

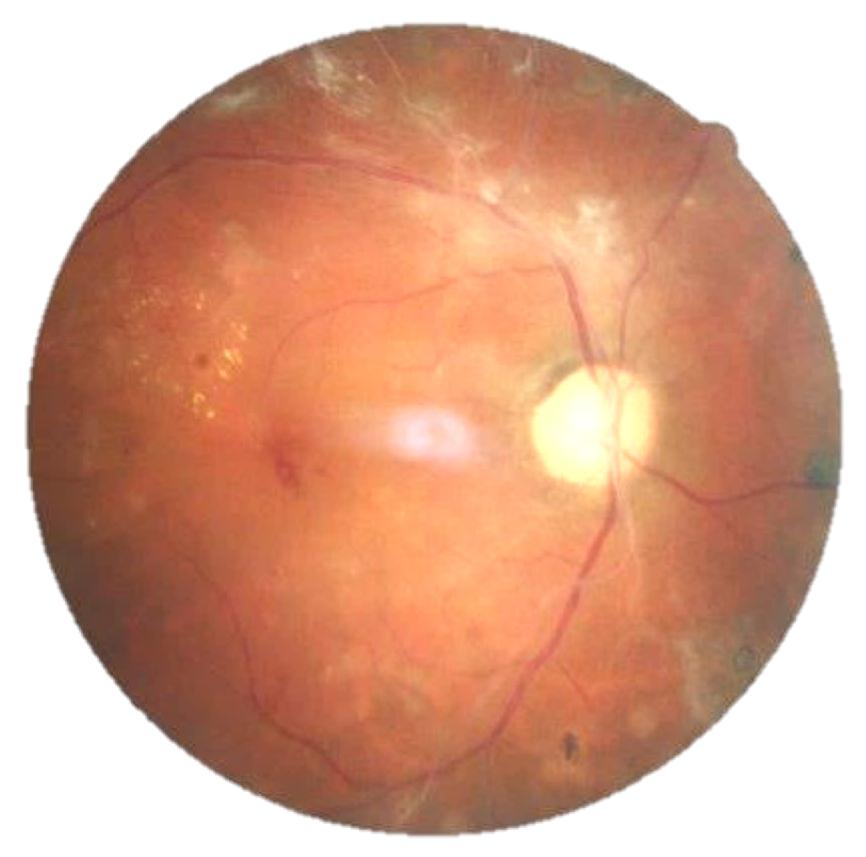
# Frontal midline theta predicts diagnosis style in a medical similarity judgement task

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## INTRODUCTION



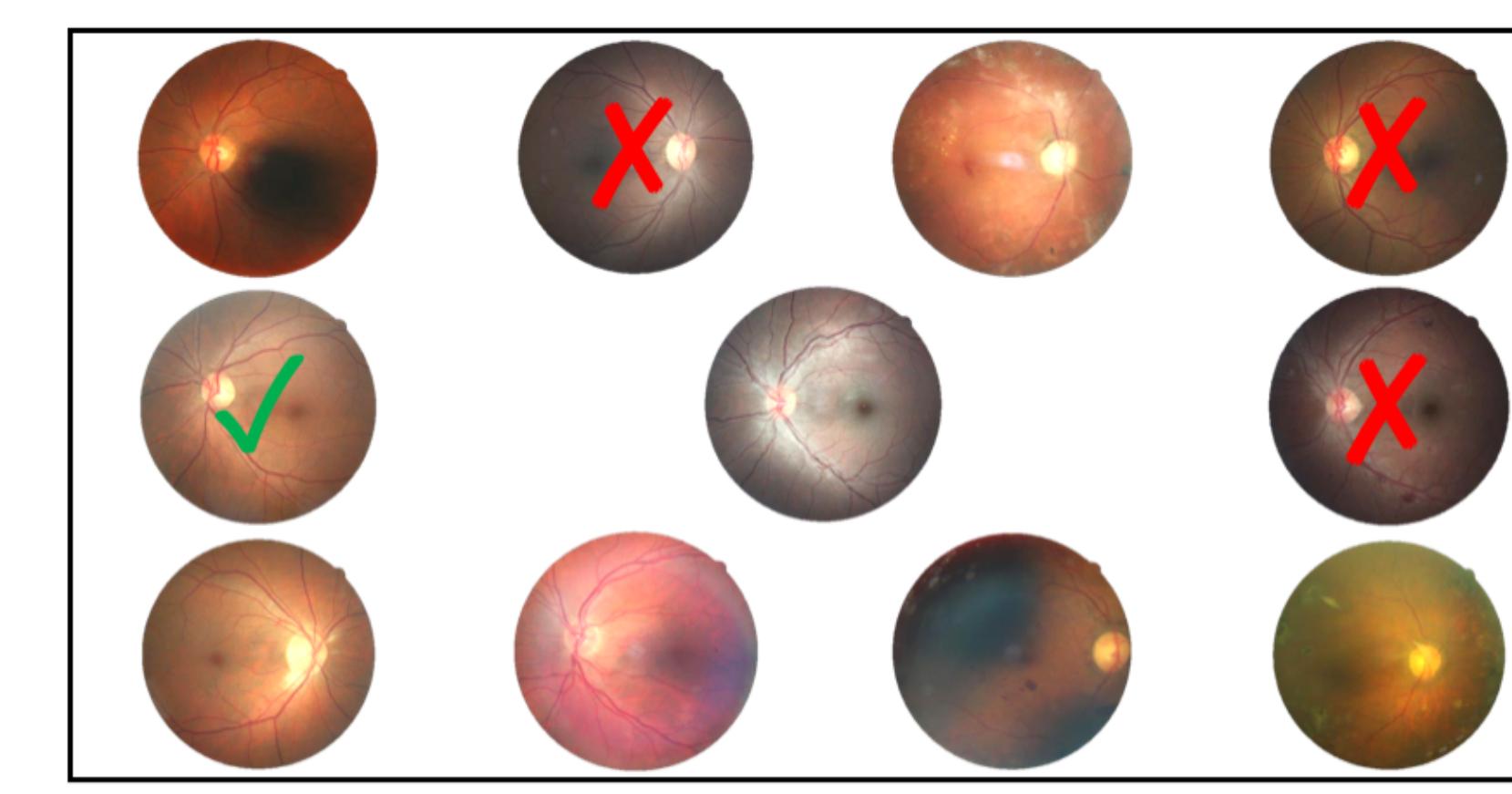
Diabetic retinopathy features<sup>1</sup>

- Diabetic retinopathy is diagnosed via the examination of images
- Severity scale: none, mild, moderate, severe, proliferative
- Early-career MDs report low confidence in diagnosing diabetic retinopathy<sup>2</sup>. Why?

Rule-based learning (severity scale)

Implicit categorization (perceptual space)

## METHODS



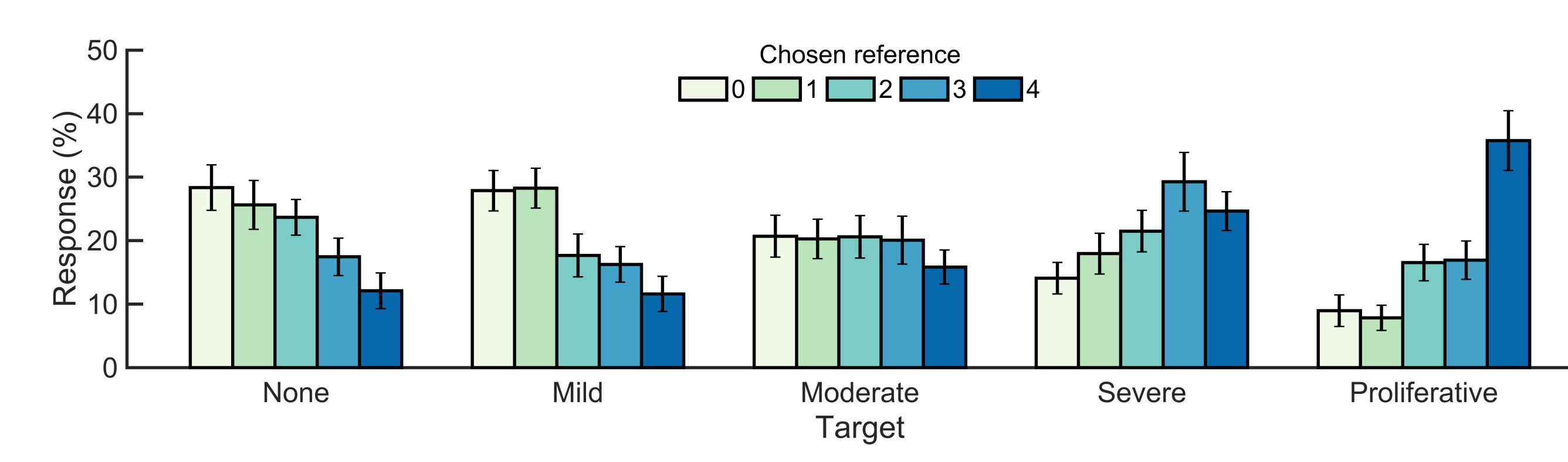
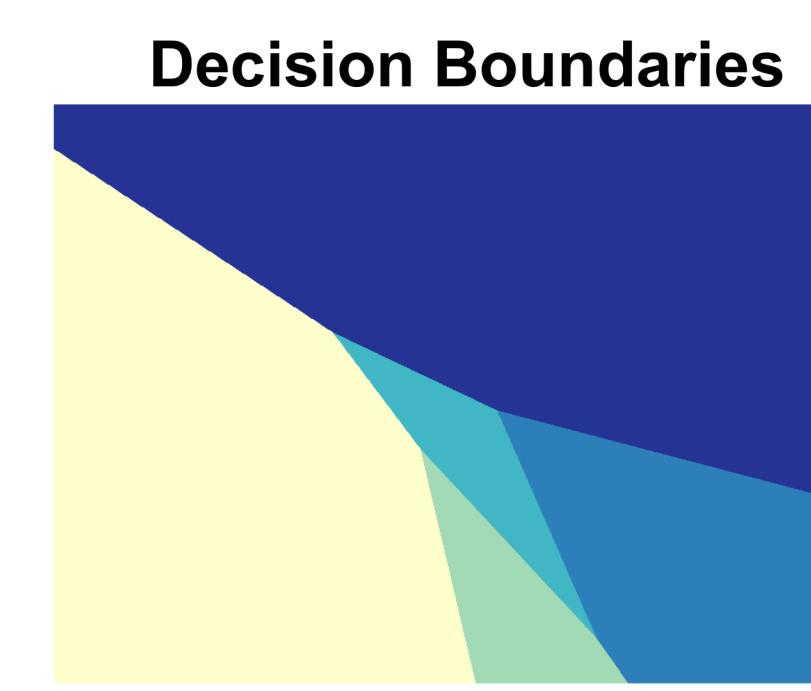
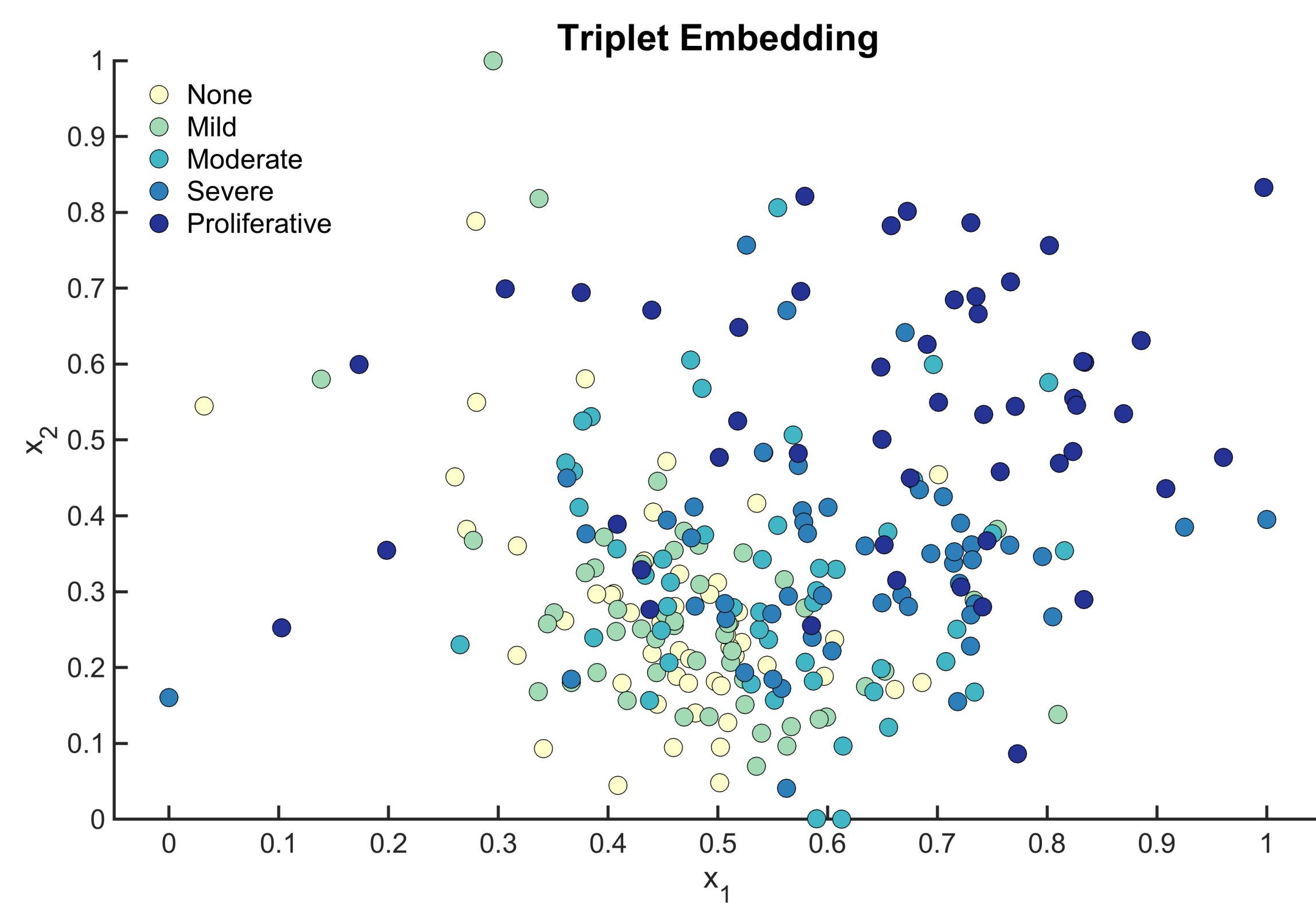
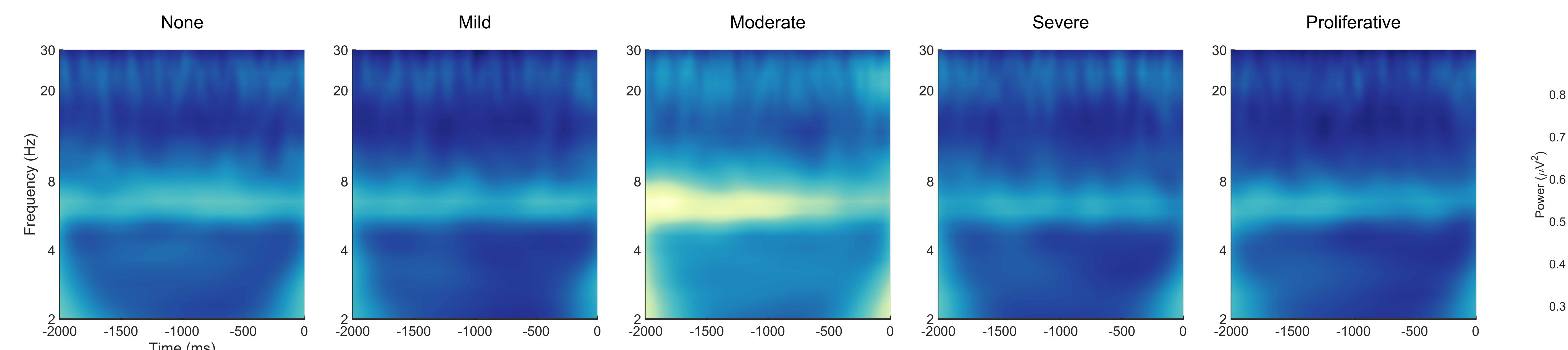
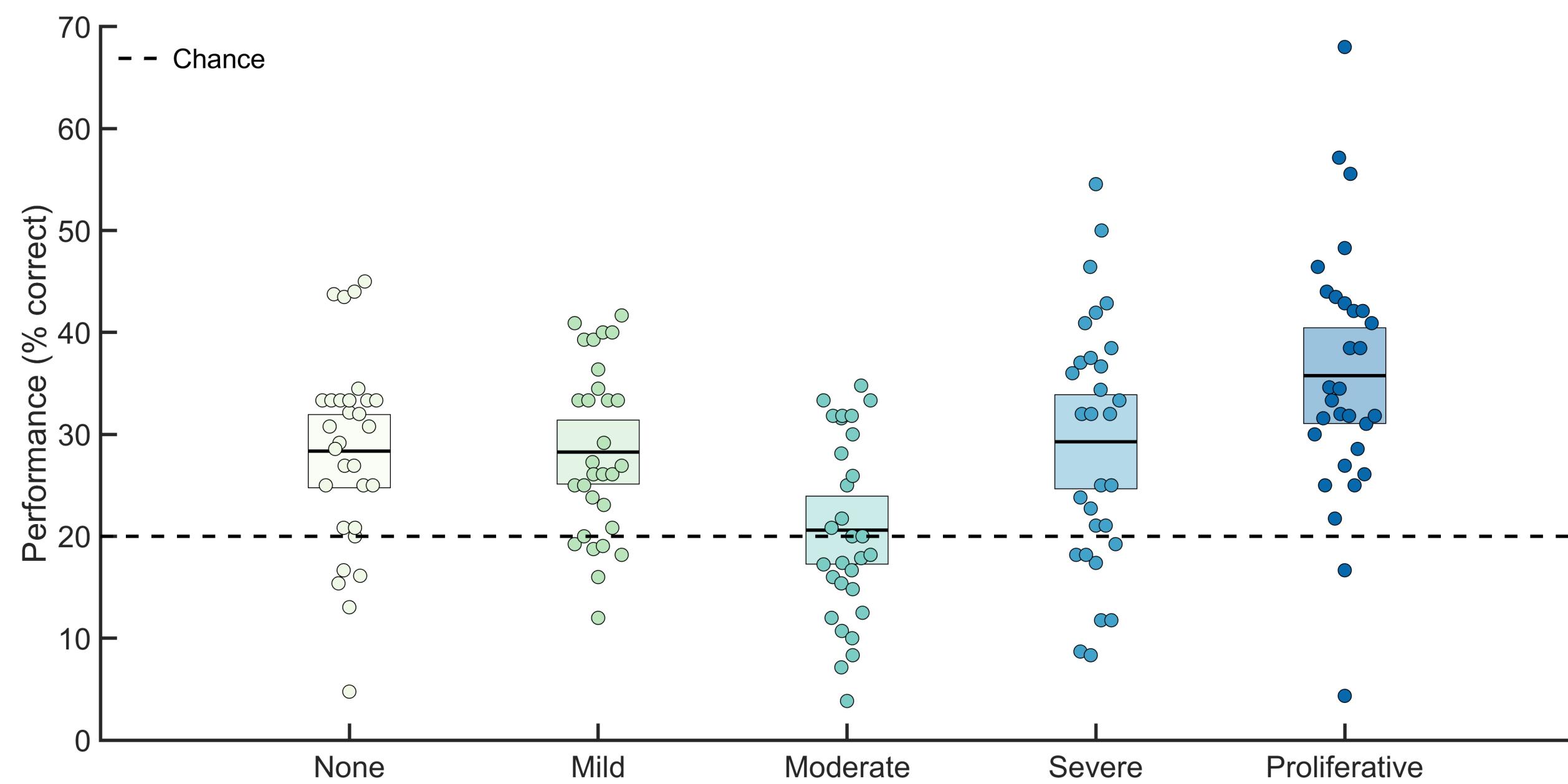
Decision   Pre-feedback   Feedback   Until response   400-600 ms   1000 ms   50 ms   (Continue until correct)

### The similarity judgement task

- Accuracy (did the diagnosis match?)
- Triplets (data of the form A is more similar to B than C)<sup>3</sup>
- Frontal midline theta (EEG measure of cognitive control)<sup>4</sup>

Images and diagnoses from [www.kaggle.com/c/diabetic-retinopathy-detection](http://www.kaggle.com/c/diabetic-retinopathy-detection)  
N = 31, 8 M, 5 LH, Mean Age: 22.0, 95% CI [19.5, 24.5]

## RESULTS



## Conclusions

- Retinopathy diagnosis is challenging due to *perceptual overlap*
- Perceptual overlap is accompanied by enhanced cognitive control (as indexed by FMT)
- Next step: task optimization<sup>5</sup>

1. Wong, T. Y., Cheung, C. M. G., Larsen, M., Sharma, S., & Simó, R. (2016). Diabetic retinopathy. *Nature Reviews Disease Primers*, 2, 16012.

2. George, J. T., Warriner, D. A., Anthony, J., Rozario, K. S., Xavier, S., Jude, E. B., & McKay, G. A. (2008). Training tomorrow's doctors in diabetes: A multi-centre survey. *BMC Medical Education*, 8, 22.

3. Maaten, L. van der, & Weinberger, K. (2012). Stochastic triplet embedding. In 2012 IEEE International Workshop on Machine Learning for Signal Processing (pp. 1–6).

4. Cavanagh, J. F., & Frank, M. J. (2014). Frontal theta as a mechanism for cognitive control. *Trends in Cognitive Sciences*, 18(8), 414–421.

5. Roads, B. D., & Mozer, M. C. (2017). Improving Human-Machine Cooperative Classification Via Cognitive Theories of Similarity. *Cognitive Science*, 41(5), 1394–1411.

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