

SERIAL DEPENDENCE ACROSS FEATURES AND OBJECTS

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INTRODUCTION

Recent work claims that visual perception is systematically biased toward stimuli seen in the recent past, a phenomenon known as **serial dependence** (SD)¹.

Whether SD is of truly perceptual or post-perceptual nature, however, is still an open question².

Here we sought to provide a definitive answer by testing whether SD is selective for visual features and stimuli, a hallmark of early perceptual processes.

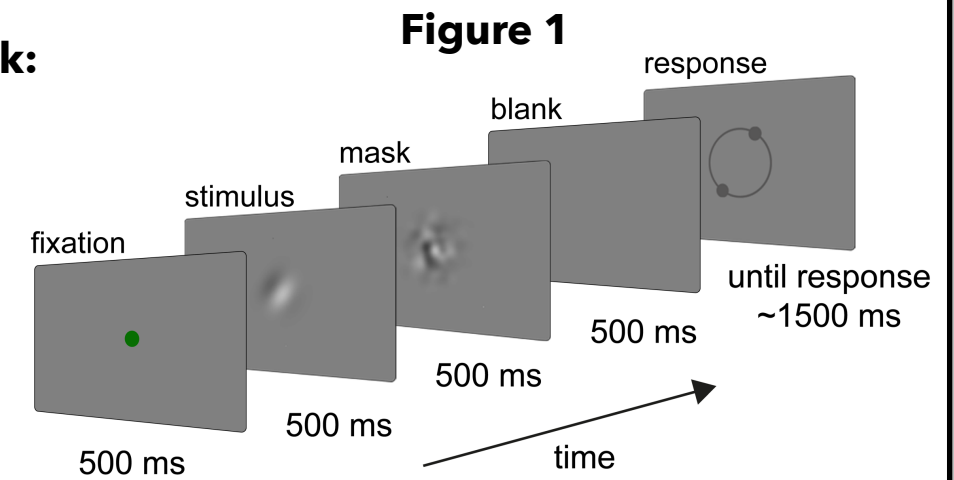
METHODS

Orientation adjustment task:

Participants reproduced the orientation of stimuli by adjusting a response probe.

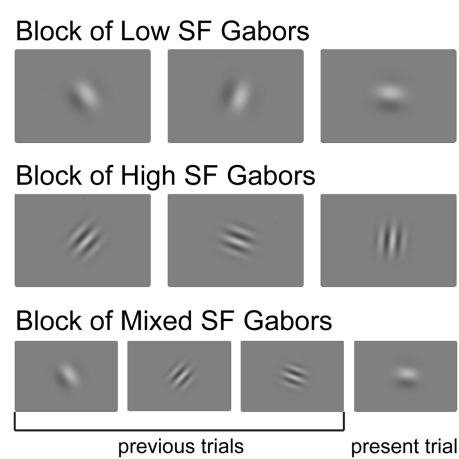
SD:

The deviation of adjustment errors toward previous orientations.



EXPERIMENT 1

Figure 2



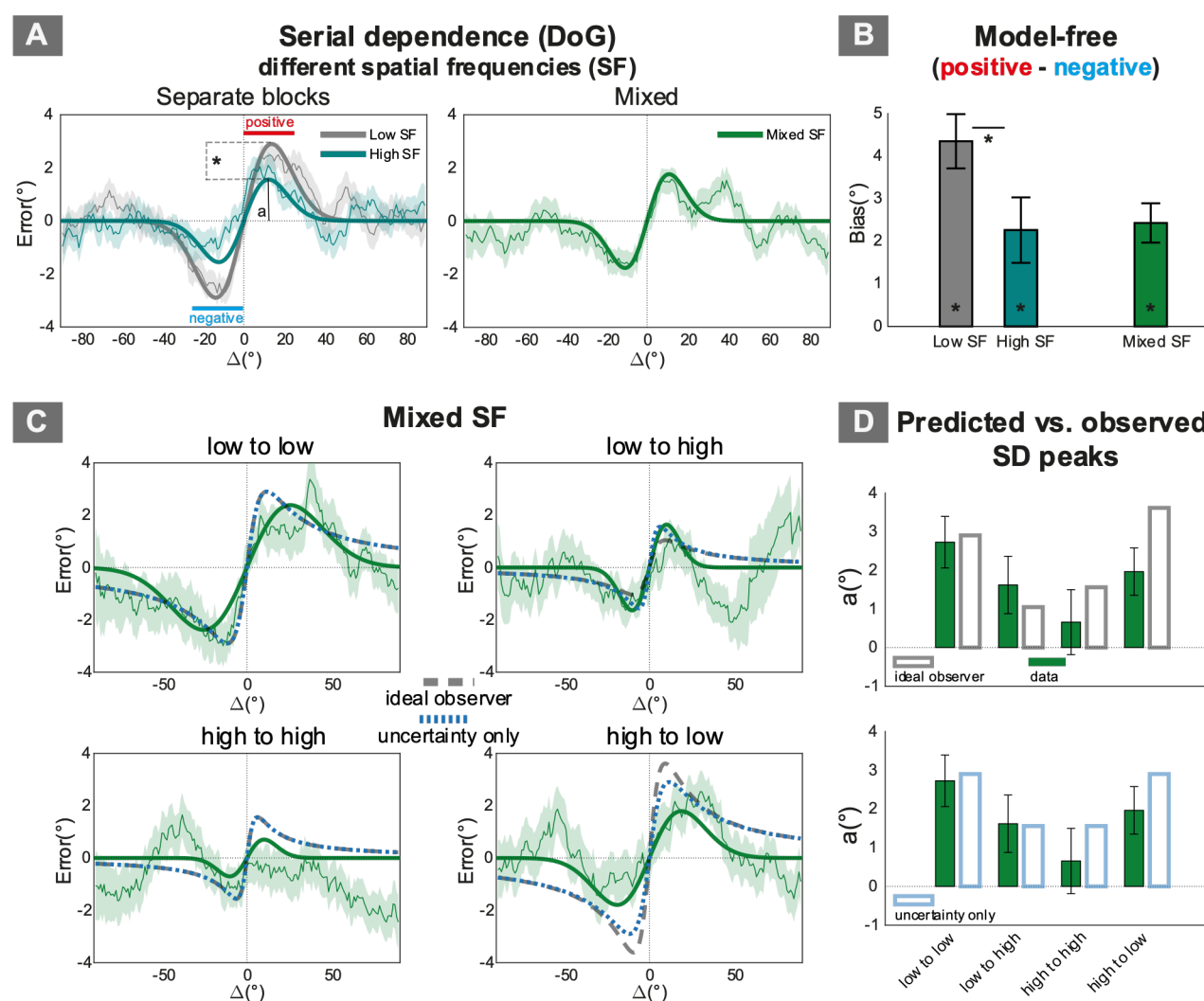
N = 24

SD for Gabors with different spatial frequencies (SF):

Conditions:

Low SF Gabor (.33 cpd)
High SF Gabor (1.00 cpd)
Mixed SF

Figure 3

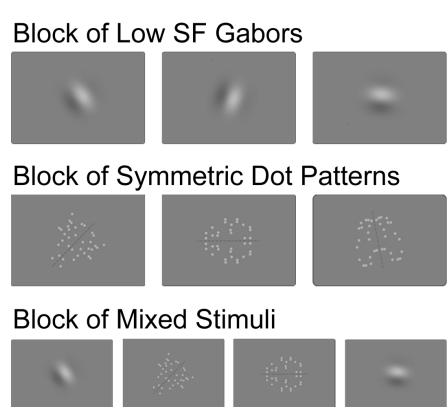


RESULTS

- SD occurred in all conditions (Fig. 3A-B);
- SD was overall larger for Low SF Gabors;
- In Mixed SF, SD occurred independently of changes in spatial frequency;
- Comparing an **Ideal Observer model** (optimal combination of past and present stimuli)³ with an **Uncertainty Only model**, revealed that SD is explained mostly by the uncertainty in present stimuli (Fig. 3C-D).

EXPERIMENT 2

Figure 4



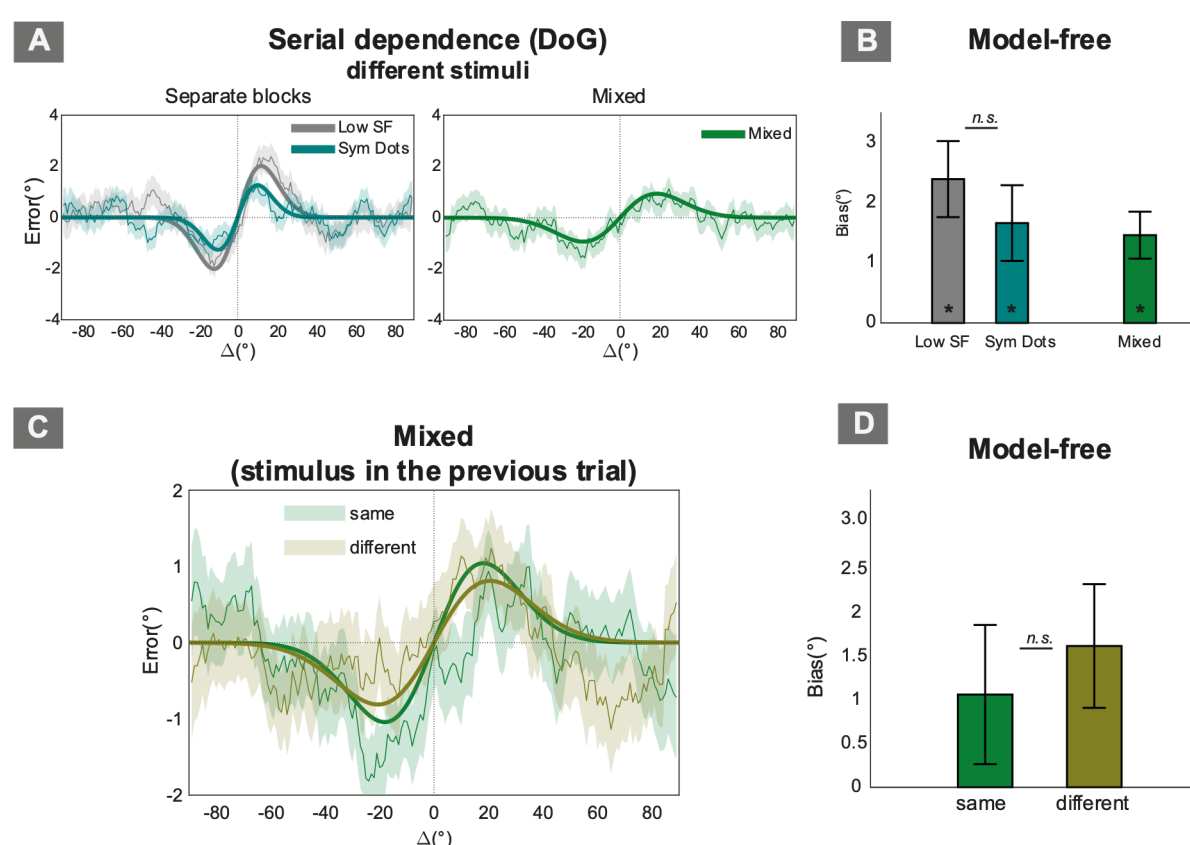
N = 24

SD for different stimuli:

Conditions:

Low SF Gabor
Symmetric Dot
Mixed

Figure 5



RESULTS

- SD occurred in all conditions (Fig. 5A-B);
- SD was not significantly different between blocks of Low SF and Symmetric Dots (Fig. 5B);
- Crucially, we observed SD in the mixed block independent from the type of stimuli presented in the previous and present trial (Fig. 5C-D).

CONCLUSION

- SD is independent from stimuli and stimulus features.
- SD emerges at high-level processing stages where task-relevant representations can be dissociated from the physical attributes of stimuli.
- SD is not purely perceptual.**

REFERENCES

- Fischer, J., & Whitney, D. (2014). Serial dependence in visual perception. *Nature neuroscience*, 17(5), 738-743.
- Pascucci, D., Mancuso, G., Santandrea, E., Della Libera, C., Plomp, G., & Chelazzi, L. (2019). Laws of concatenated perception: Vision goes for novelty, decisions for perseverance. *PLoS biology*, 17(3), e3000144.
- Cicchini, G. M., Mikellidou, K., & Burr, D. C. (2018). The functional role of serial dependence. *Proceedings of the Royal Society B*, 285(1890), 20181722.