



Comparison between the calculated and the measured neural transfer function

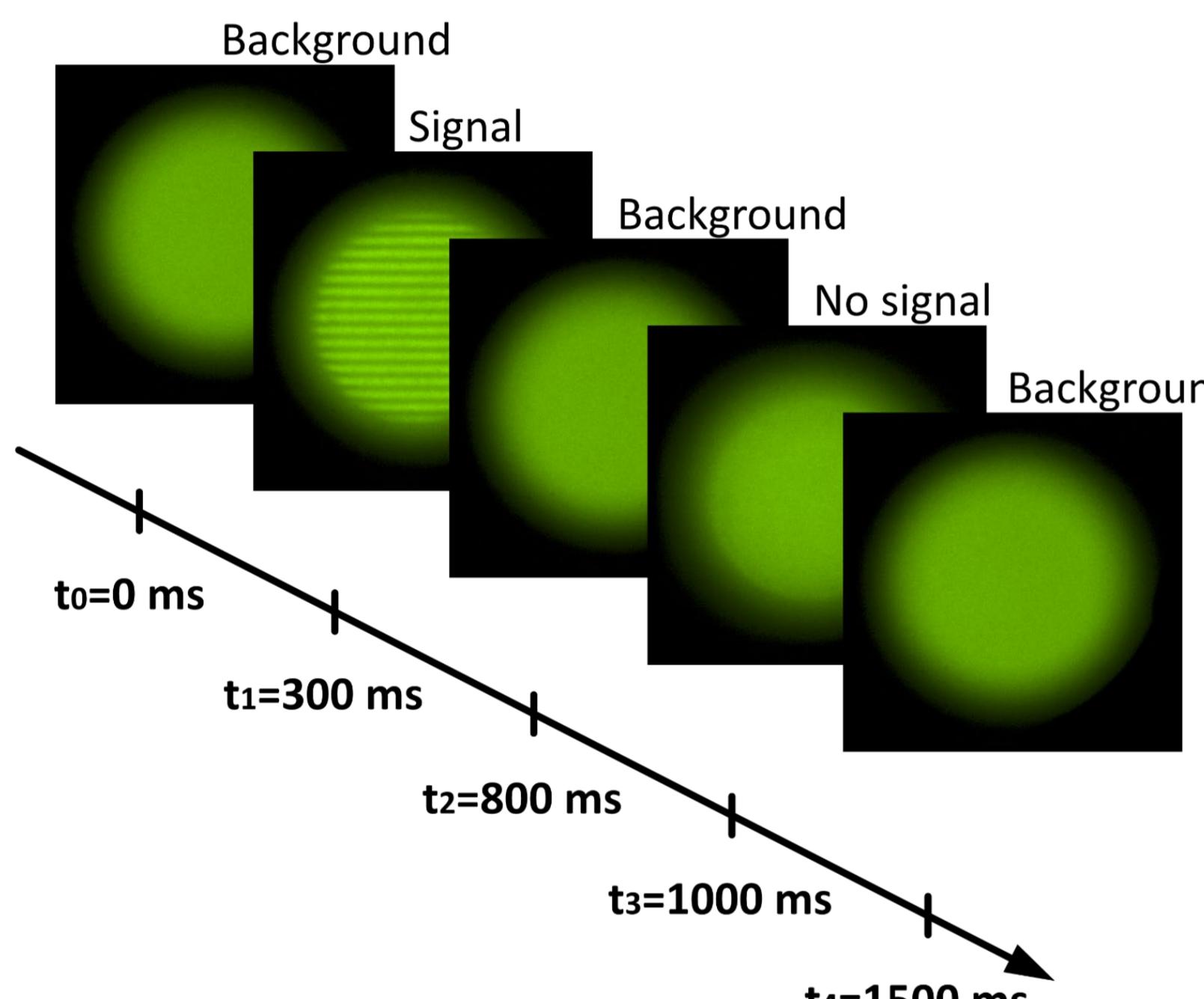
5440

Jonas Müller¹, Niklas Domdei², Siegfried Wahl^{1, 2}¹ Institute for Ophthalmic Research, Eberhard Karls University of Tübingen, Elfriede-Auhorn-Strasse 7, Tübingen, Germany;² Carl Zeiss Vision International GmbH, Turnstrasse 27, Aalen, Germany

Methods

1. Direct NTF measurements:

- Laser-interference System (aberration-free stimulation) [2]
- Two-interval forced-choice task (QUEST)



- Spatial frequencies: 3, 6, 9, 12, 18, 24 cpd

2. Calculations of NTF with LOAs:

- Three aberrometer measurements (ZEISS i.Profiler plus)
→ calculation of average MTF (matching pupil size to CSF)
- CSF measurements (matching conditions to NTF measurements)
 - LCD-Display (VIEWPrix)
 - 2-IFC task (QUEST) with 3, 6, 9, 12, 18, 24 cpd
 - Without glasses in 4.5 m distance

3. Calculations of NTF without LOAs:

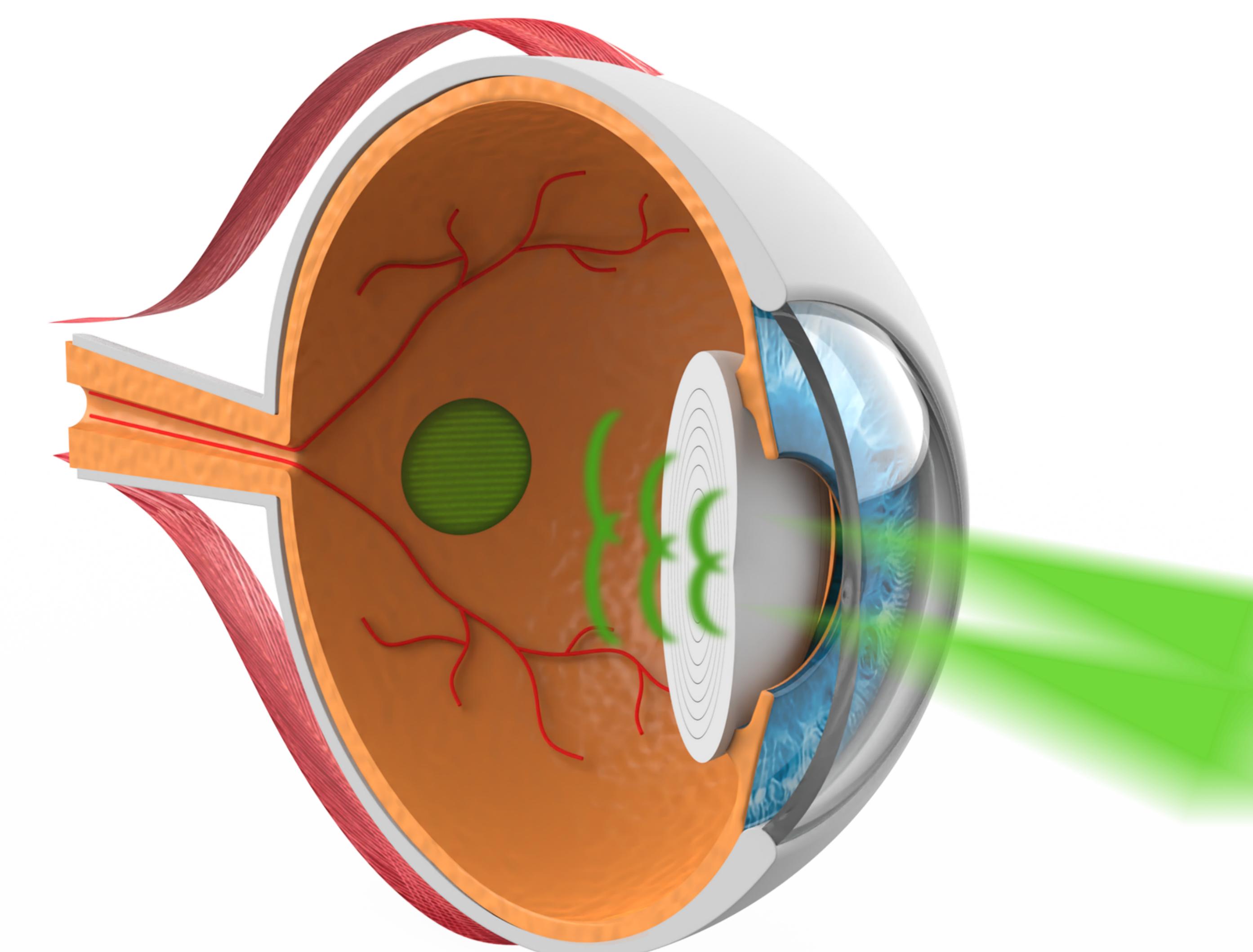
- CSF measurements with glasses in 4.5 m distance
- Set LOAs in MTF to zero

Contrast perception is defined by the **Contrast Sensitivity Function (CSF)**.

The perception is limited by:

- Optics of the eye → **Modulation Transfer Function (MTF)**
- Processing of the neural system → **Neural Transfer Function (NTF)**

Textbook relationship between the functions: $\text{CSF} = \text{MTF} \cdot \text{NTF}$ [1] (?)

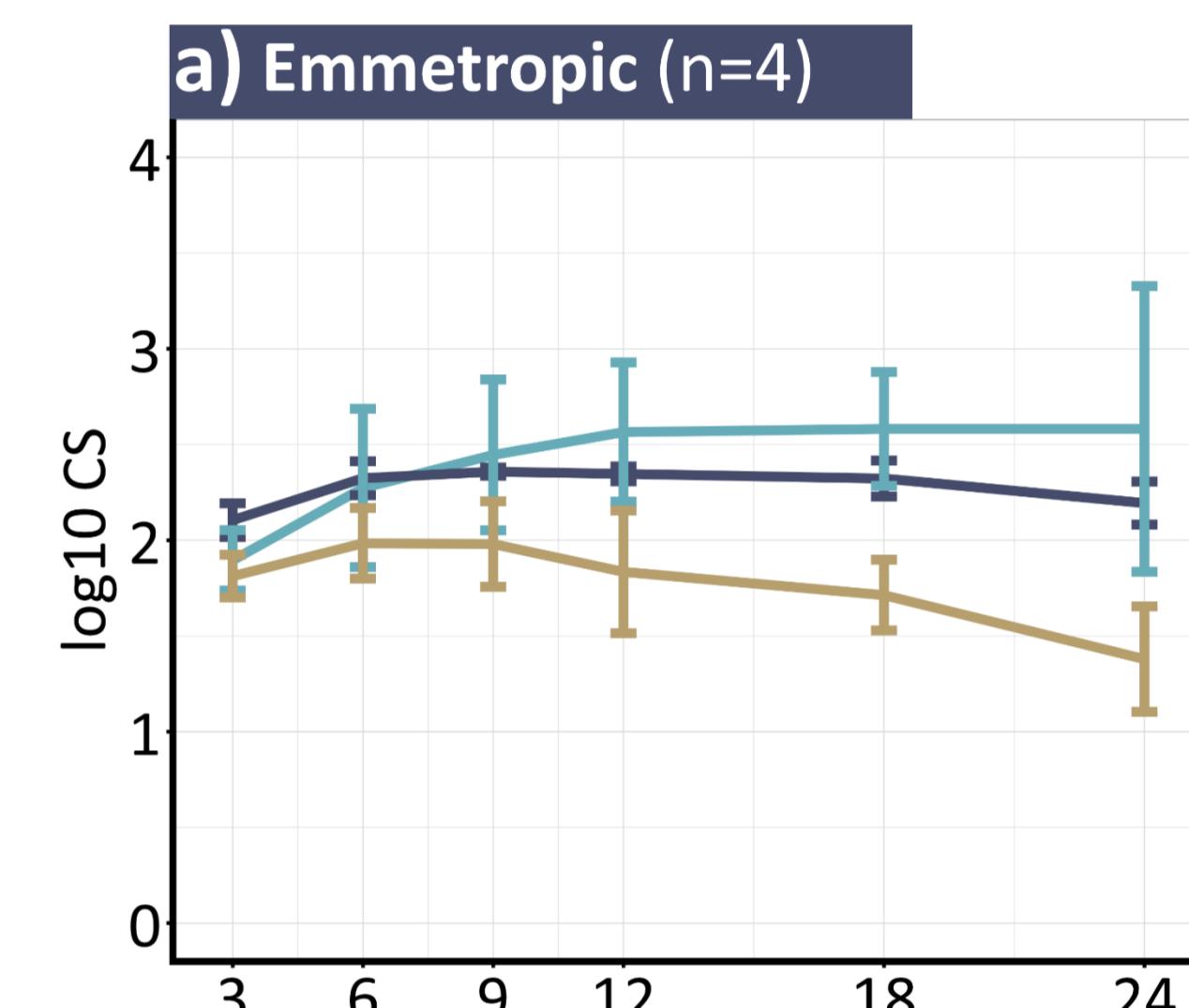


- **Emmetropic** and **corrected myopic** participants show a **good agreement** between **directly measured and calculated NTF**
- **Overestimation for calculated NTF in myopic** participants with LOAs
→ MTF improves at a higher rate than contrast sensitivity [3]

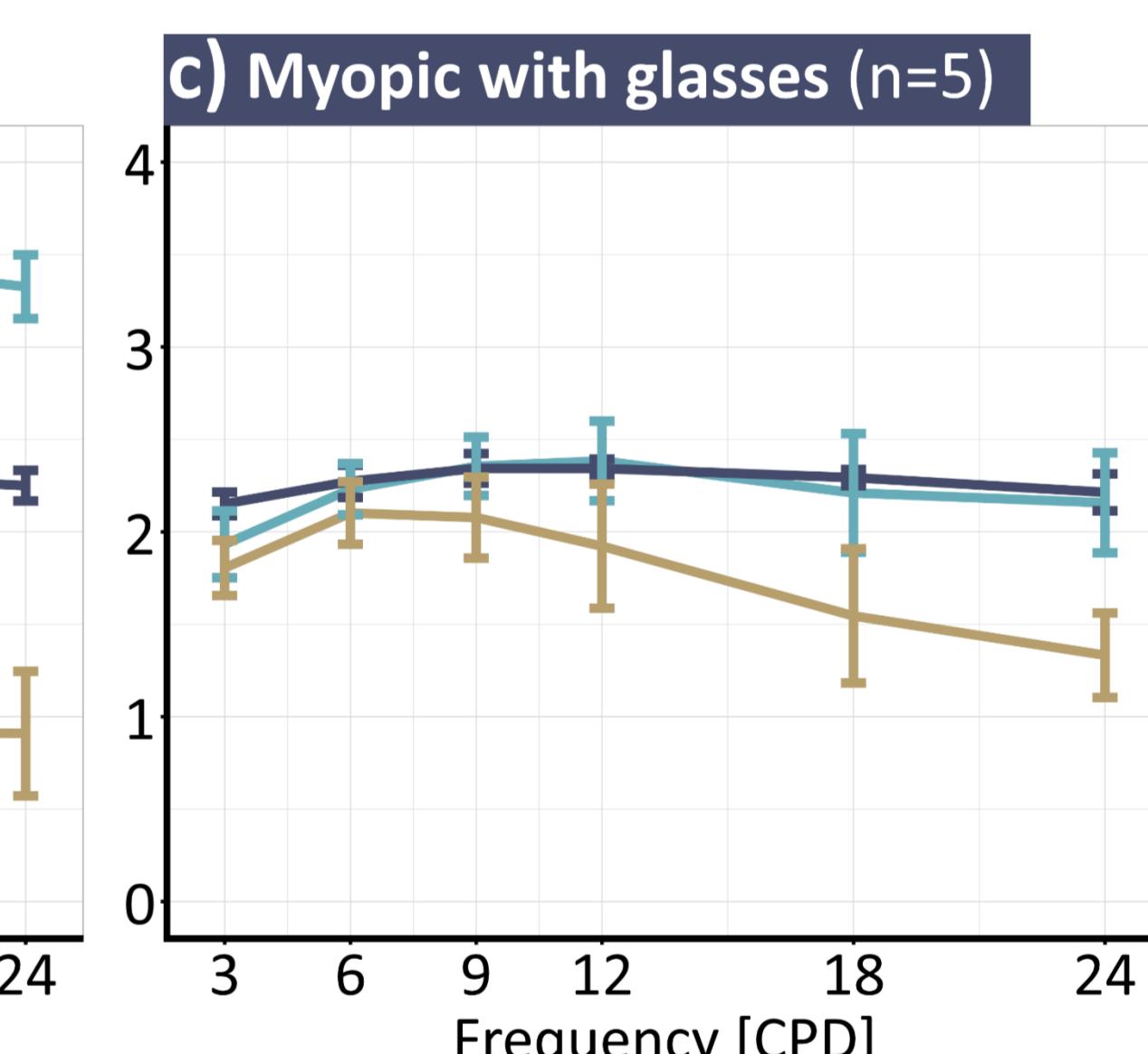
Results

Rx as spherical equivalent (average ± SD):

- Emmetropic: -0.17 ± 0.33 D
- Myopic: -1.78 ± 0.69 D
- Myopic with glasses: -2.11 ± 0.19 D

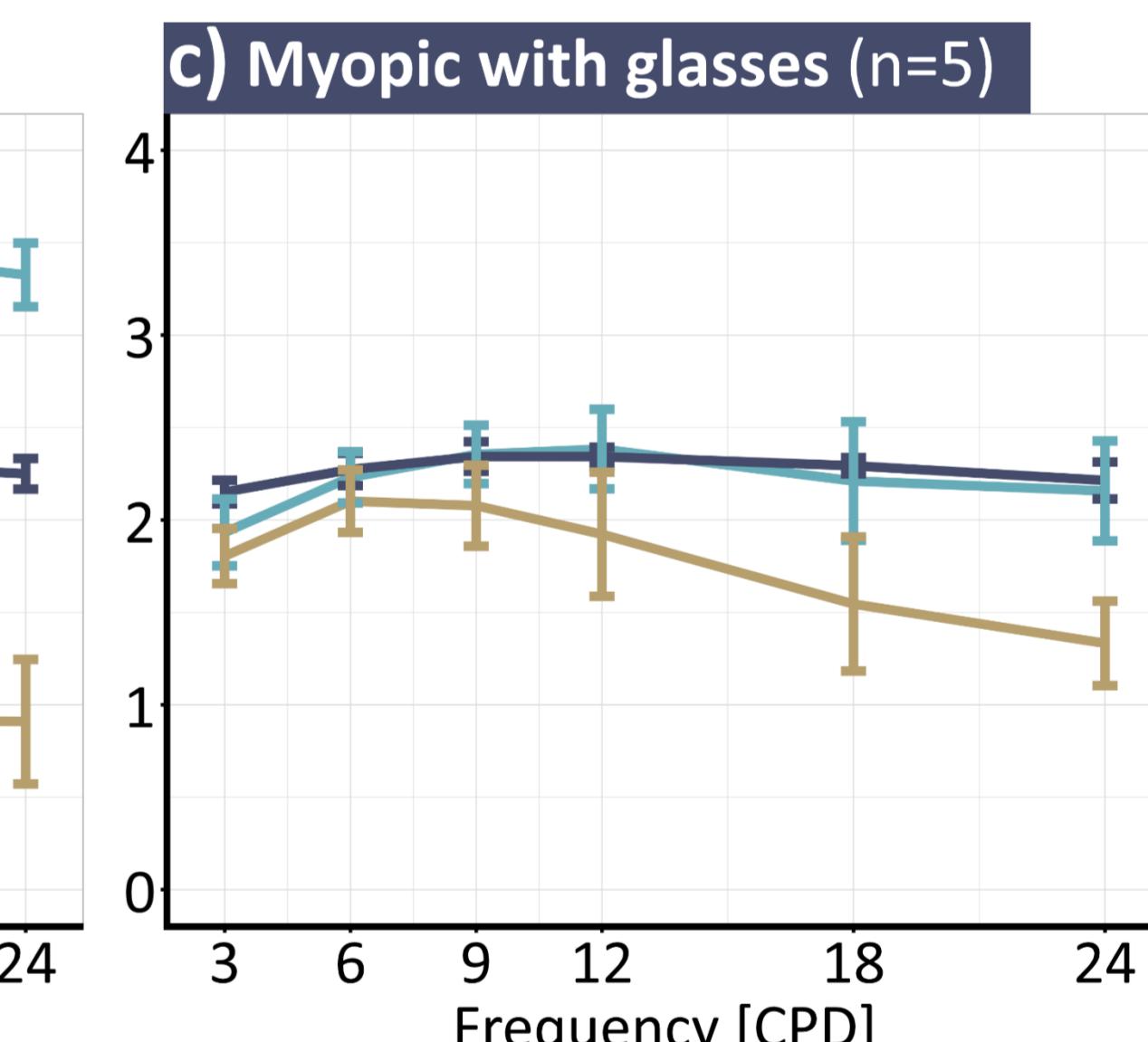


Legend:
Calculated NTF
CSF
NTF



a) Emmetropic (n=4)

b) Myopic (n=6)



c) Myopic with glasses (n=5)

References

- [1] Losada, M. A., et al. "Relative Contributions of Optical and Neural Limitations to Human Contrast Sensitivity at Different Luminance Levels." *Vision Research* 33, no. 16 (November 1, 1993): 2321–36.
- [2] Suchkov, N., et al. "SLM-Based Interferometer for Assessing the Polychromatic Neural Transfer Function of the Eye." *Biomedical Optics Express* 12, no. 10 (October 1, 2021): 6040–54.
- [3] De Gracia, P., et al. "Contrast Sensitivity Benefit of Adaptive Optics Correction of Ocular Aberrations." *Journal of Vision* 11, no. 12 (October 10, 2011): 5–5.

Get the
poster: