

Separating complex spatial perception from scene construction

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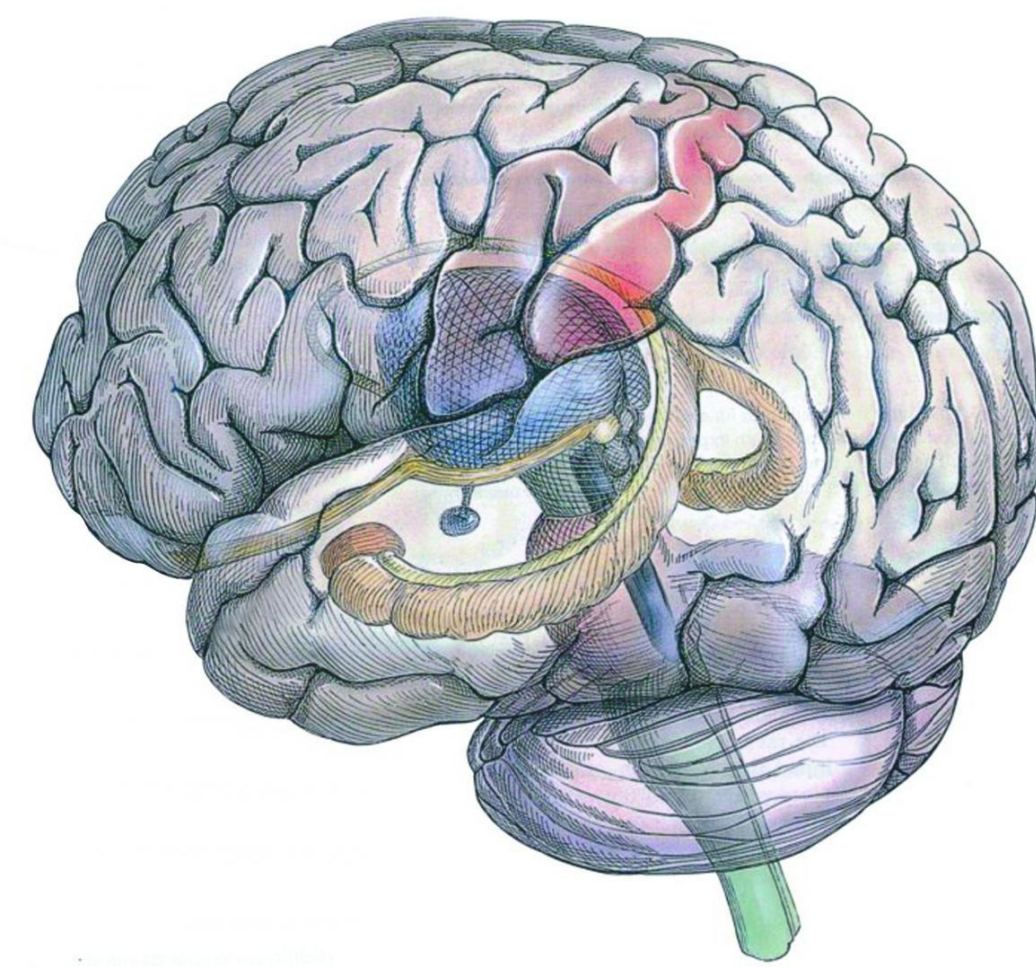
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The hippocampus and scene processing

Patient^{1,2,3,4} and neuroimaging^{4,5,6} studies have implicated the hippocampus in scene processing.

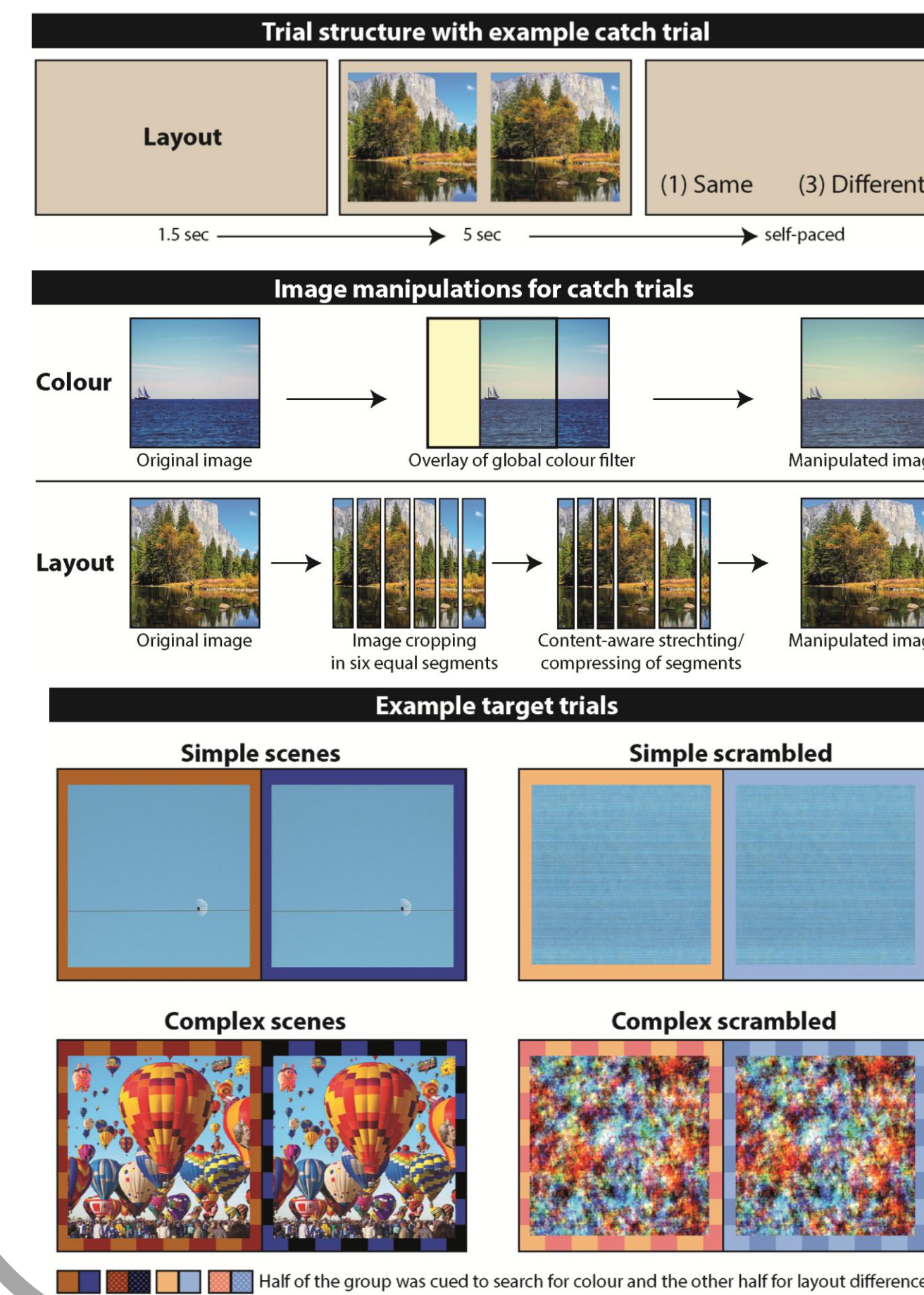
However, not much is known about which features of scenes drive the hippocampal response.



Here, we tested 3 features of scene processing:

1. Naturalistic scenes versus scrambled images
2. Visual complexity - simple versus complex
3. Perceptual versus constructive tasks

fMRI investigation



Participants

- 20 healthy participants (mean age 27.6 +/-5y)

Task

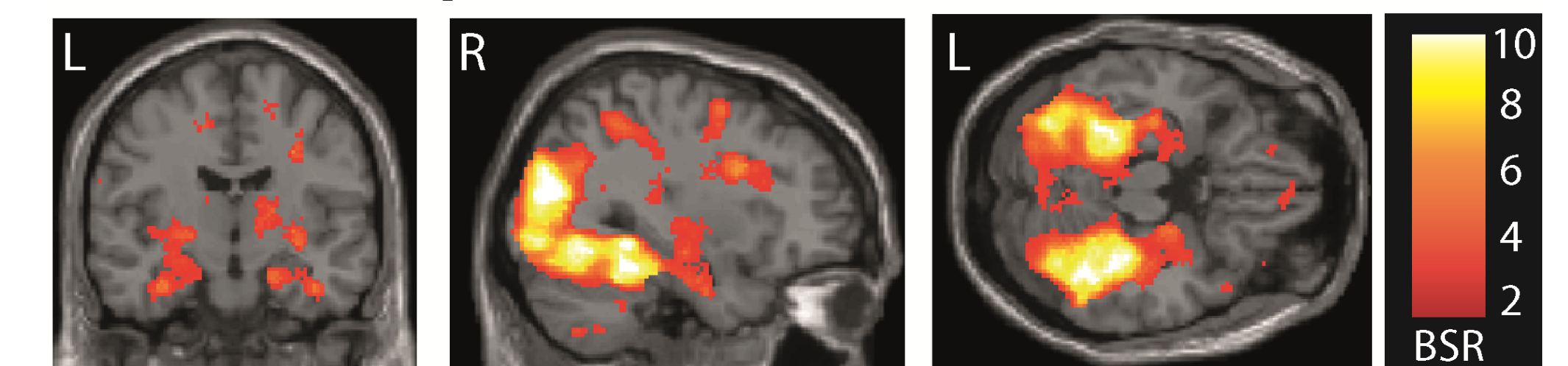
- 320 image pairs
- Cue for layout or color
- Most images were identical pairs
- Images were counterbalanced across participants

Analyses

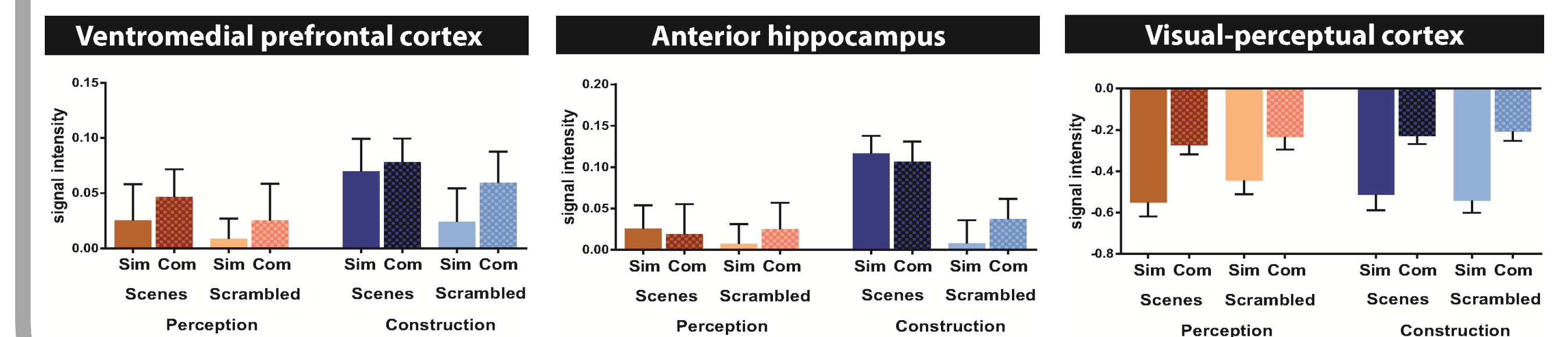
- Partial Least Squares (PLS)⁷

Results - fMRI

Brain pattern associated with scenes



The hippocampus was embedded in a functional network processing naturalistic scenes

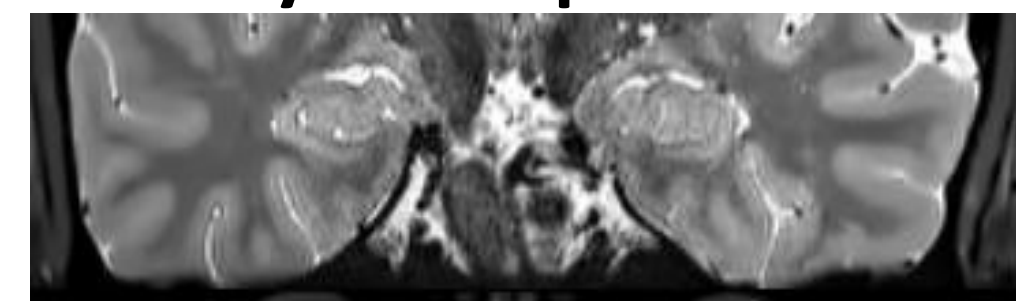


Each brain region responded to specific visual features

McCormick, et al. (in preparation)

Patient investigation

Healthy Participant



Amnesic Patient



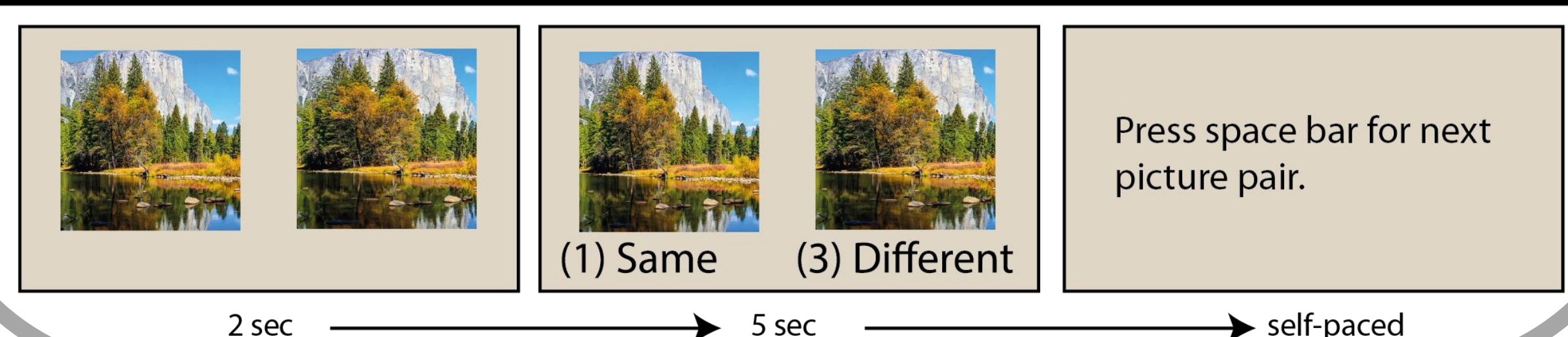
Participants

- 12 patients with bilateral focal hippocampal damage (mean age 67.4 +/-9y)
- 24 matched healthy controls (mean age 62.1 +/-8y)

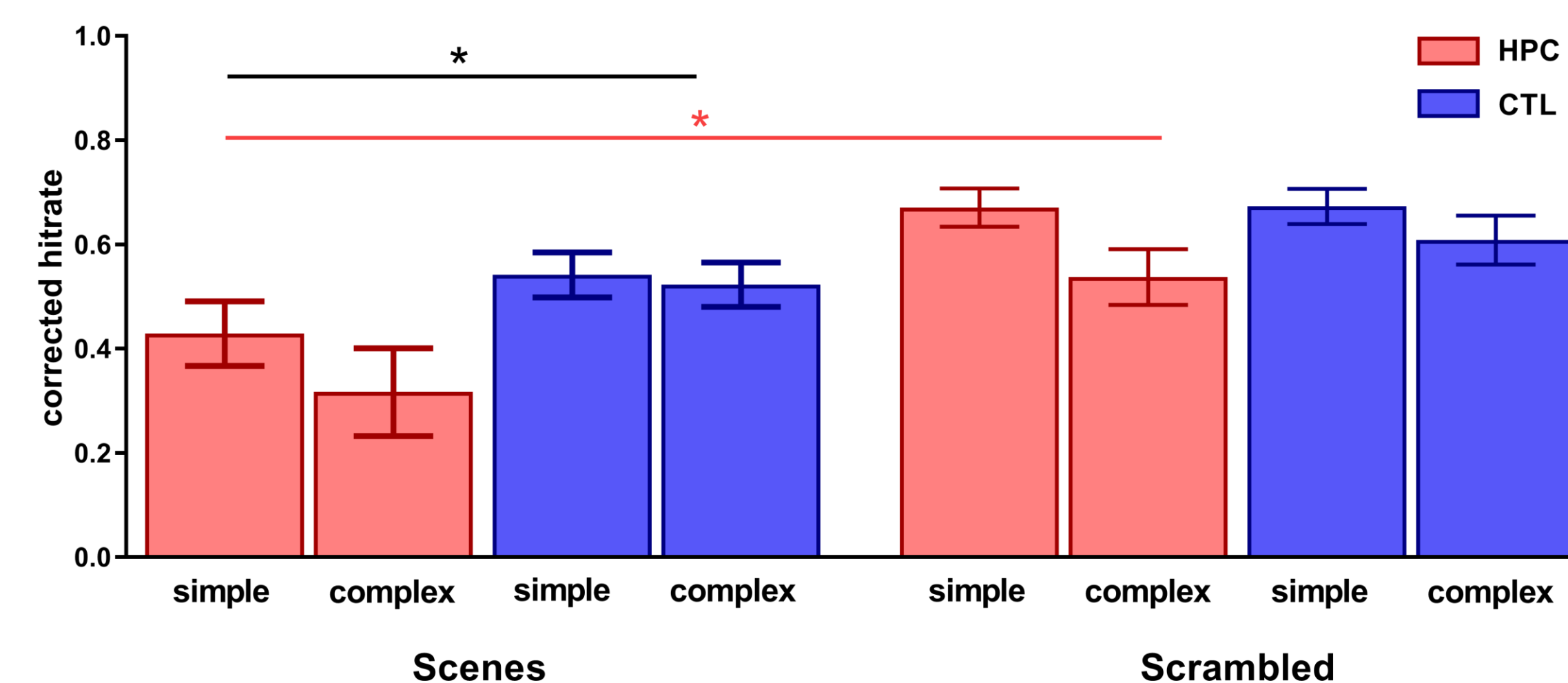
Task

- 160 image pairs
- 7 sec to decide whether pairs were identical or different

Trial structure



Results - patients



Displayed are means and standard errors. * $p < 0.05$, HPC= patients with hippocampal damage, CTL= controls. No differences between patients and controls were apparent for perceptual and constructive trials. Hence, the data displayed here are collapsed across these conditions.

- Patients detected fewer differences in naturalistic scenes compared to scrambled images
- Patients detected fewer differences in naturalistic scenes compared to the control participants
- There was no effect of stimulus complexity

McCormick, et al. (in preparation)

Conclusions

Our patient and fMRI investigations highlight a distinct role of the hippocampus in processing naturalistic scenes.

The effects documented were evident irrespective of whether scenes were simple or complex.

In addition, the fMRI findings show that scene processing is supported by a functional network to which each brain region contributes differently. Here, the anterior hippocampus may have a special role in scene construction^{8,9,10}.

References

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