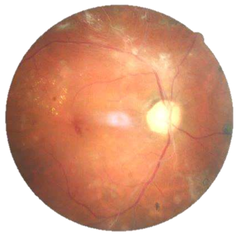
Frontal midline theta predicts diagnosis style in a medical similarity judgement task

C.D. Hassall[1], M.S. Chia[1], B. Wright[2], and O.E. Krigolson[1]

Centre for Biomedical Research[1], Division of Medical Sciences[2], University of Victoria

University of Victoria | Centre for Biomedical Research

INTRODUCTION

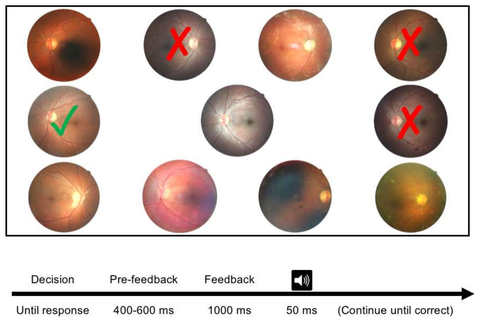


Diabetic retinopathy features[1]

- 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[2]. *Why?*

Rule-based learning (severity scale) ⟷ Implicit categorization (perceptual space)

METHODS

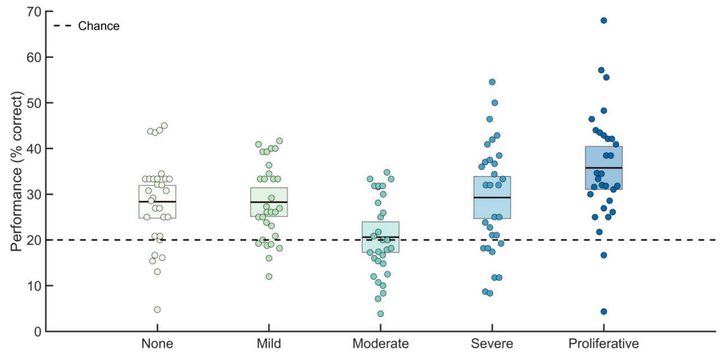


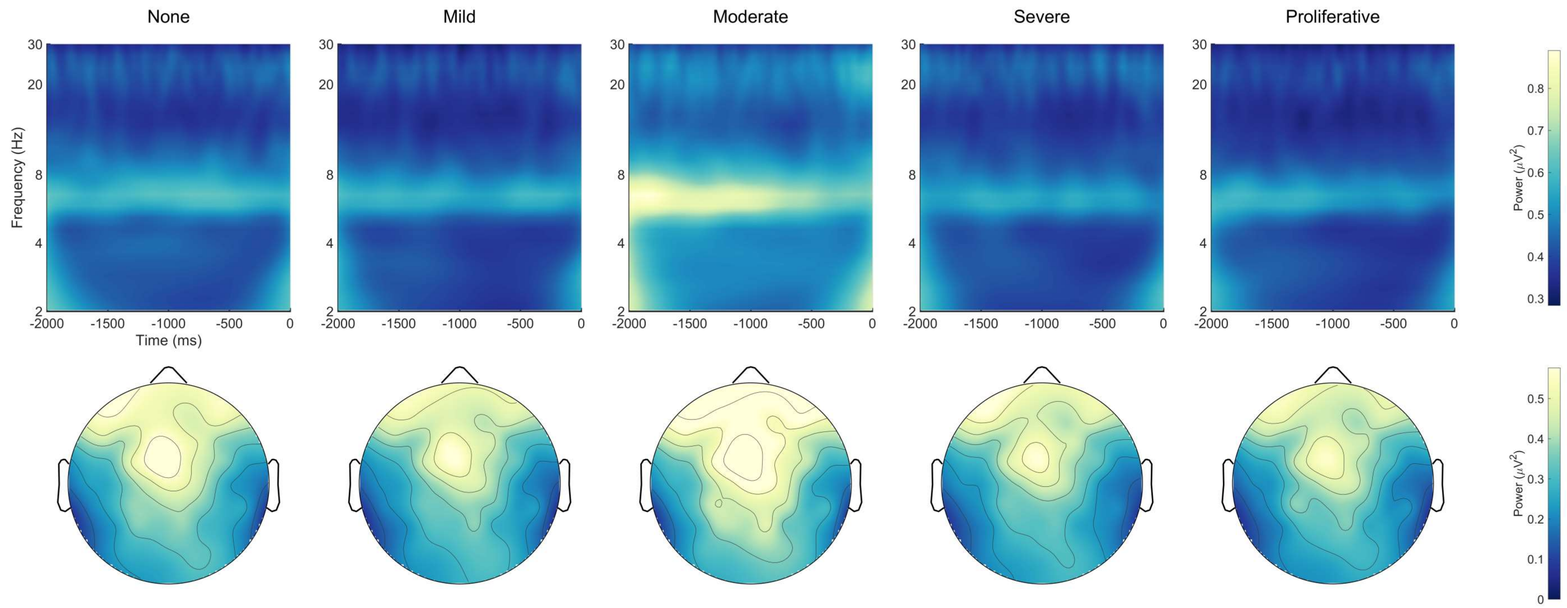
The *similarity judgement task*

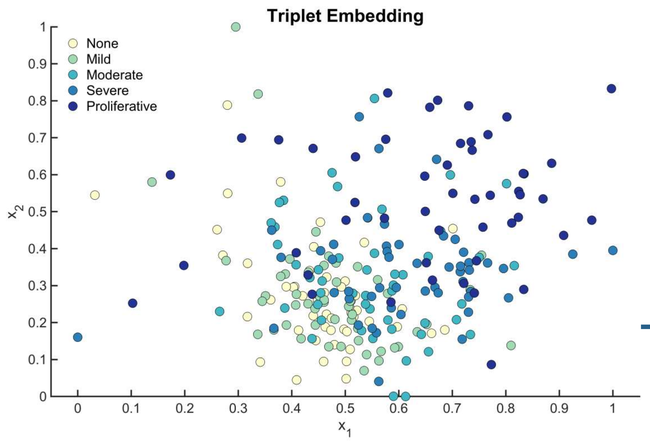
Accuracy (did the diagnosis match?)
Triplets (data of the form *A* is more similar to *B* than *C*)[3]
Frontal midline theta (EEG measure of cognitive control)[4]

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

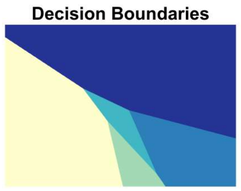
RESULTS

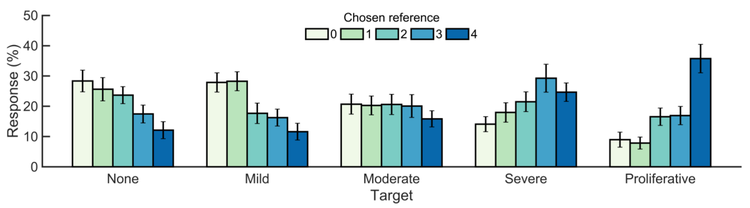






LDA





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[5]

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.

Download PDF at www.cameronhassall.com/retinopathy

Cameron Hassall, Theoretical and Applied Neuroscience Lab, University of Victoria – www.krigolsonlab.com – chassall@uvic.ca

NSERC CRSNG