Stimulus familiarity and expectation jointly modulate neural activity in the ventral visual stream

Mariya E. Manahova[1], Pim Mostert[1], Peter Kok[2], Jan-Mathijs Schoffelen[1], Floris P. de Lange[1]

[1] Donders Institute, Radboud University, Nijmegen, The Netherlands, [2] Department of Psychology, Yale University, New Haven, Connecticut, United States

INTRODUCTION

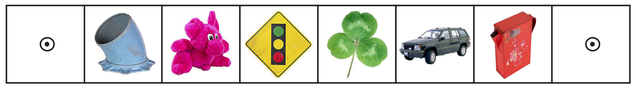
- Both familiarity and expectation modulate the sensory response in the visual system[1,2]. These effects have been studied in monkeys but not yet extensively in humans.
- It remains unclear whether the effects of familiarity and expectation on the sensory response are separable.

RESEARCH QUESTIONS

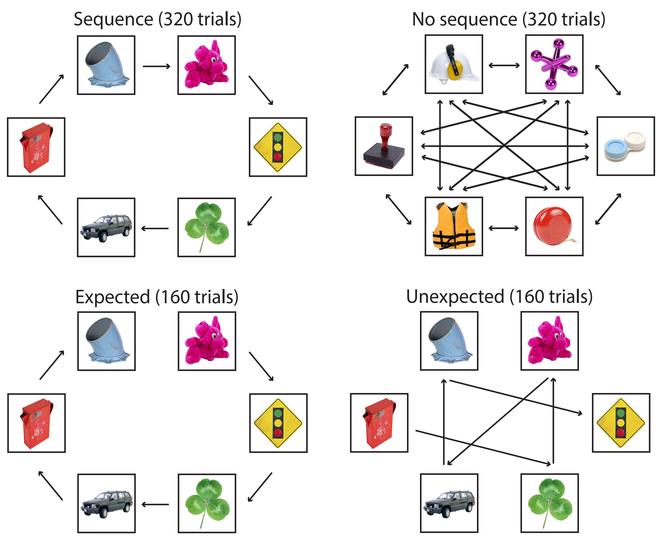
- How do familiarity and expectation modulate the human sensory response?
- Are the effects of familiarity and expectation separable?

DESIGN

TRIAL STRUCTURE



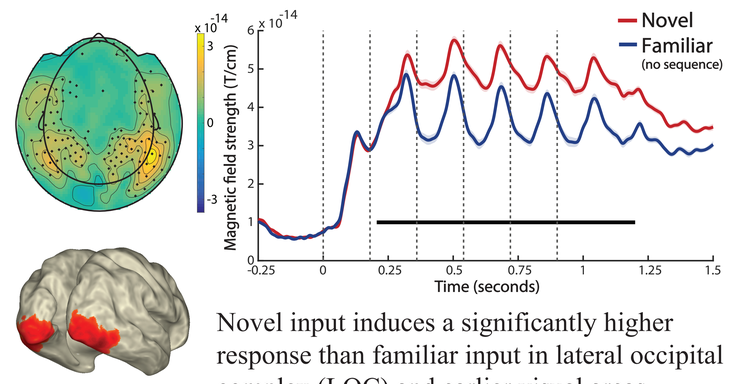
CONDITIONS: FAMILIAR (640 TRIALS)



CONDITIONS: NOVEL (320 TRIALS)

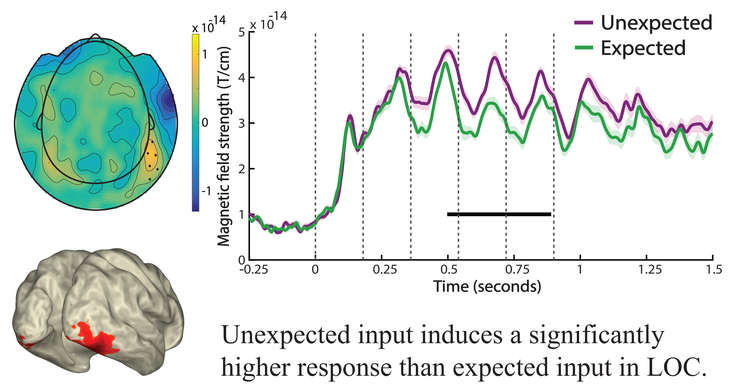
RESULTS

FAMILIARITY: AMPLITUDE



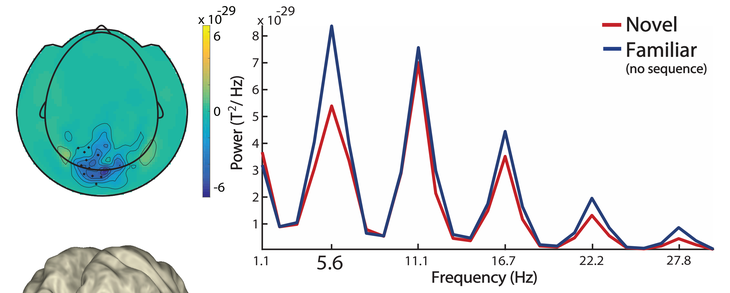
Novel input induces a significantly higher response than familiar input in lateral occipital complex (LOC) and earlier visual areas.

EXPECTATION: AMPLITUDE



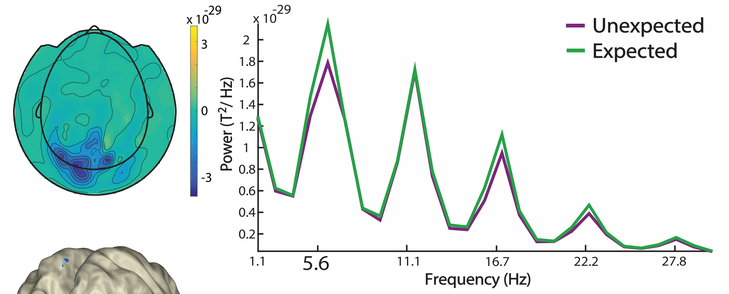
Unexpected input induces a significantly higher response than expected input in LOC.

FAMILIARITY: DYNAMIC RANGE



Familiar input is associated with a significantly larger dynamic range than novel input in early visual cortex.

EXPECTATION: DYNAMIC RANGE



Expected input is associated with an insignificant, slightly larger dynamic range than unexpected input.

CONCLUSIONS

- Familiarity and expectation jointly modulate the neural activity in the human brain elicited by a stimulus.
- The two effects are independent albeit similar in nature.
- Novel and unexpected input require more resources when processed in the brain than familiar and expected input, respectively.

REFERENCES

1. Meyer, T., Walker, C., Cho, R., & Olson, C. R. (2014). Image familiarization sharpens response dynamics of neurons in infero-temporal cortex. *Nature Neuroscience, 17*(10), 1388-1394.

2. Meyer, T., & Olson, C. R. (2011). Statistical learning of visual transitions in monkey inferotemporal cortex. *Proceedings of the National Academy of Sciences of the USA, 108*(48), 19401-19406.

Correspondence: Mariya Manahova (m.manahova@donders.ru.nl)