

# Visual pattern preferences: Testing the processing bias hypothesis with background-matching stimuli to shed light on signal design evolution

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## Background

Natural and sexual selection can be in conflict in driving the evolution of sexual ornamentation. Sexual selection typically favours conspicuousness to potential mates, whereas natural selection penalizes detectability to avoid predators. Focusing on signal efficiency rather than detectability, however, suggests that natural and sexual selection need not be antagonistic. Considerable evidence demonstrates that people prefer images that match the statistics of natural scenes<sup>1</sup>, likely because they are efficiently processed by the brain. This "processing bias"<sup>2</sup> predicts that once detected, camouflage patterns should also be attractive and could serve as evolutionary precursors of sexual signals.

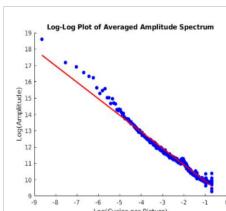
## Methods

Two white noise images (650 x 650 px): a target and a background image, was Fourier transformed to change the slope of the relationship between the log-amplitude spectrum and the log frequency corresponding to different conditions

### Conditions:

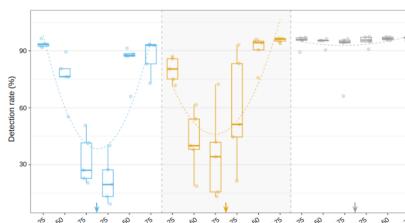
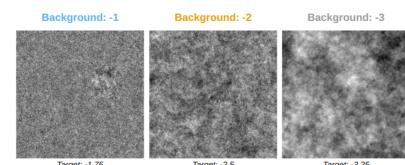
- background image: slope = -1, -2, -3
- target image: slope = background slope  $\pm 0.25; \pm 0.5; \pm 0.75$

Online experiment: 1757 participants (61% W)

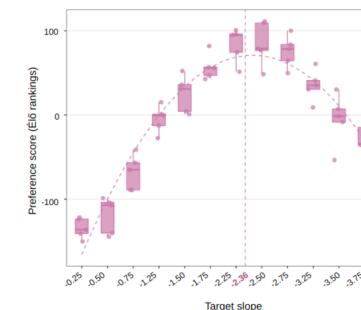


Fourier slope of an image

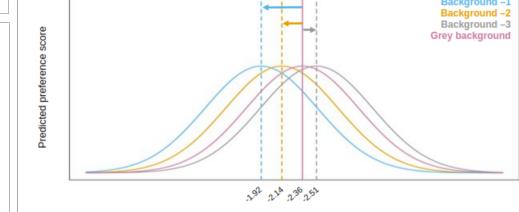
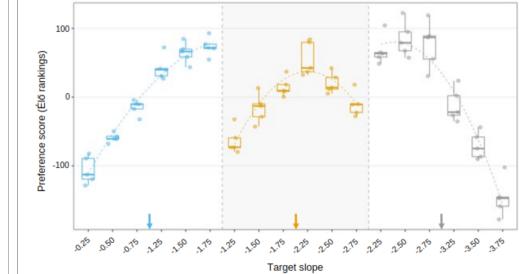
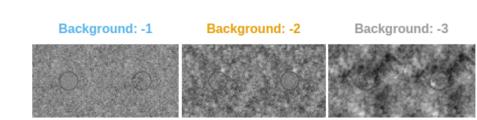
## Experiment 1: Detection task



## Experiment 2: Preference task (2-AFC) with a grey background

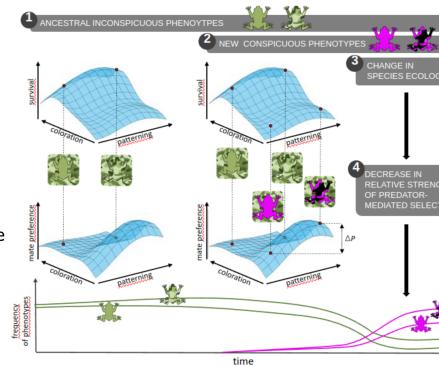


## Experiment 3: Preference task (2-AFC) with a patterned background



## Conclusion

- Preference for targets with a slope similar to the absolute preference for spatial statistics
- Background effect: Patterned backgrounds pull the preference peak away from the absolute preference for spatial statistics
- Camo effect: Stimuli with the highest background matching tend to have higher preference scores
- Potential preference trade-off: we have a preference for natural statistics but this can be modified by the background
- Camouflage patterns could serve as evolutionary precursors of sexual signals through the exploitation of processing bias



## References

- <sup>1</sup> Geller, Bartho, Thömmes, Redies (2022). Statistical image properties predict aesthetic ratings in abstract paintings created by neural style transfer. *Front. Neurosci.* 16, 999720.
- <sup>2</sup> Renoult & Mendelson (2019). Processing bias: extending sensory drive to include efficacy and efficiency in information processing. *Proc. R. Soc. B Biol. Sci.* 286, 20190165.

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