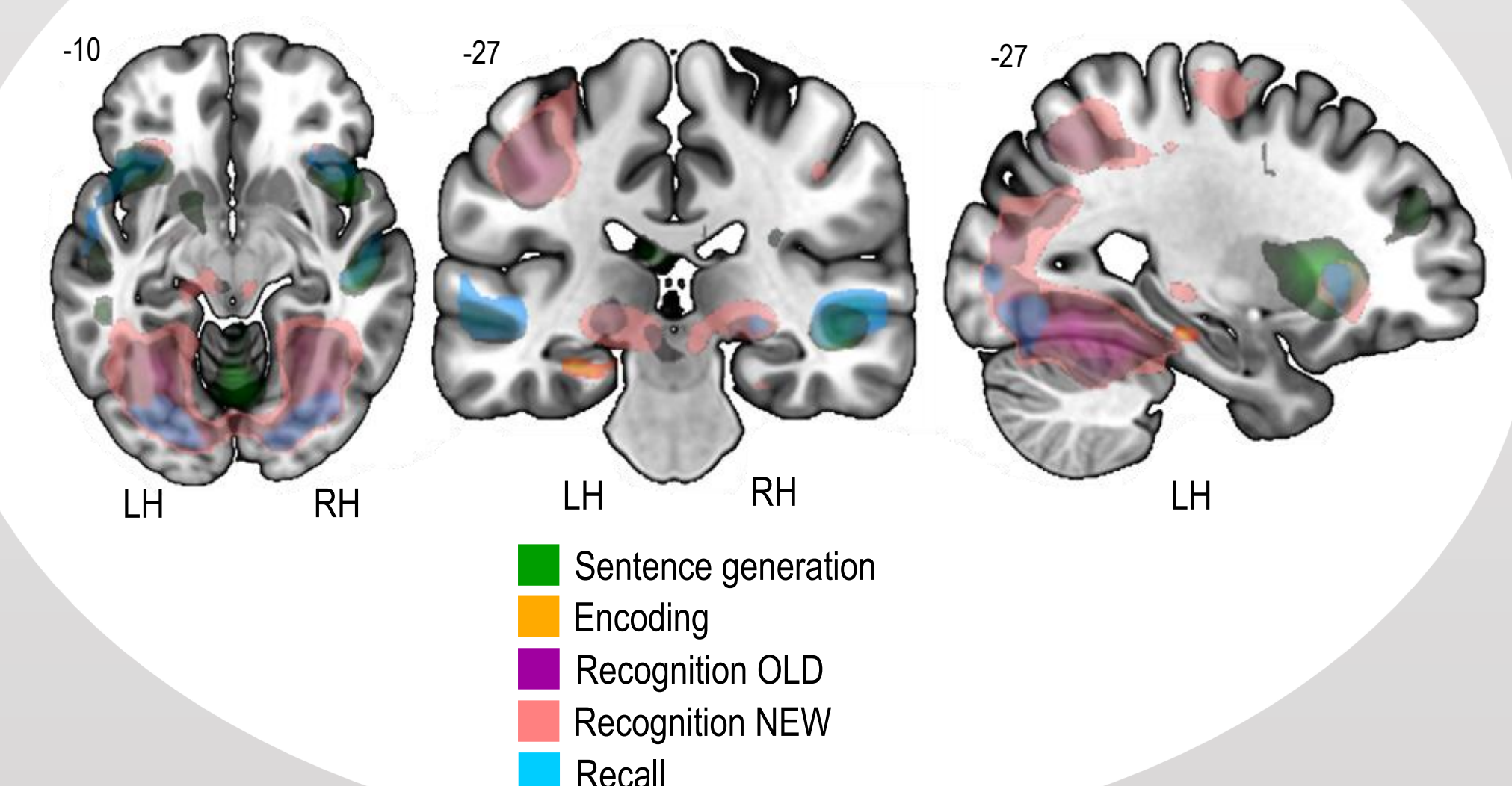
- Develop a protocol that would allow to assess language and memory in interaction and interplay.
- Validate that the protocol can map language-and-memory network.

Methods

- Twenty right-handed subjects (9 females, $M_{age} = 21$) were tested with GE2REC protocol.
- The fMRI data were acquired at 3T MR imager
- Functional runs: gradient-echo/T2* weighted EPI method (42 adjacent axial slices parallel to the bicommissural plane, sequential mode, slice thickness: 3mm, voxel size 3x3 mm, TR = 2.5 s, TE = 30ms, flip angle = 82°)
- Anatomical scan: 3D T1-weighted high-resolution using a 3D T1TFE (field of view = 256 × 256 × 160 mm; resolution: 1 × 1 × 1 mm; acquisition matrix: 256 × 256 pixels; reconstruction matrix: 256 × 256 pixels)
- Data processing:
 - Spatial pre-processing steps (SPM12)
 - Statistical analyses: GLM first level → second level
 - Behavioural data analysis – correct recognition/rejection during the recognition run

Conclusions

Fig.5: Illustrative overview of the synthesis of results obtained with GE2REC protocol



- Results corroborate the ability of GE2REC to robustly activate a fronto-temporo-parietal language network together with temporal mesial, prefrontal and parietal cortices during memory tasks.
- Activations during recognition may reflect employment of verbal strategy which backs up the difficulty to disentangle language and memory processes.
- The results could suggest that hippocampus connects the language-and-memory network.
- GE2REC is useful because it:
 - requires interaction of language-and-memory processes and jointly maps their neural basis (Fig.5);
 - explores encoding and retrieval, managing to elicit activation of mesial temporal structures;
 - is short and easy to perform, hence being suitable for clinical settings in addition to fundamental research;
 - has an ecological dimension in terms of tasks;
 - can be particularly important for patients with temporal lobe epilepsy.

References

- Kellermann, T. S., Bonilha, L., Eskandari, R., Garcia-Ramos, C., Lin, J. J., & Hermann, B. P. (2016). Mapping the neuropsychological profile of temporal lobe epilepsy using cognitive network topology and graph theory. *Epilepsy & Behavior*, 63, 9–16.
- Tracy, J. I., & Boswell, S. B. (2008). Mesial temporal lobe epilepsy: a model for understanding the relationship between language and memory. In B. Stemmer & H. A. Whitaker (Eds.), *Handbook of the neuroscience of language* (pp. 319–328). Elsevier.
- Schuchard, J. & Thompson, C.K. (2014) Implicit and Explicit Learning in Individuals with Agrammatic Aphasia. *Journal of Psycholinguistic Research*, 43, 3, 209–24
- Mesulam, M. M. (2000). *Principles of behavioral and cognitive neurology*. Oxford University Press.
- Haag, A., & Bonelli, S. (2013). Clinical Application of Language and Memory fMRI in Epilepsy. *Epileptologie*, 30, 101–108.