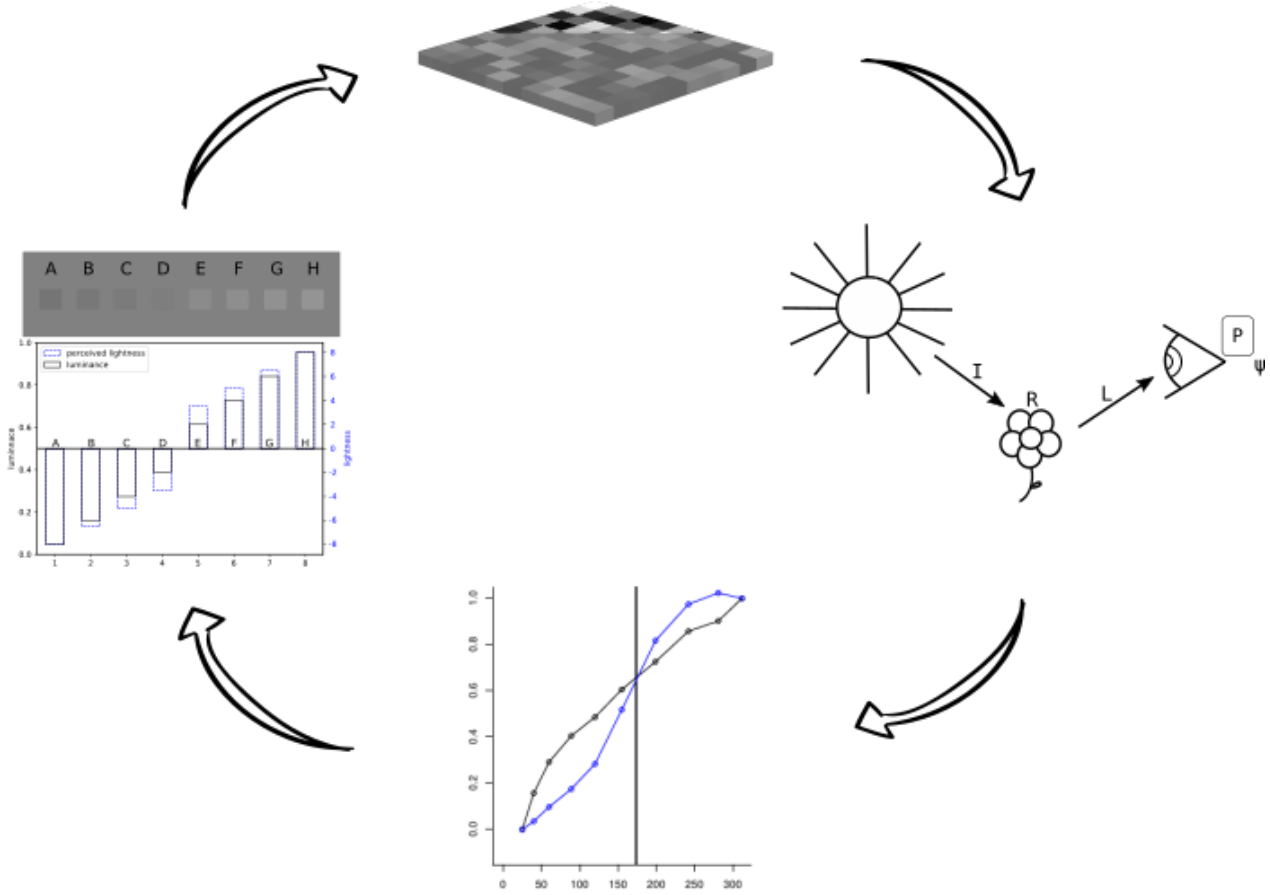
My Visual Journey

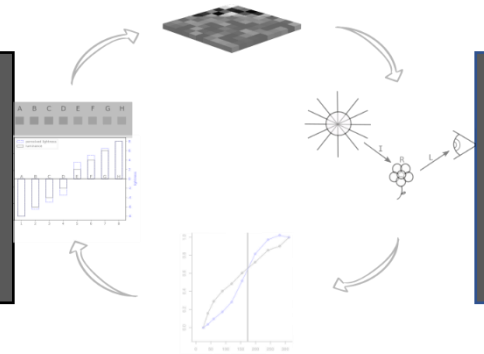
At the Department of Computational Psychology
Carolin Brunn

From CS to Psychology

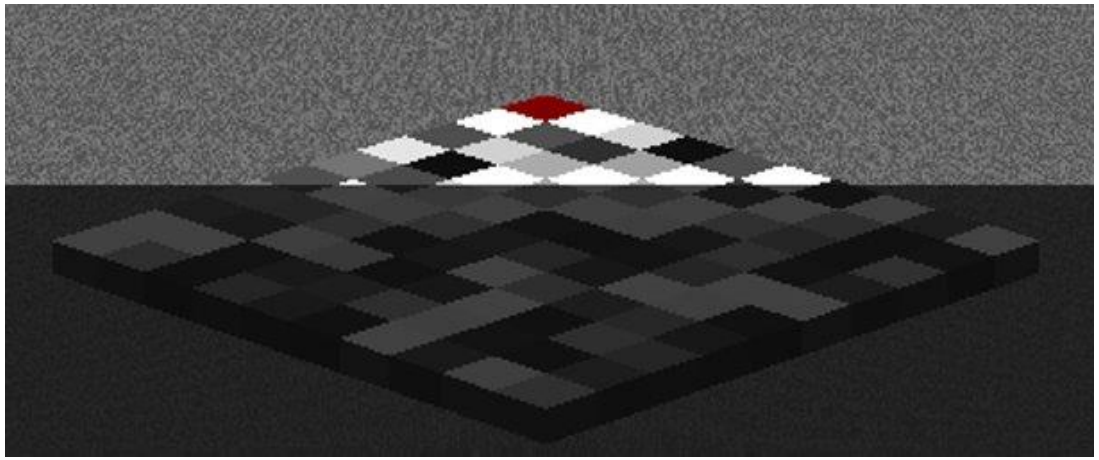
- First Insights
- Visual System
- MLDS Analysis
- Crispening Effect
- Bachelor Thesis



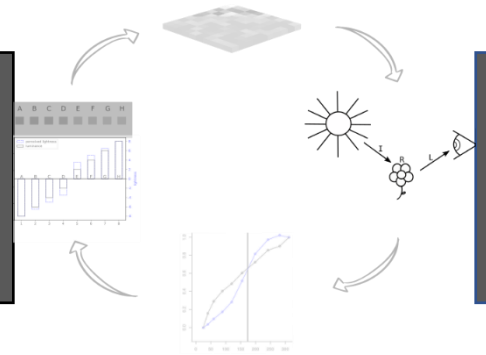
First Insights



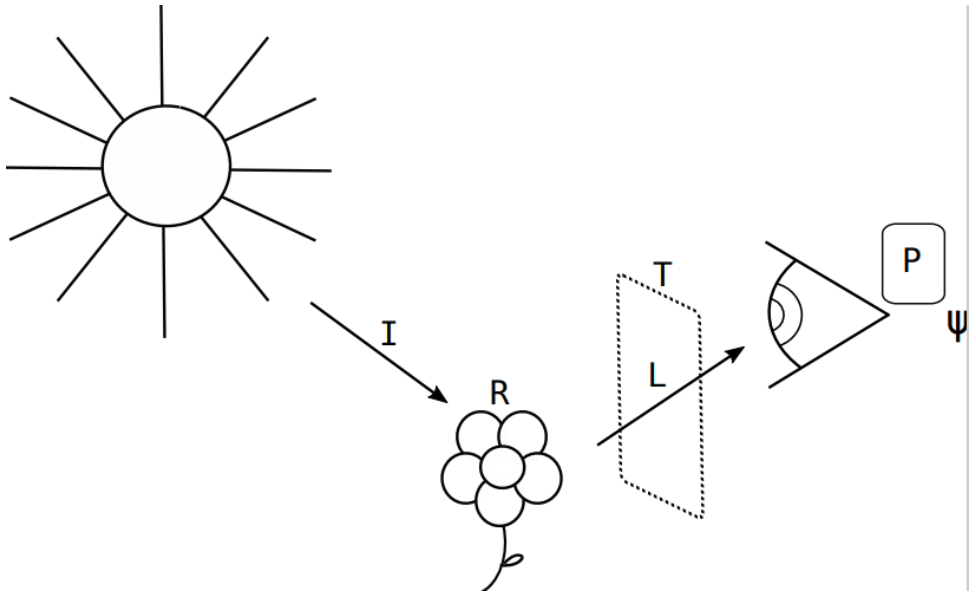
- Application of computer graphics in psychology
- Importance of right question and stimuli



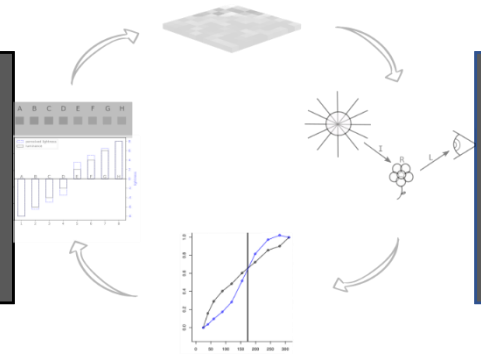
The Visual System



- Contrast, lightness
- Perception is mainly based on reflectance and not on illuminance

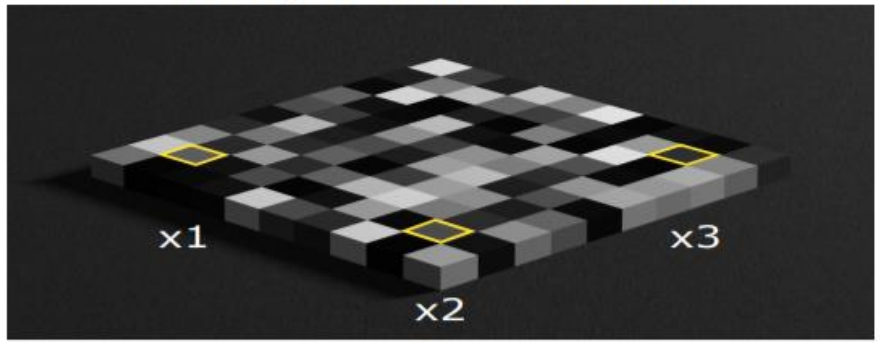


MLDS Analysis



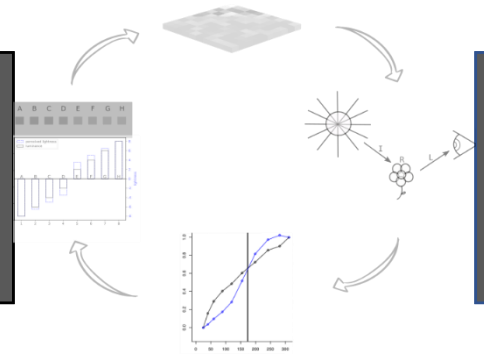
- Method of triads
- $d = (x1 - x2) - (x2 - x3) + e$

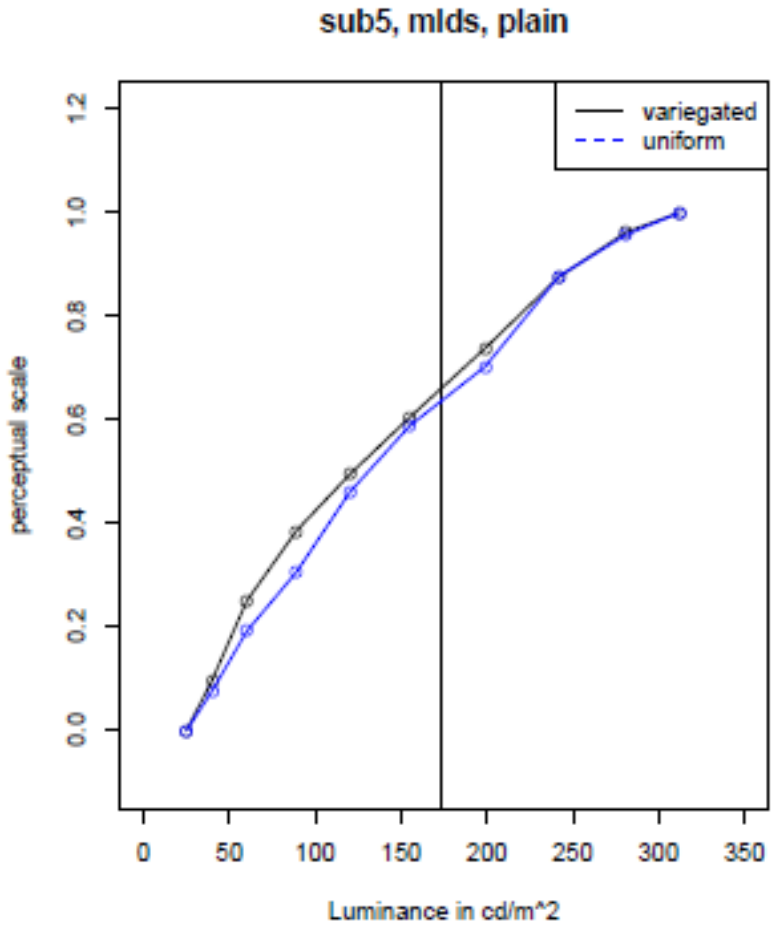
Variegated checkerboard

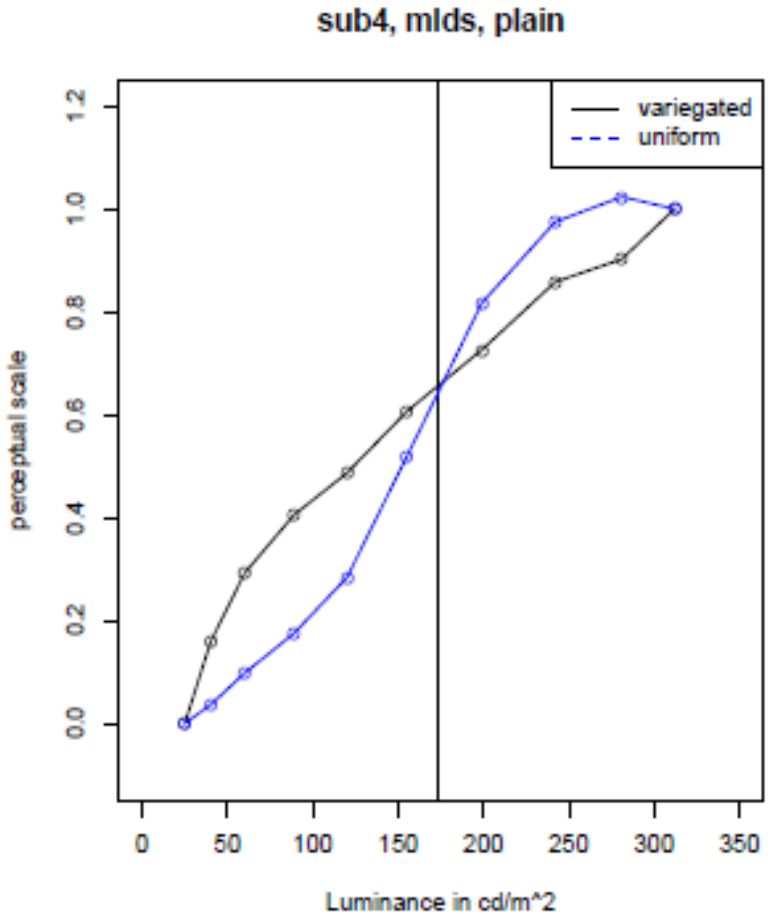


Center-surround stimuli

MLDS Analysis

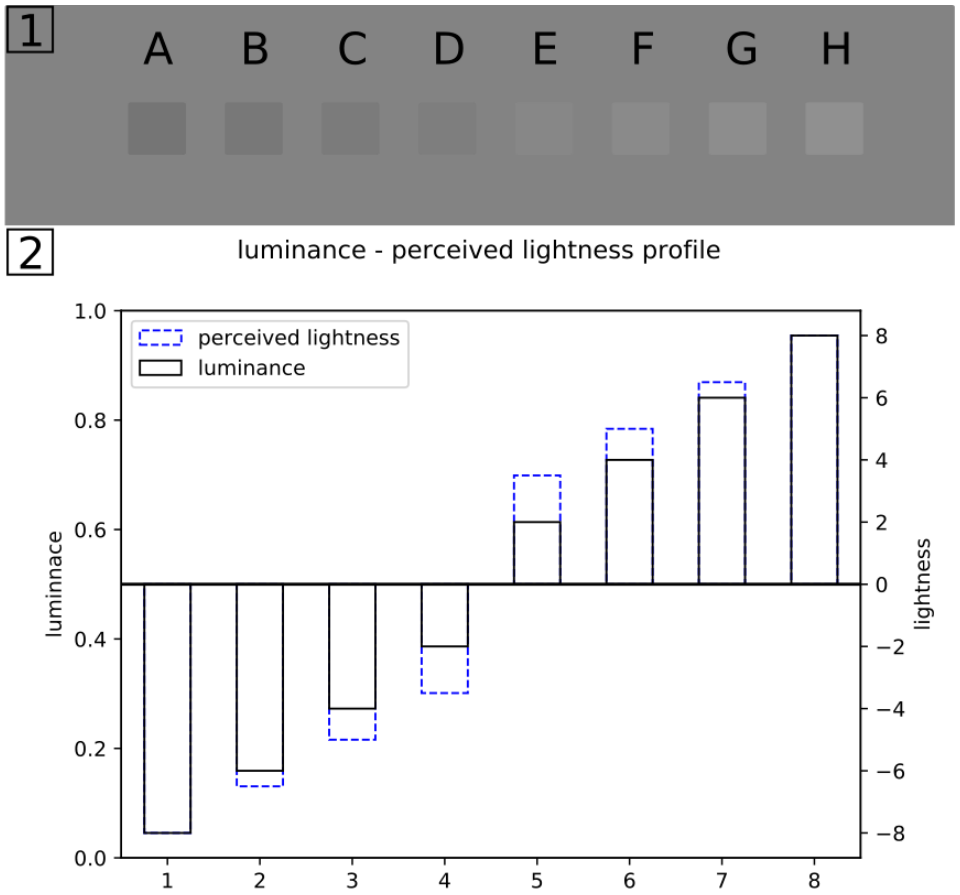




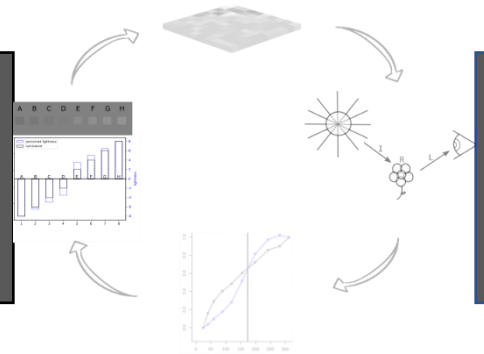


The Crispening Effect (CE)

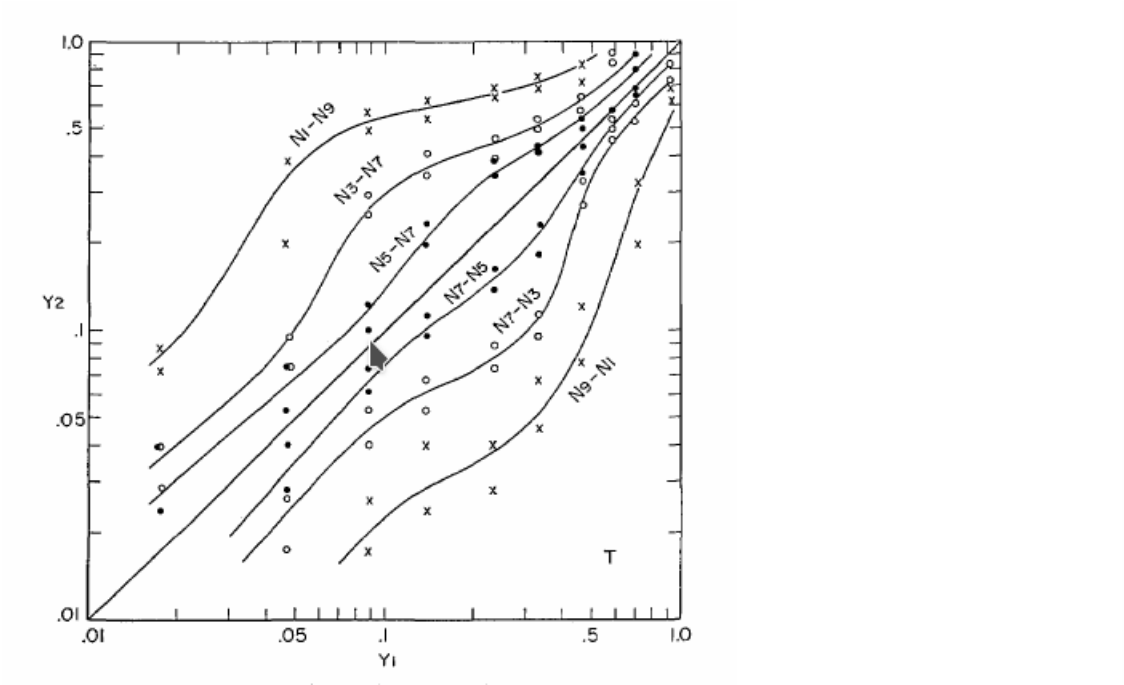
- Lightness perception influenced by background
- Equally spaced luminance values are not perceived as equally spaced in lightness space



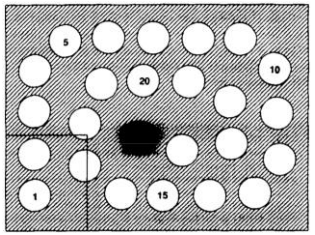
The CE in Previous Work

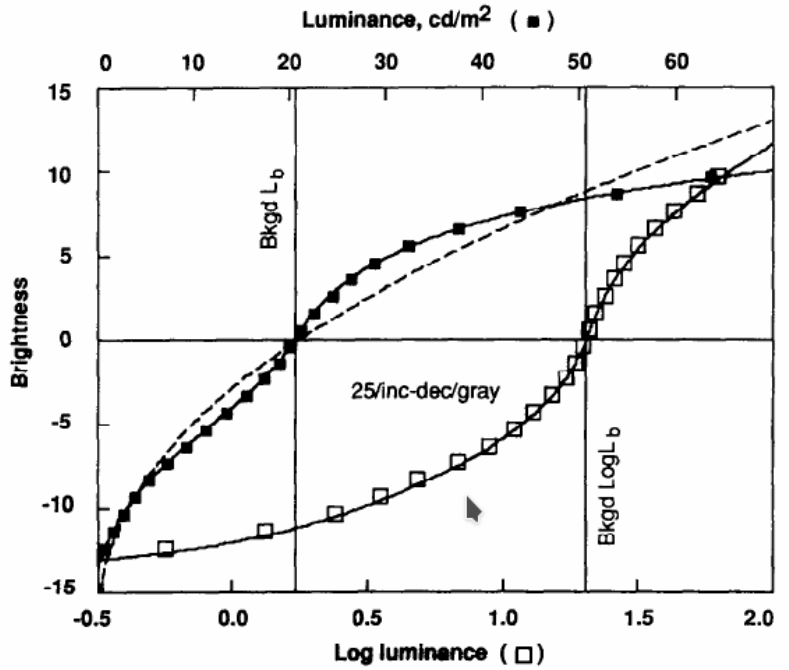


Takasaki, 1966

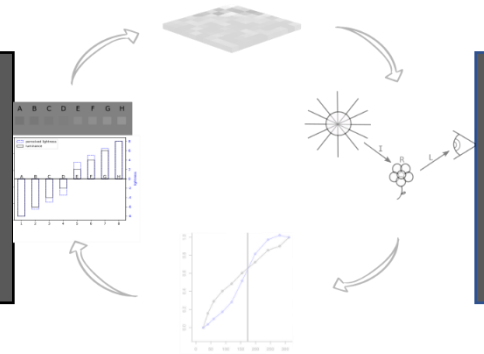


Whittle, 1992

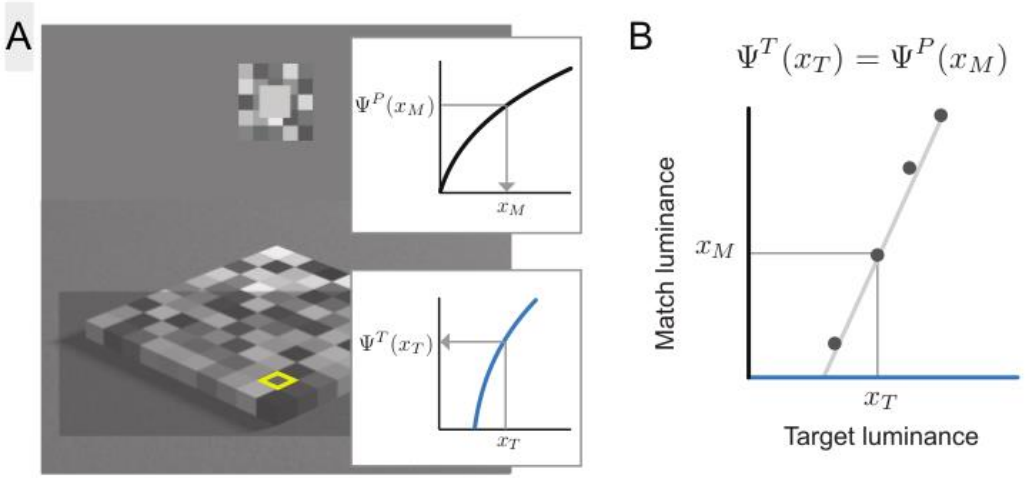




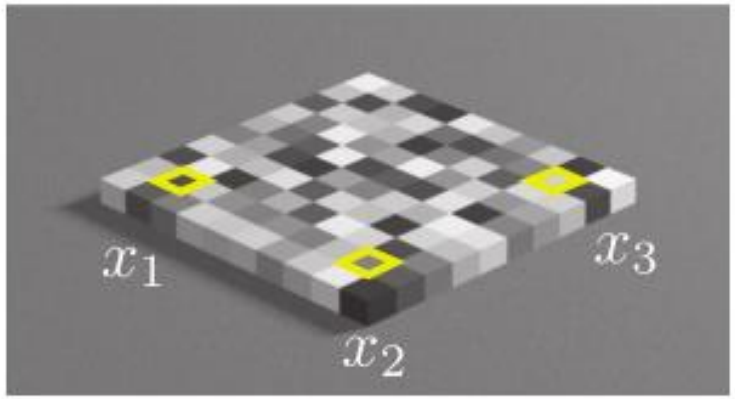
Matching vs MLDS Procedure



Matching procedure



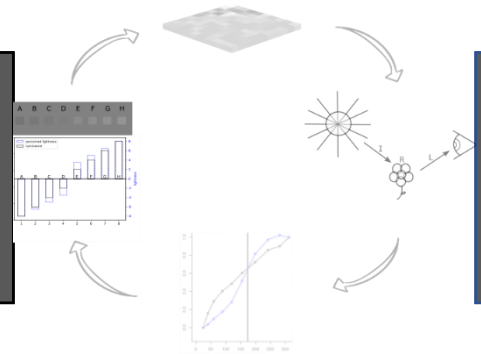
MLDS procedure



- d = (x1 – x2) – (x2 – x3) + e
  - d < 0 ➔ left
  - d ≥ 0 ➔ right

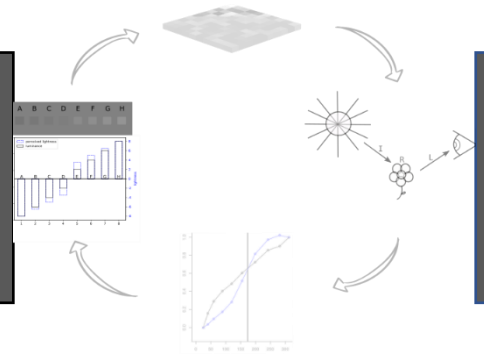
The Crispening Effect: An Artifact of a Method or a Feature of the Visual System?

Approach

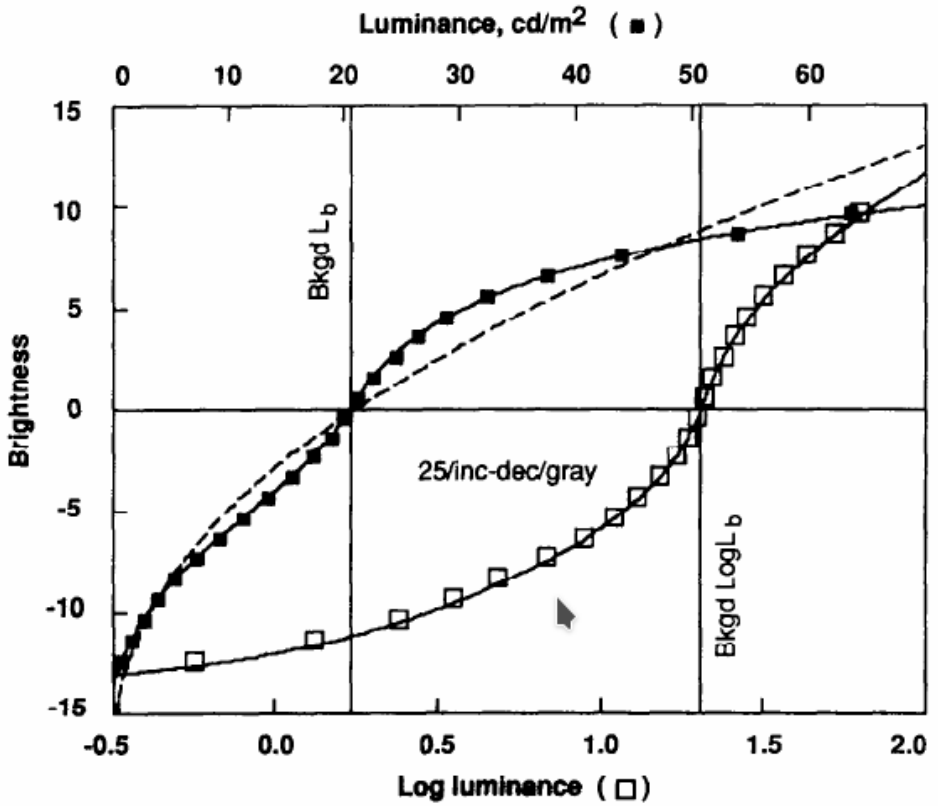


- Reanalysis of the data of Aguilar & Maertens (2020) with regard to the occurence of the Crispening Effect (CE)
- Simulation of an MLDS experiments with different spacings of the samples in luminance space

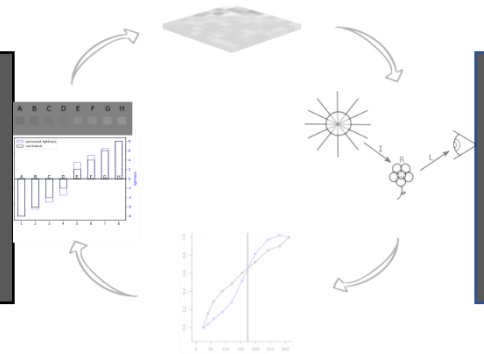
Simulation



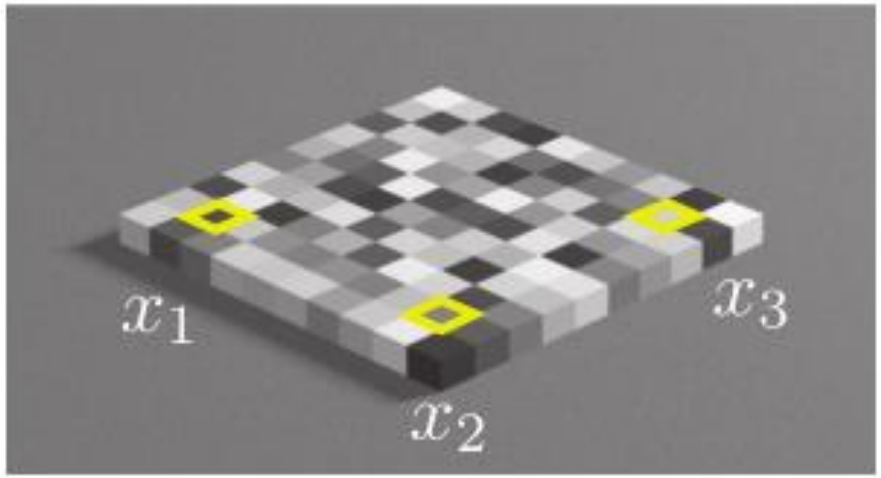
- Ground truth functions with (▄) & without(--) CE as perceptual scales of „observers“
- With CE 
- Without CE 



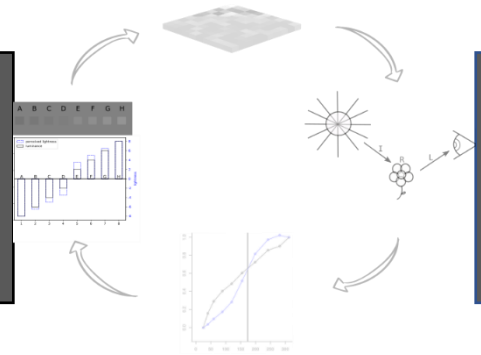
Simulation



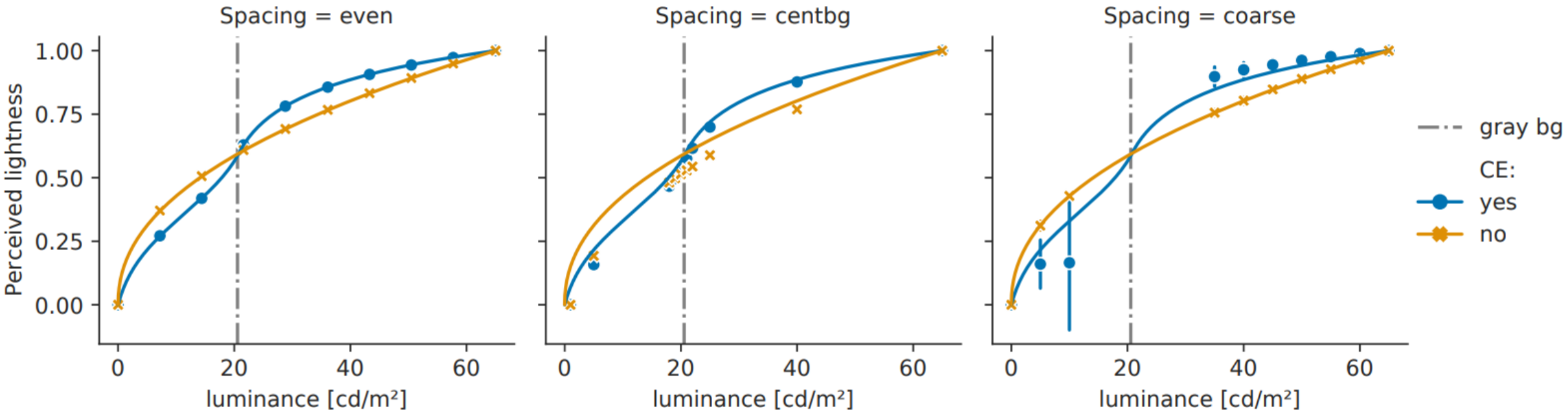
- Simulation of (a)symmetric matching
- Simulation of MLDS with different spacings
- d = (x1 – x2) – (x2 – x3) + e



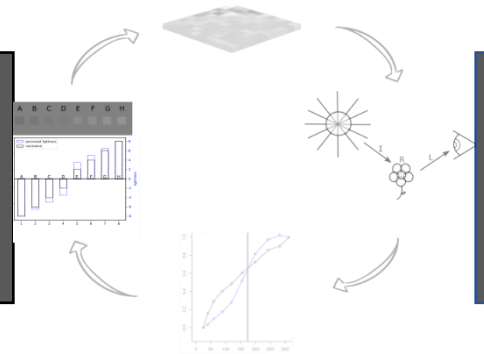
Simulation of an MLDS Experiment



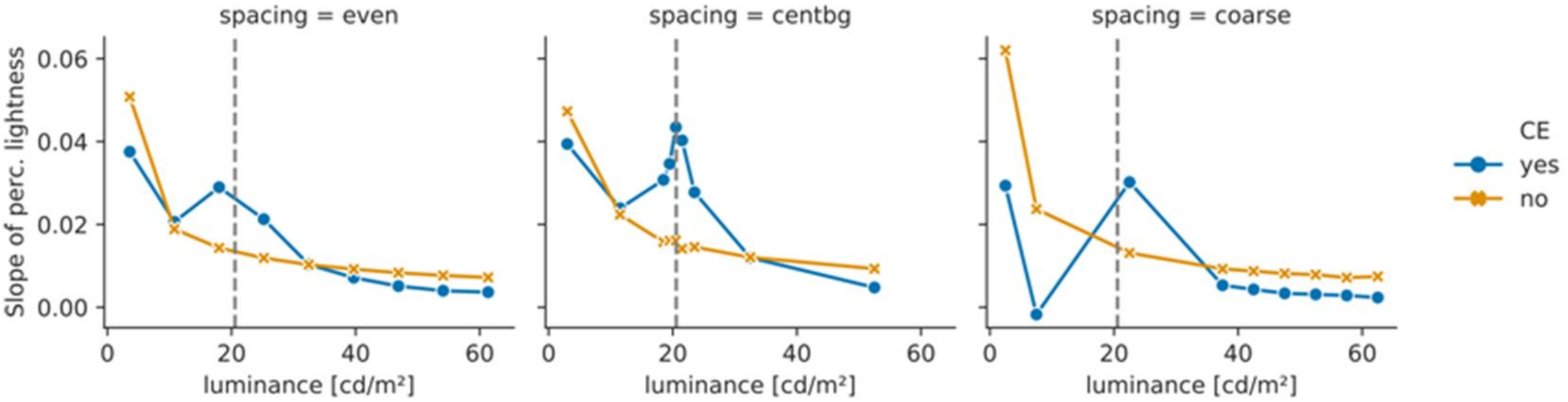
- „Perceptual“ scales



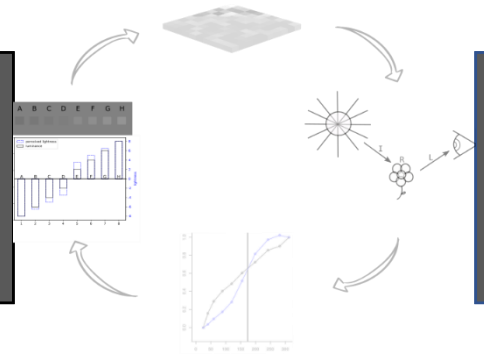
Simulation of an MLDS Experiment



- Slope

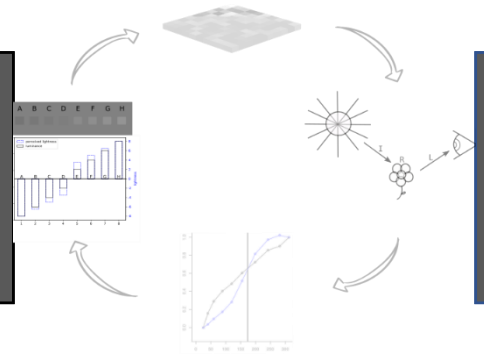


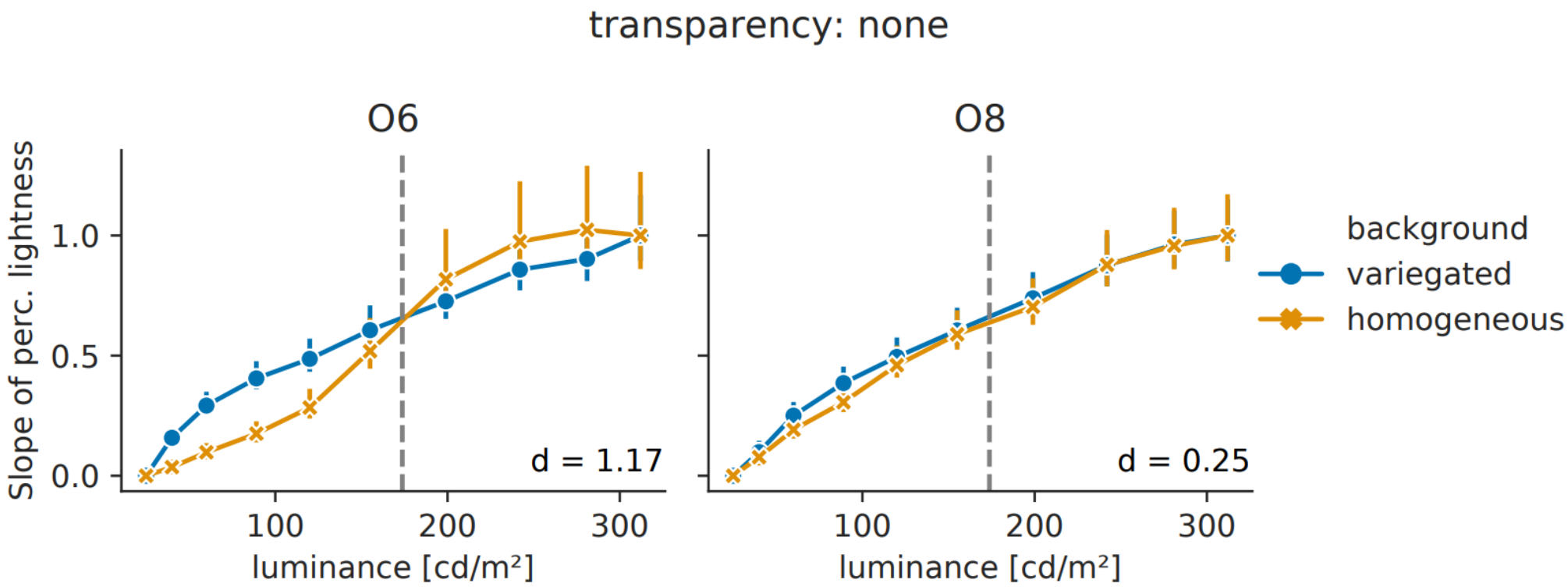
Reanalysis of Previous Work



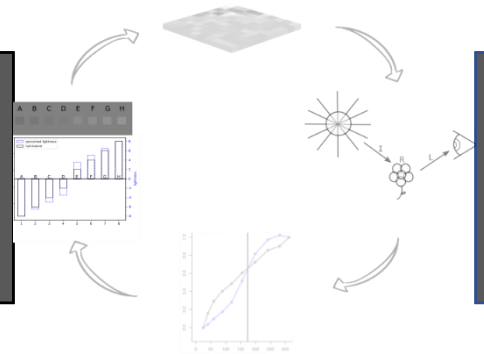
- Re-plot data and analyze slope & discriminability of the data
- Expectation: occurrence of the CE in data measured with homogeneous background (Ekroll et al.)

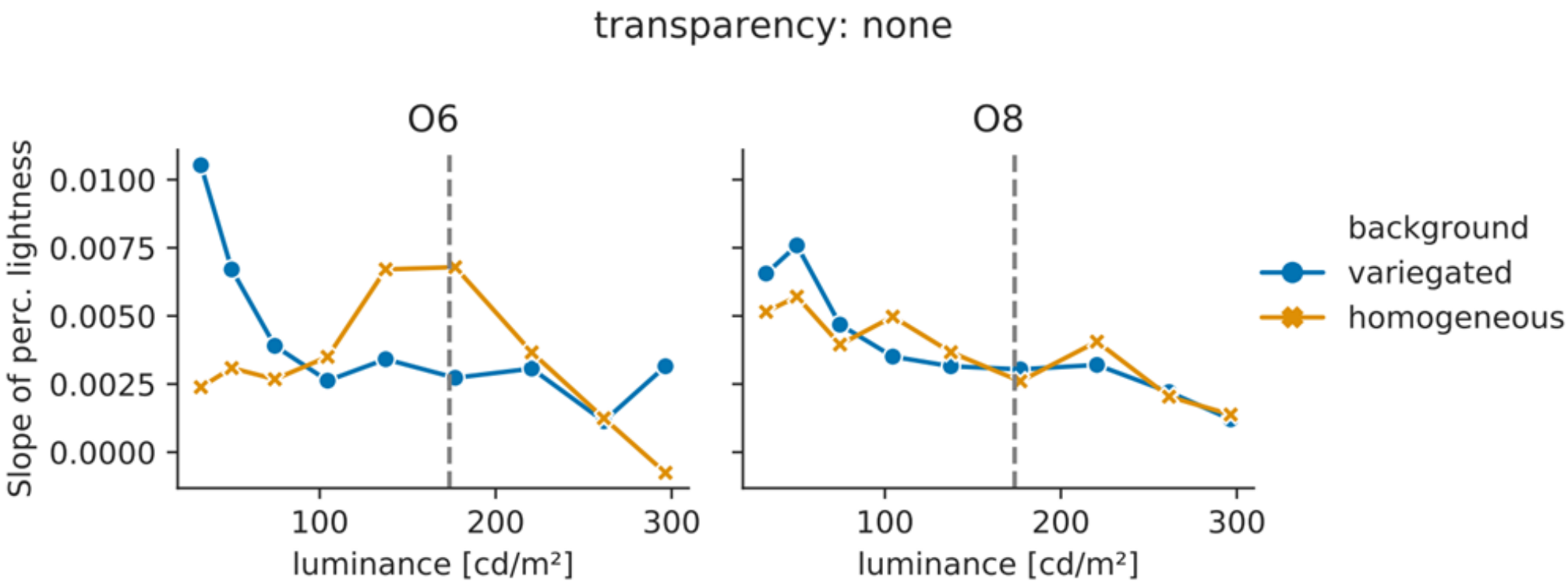
Re-analysis of MLDS data



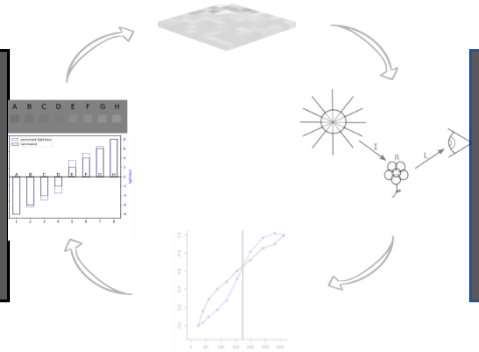


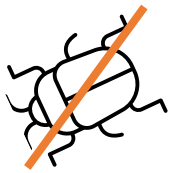
Analysis of MDLS Slope





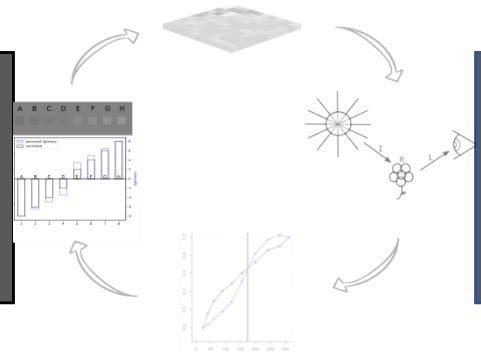
Conclusion





- Feature but not for all observers
- Possible indicator: slope + discriminability measure
- Appropriate spacings and metrics important to really qualify CE

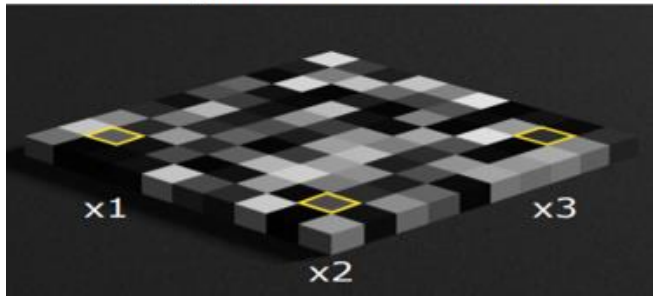
Open Questions



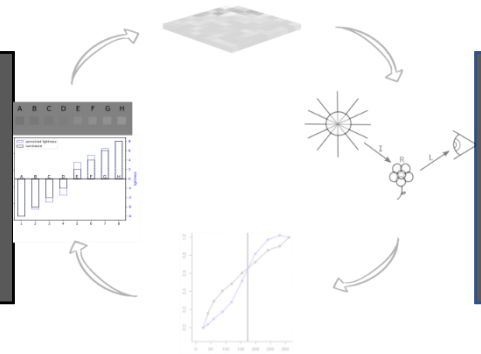
- Possible time component
- Influence of 3D-component in stimuli
- More sophisticated metrics needed

Center-surround stimuli

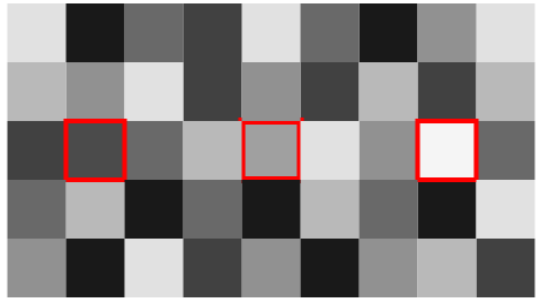
Variegated checkerboard

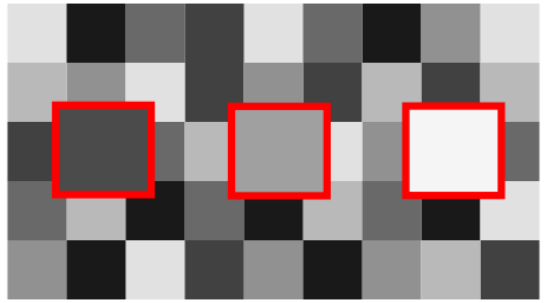


Open Questions



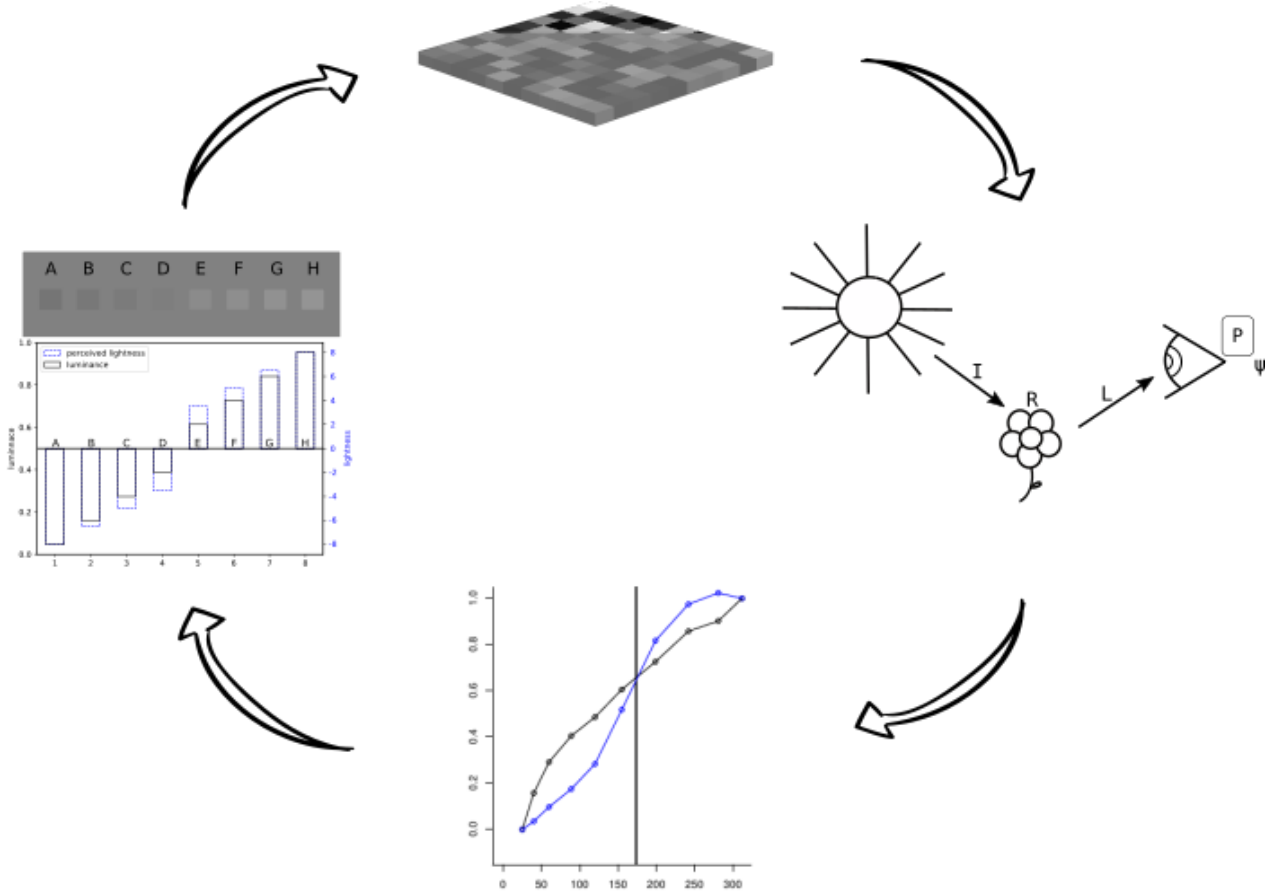
- Possible time component
- Influence of 3D-component in stimuli
- More sophisticated metrics needed





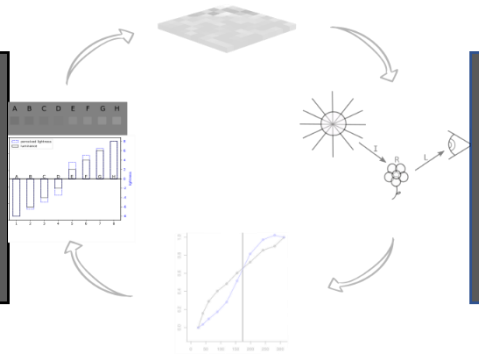
My Conclusion

- It‘s not always 1 or 0
- Importance of the right questions
- New way of thinking

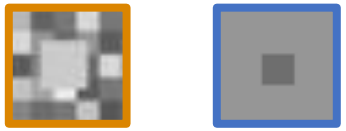


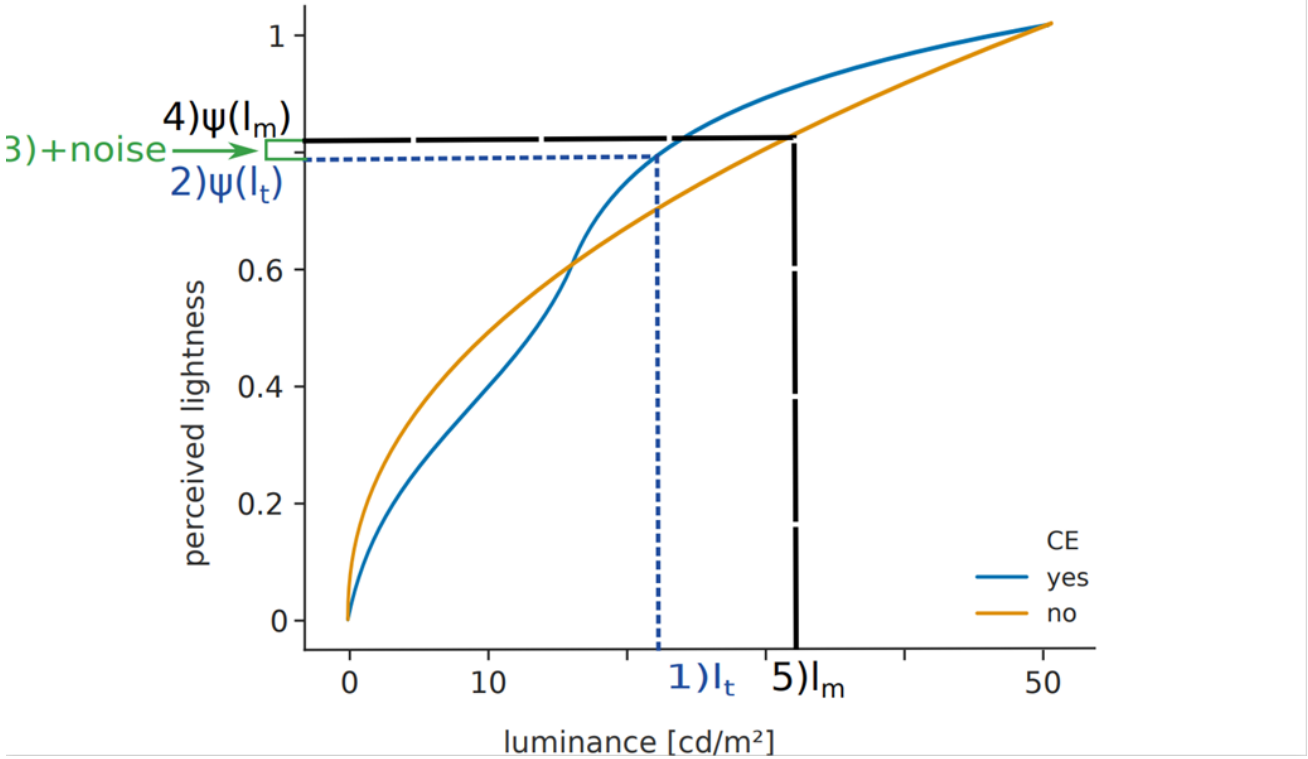
Thank you!

Simulation

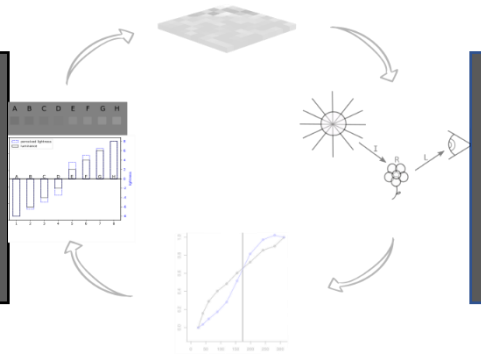


- Simulation of (a)symmetric matching

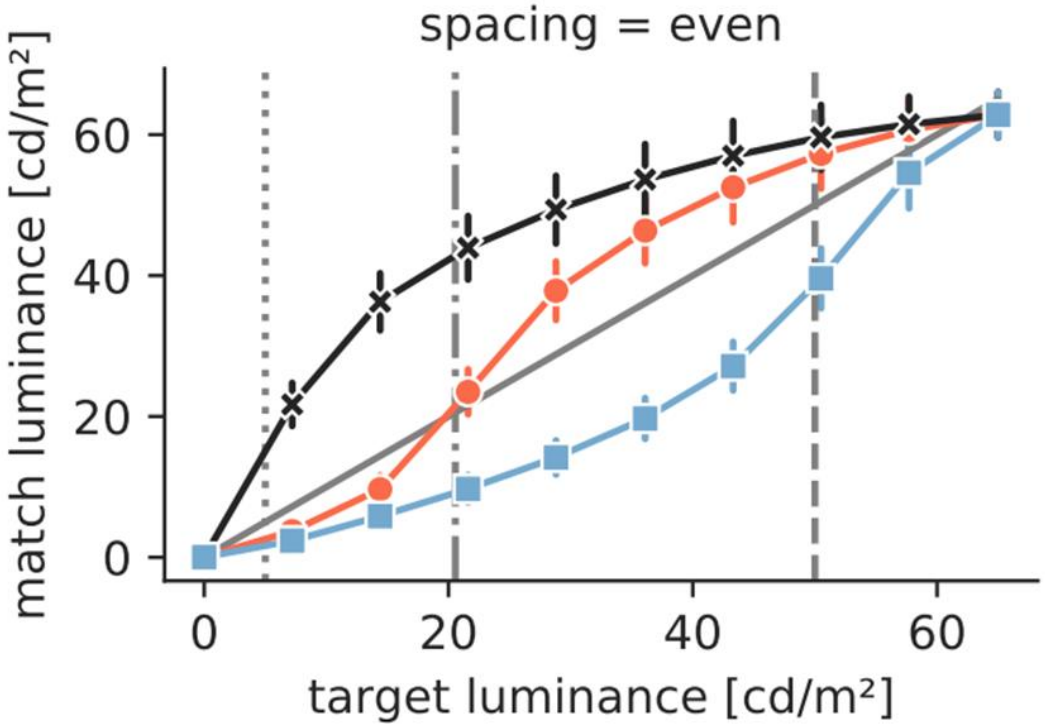




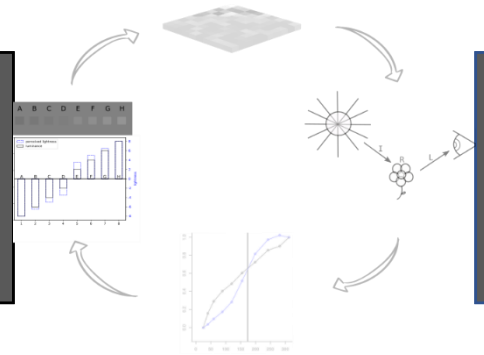
Simulation of Asymmetric Matching



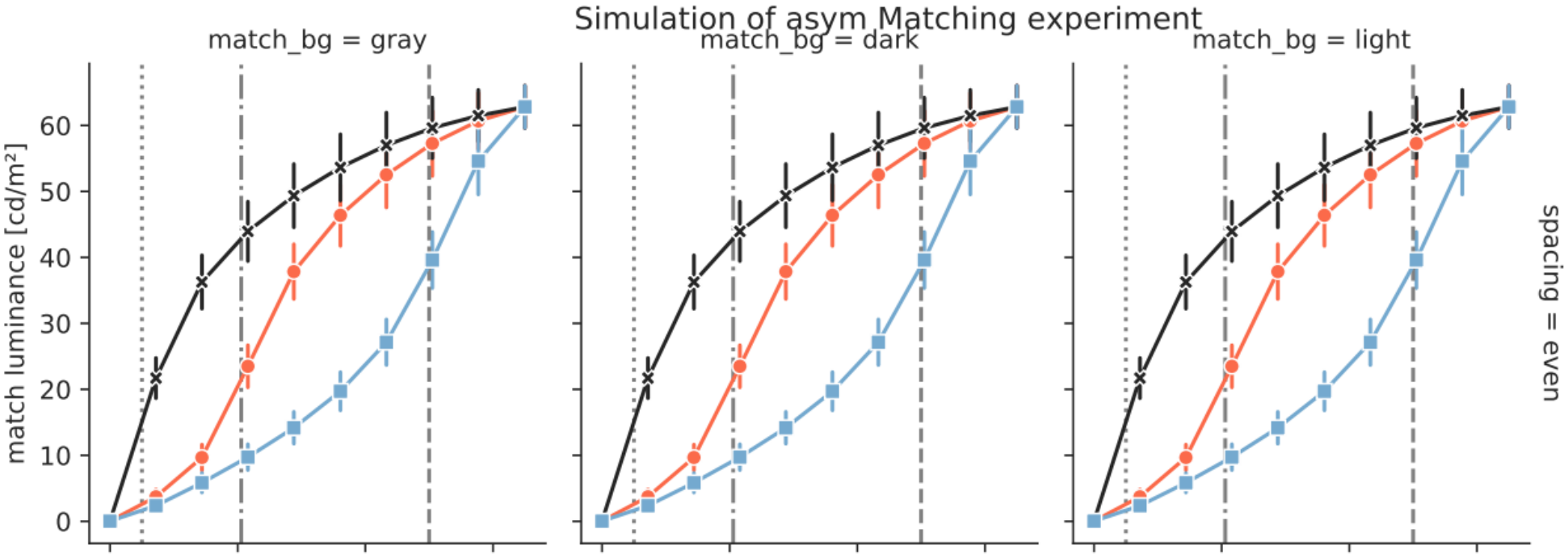
- Recovers the CE
- Indication of valid simulation method



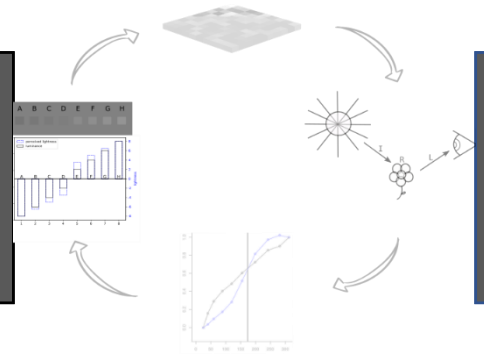
Simulation of Asymmetric Matching



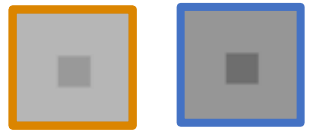
- Scales do NOT change dependent on the match luminance

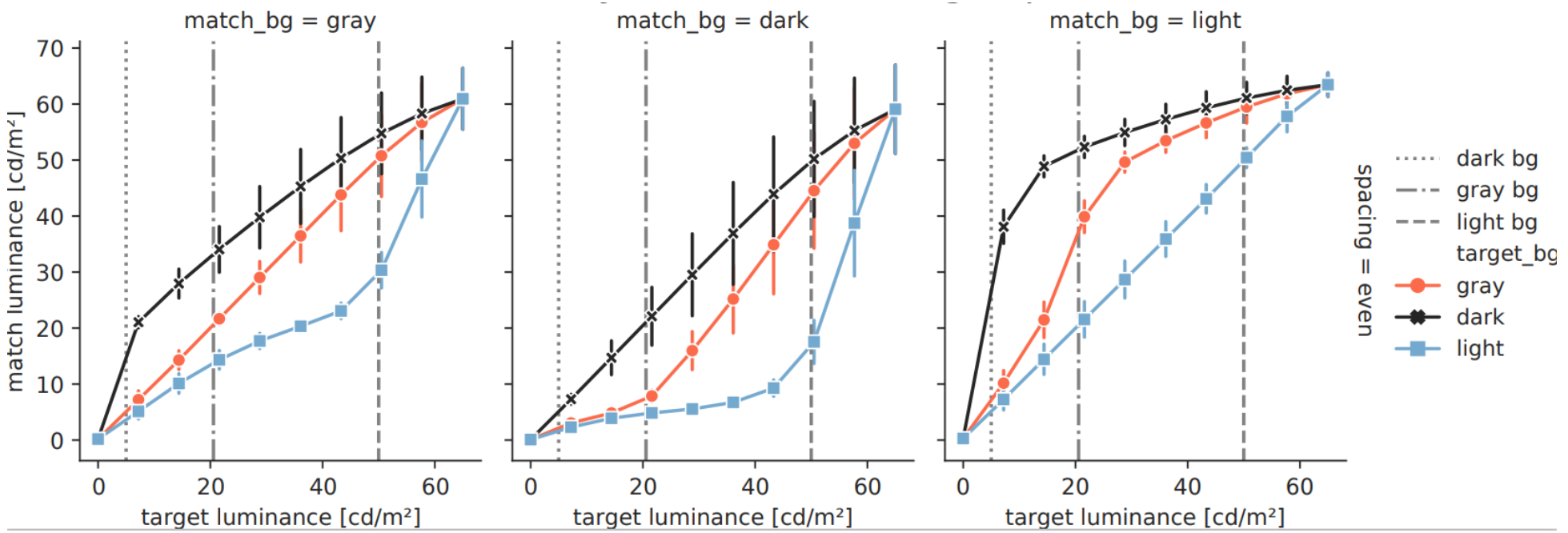


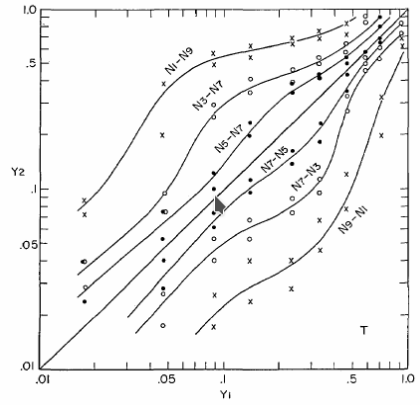
Simulation of Symmetric Matching



- Comparison between homogeneous backgrounds with different lightness looks similar to Takasaki‘s results
- Scales depend on the match‘s background luminance!







Simulation: Model Identification

- Similarity between resulting scales and ground truth functions
  - 10 luminance values (x_i)
    - ➢ 10 average perc. scale values (over 100 simulation runs) (p_i)
    - ➢ 10 f(x_i) based on ground truth function at x_i (g_i)

- $sum_\Delta = \sum(\Delta_i)$ where $\Delta_i = | p_i - g_i |$ and $i = \{1, \ldots, 10\}$

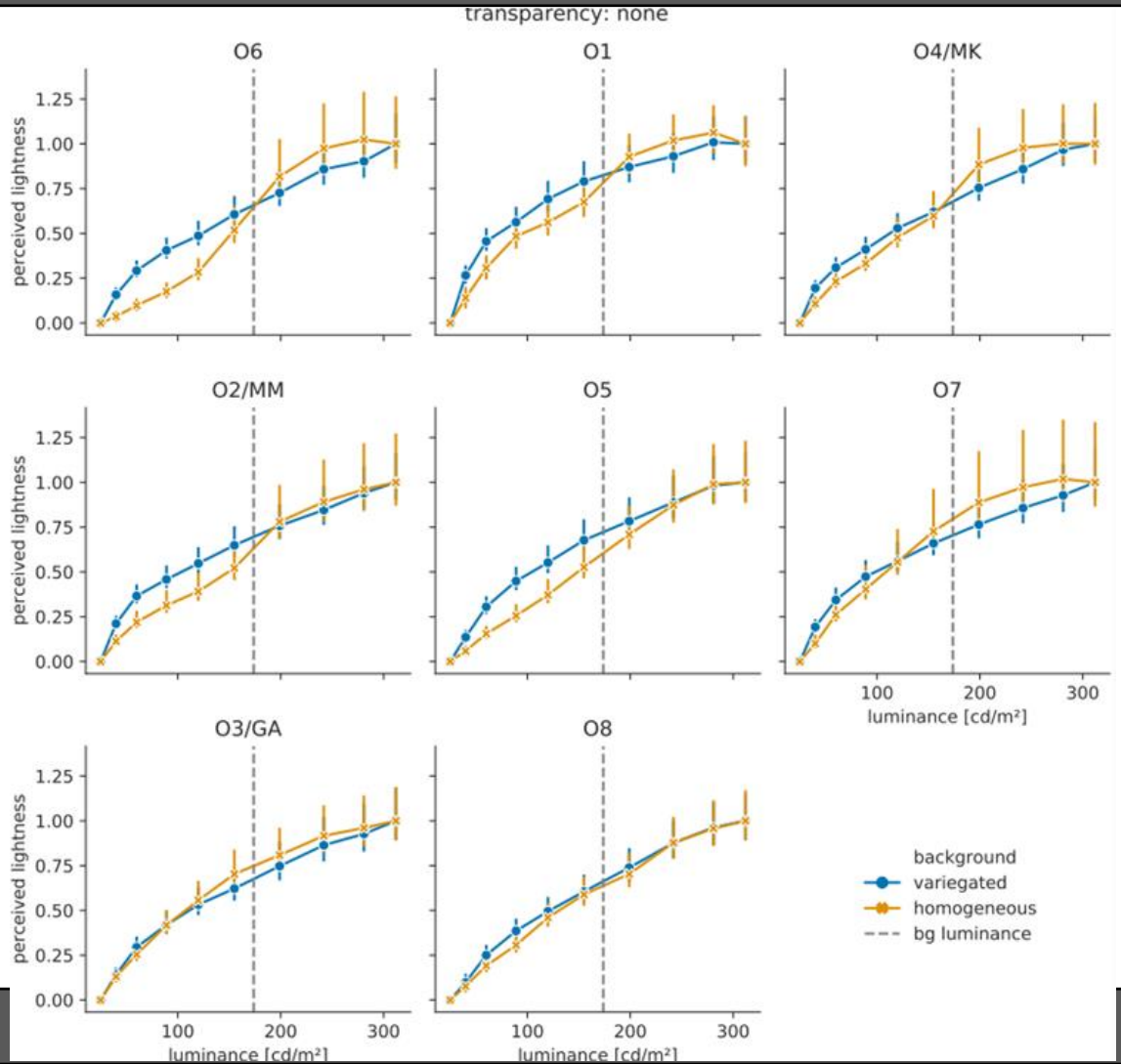
Simulation: Discriminability

- Ground truth functions can be visually discriminated
- Average distance between the data points of the 2 scales
  - 10 luminance values (x_i) ➔ 10 average perc. scale values for each scale (p_i & q_i)

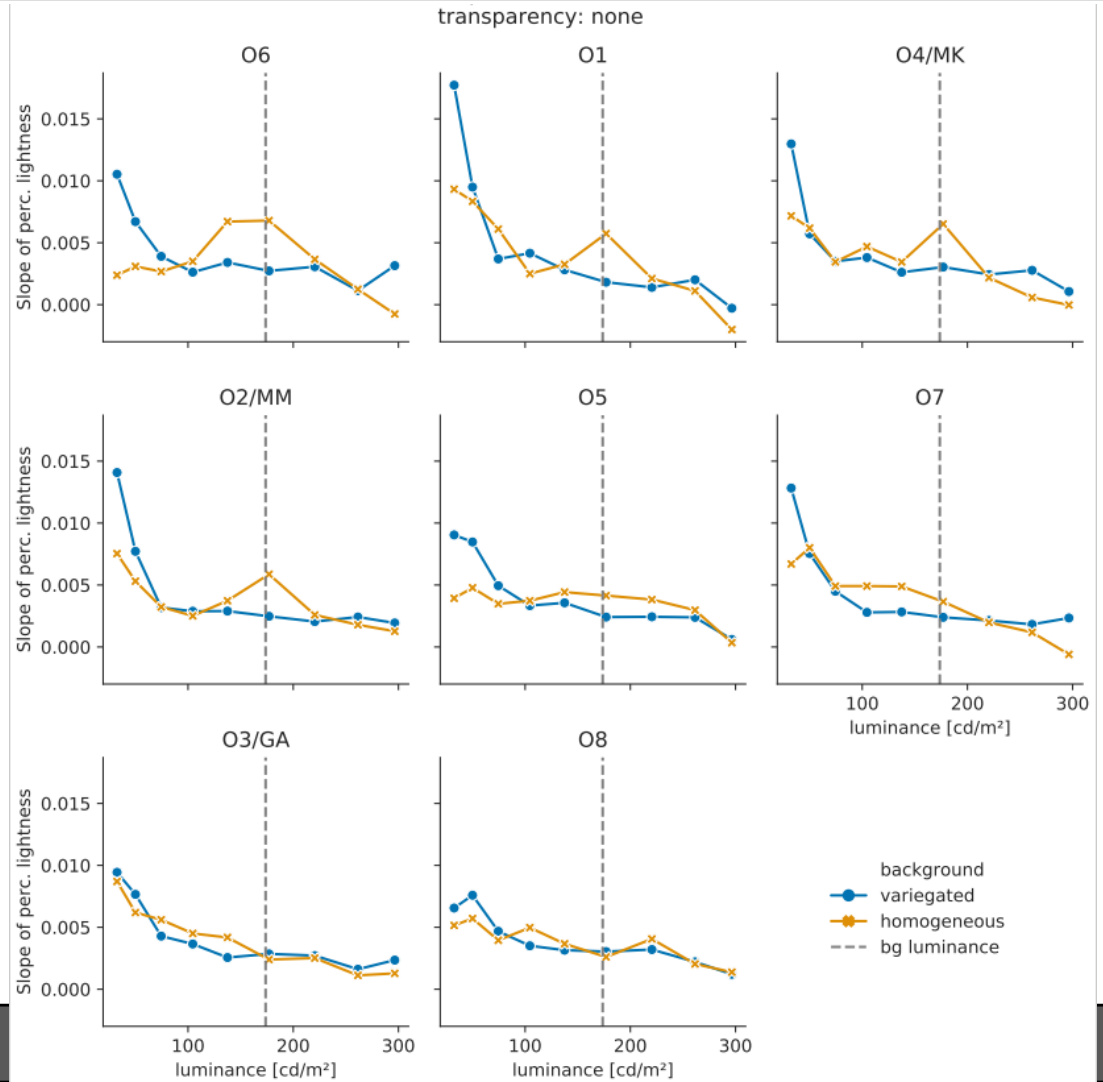
- $avg_d = \frac{\sum d_j}{100}$, with j = {1, …, 100} and

$d_j = \sum(\Delta_i)$, with $\Delta_i = |p_i - q_i|$ and i = {1, …, 10}

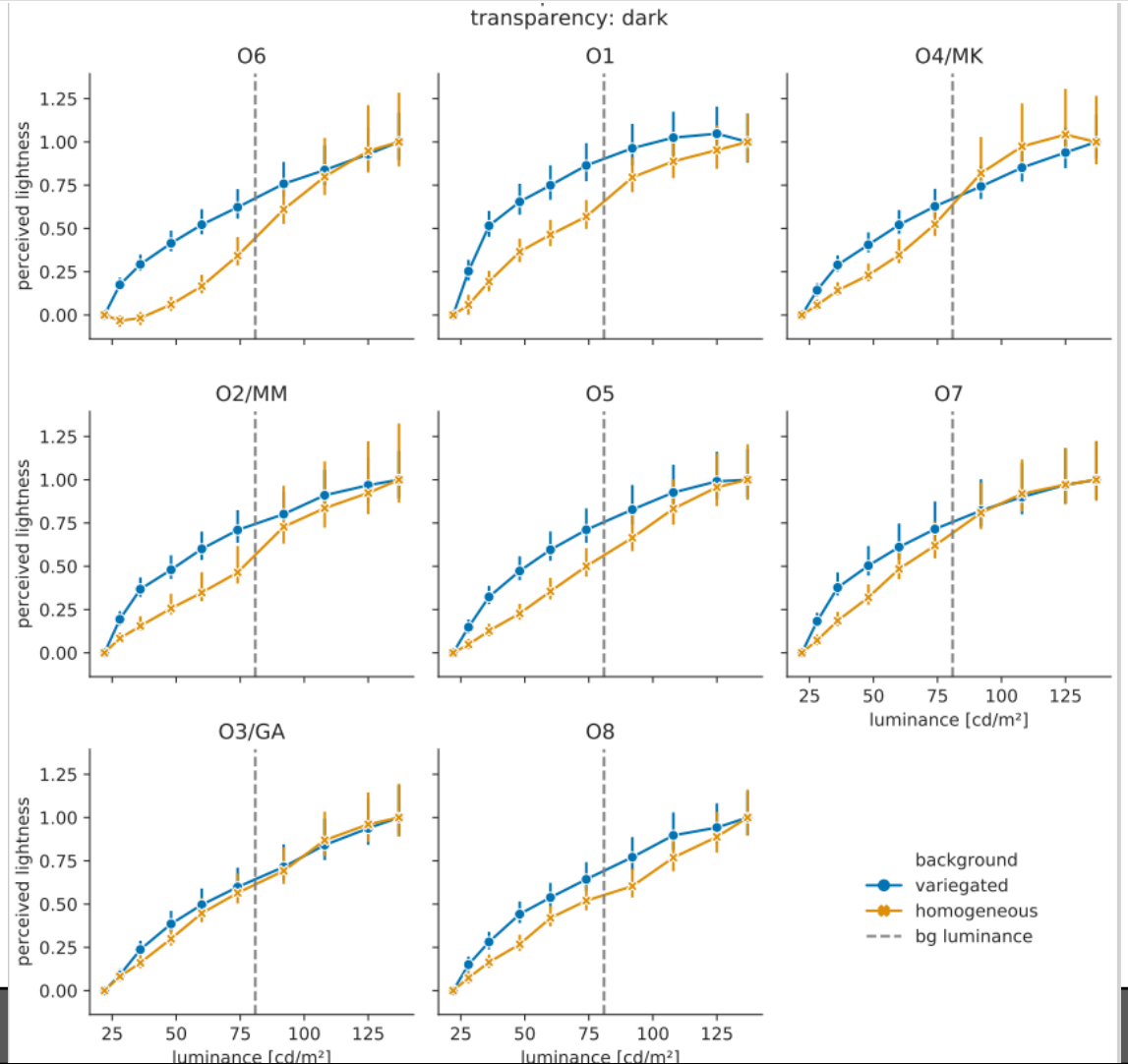
Reanalysis: MLDS data - plain



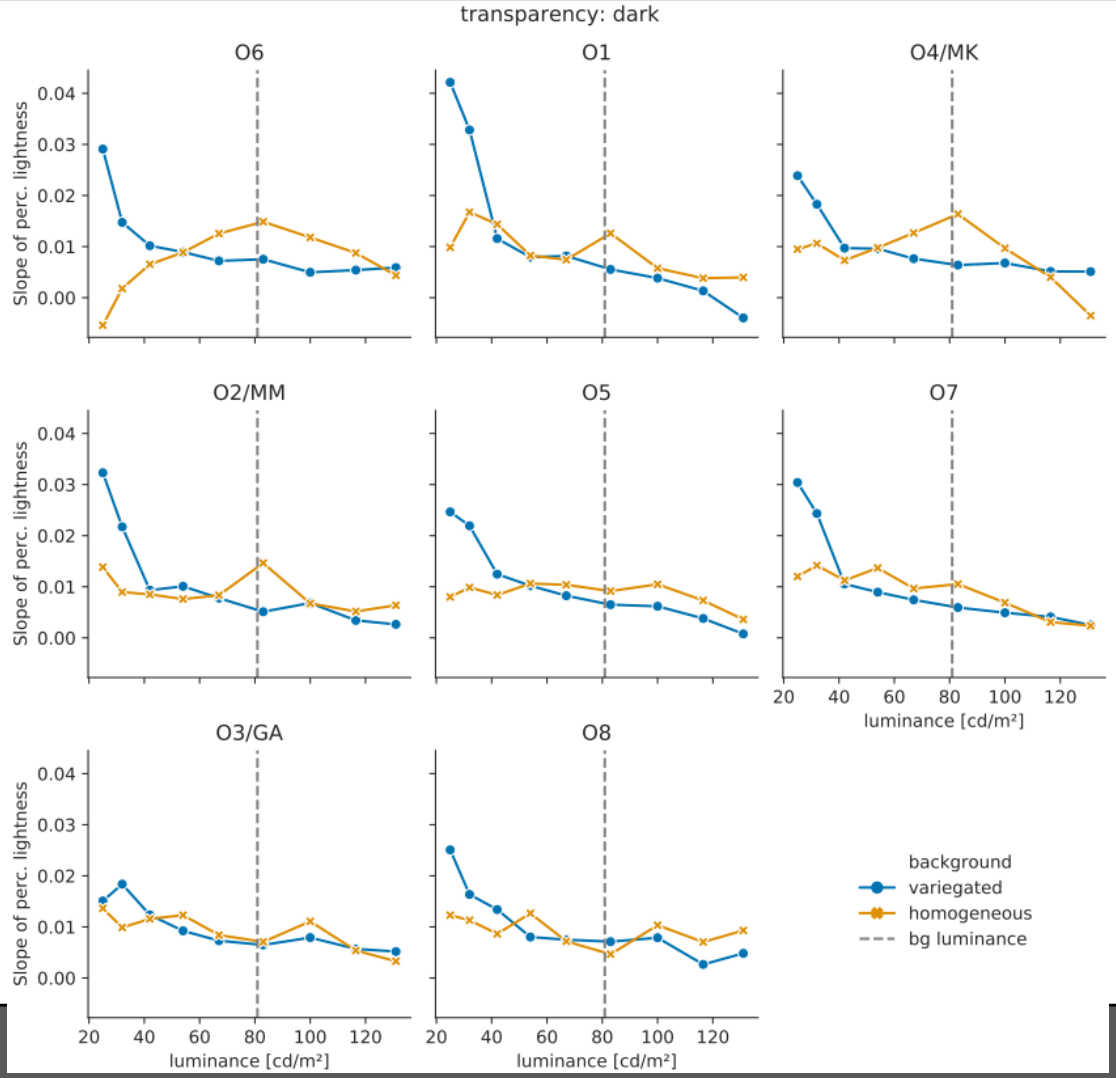
Reanalysis: MLDS slope - plain



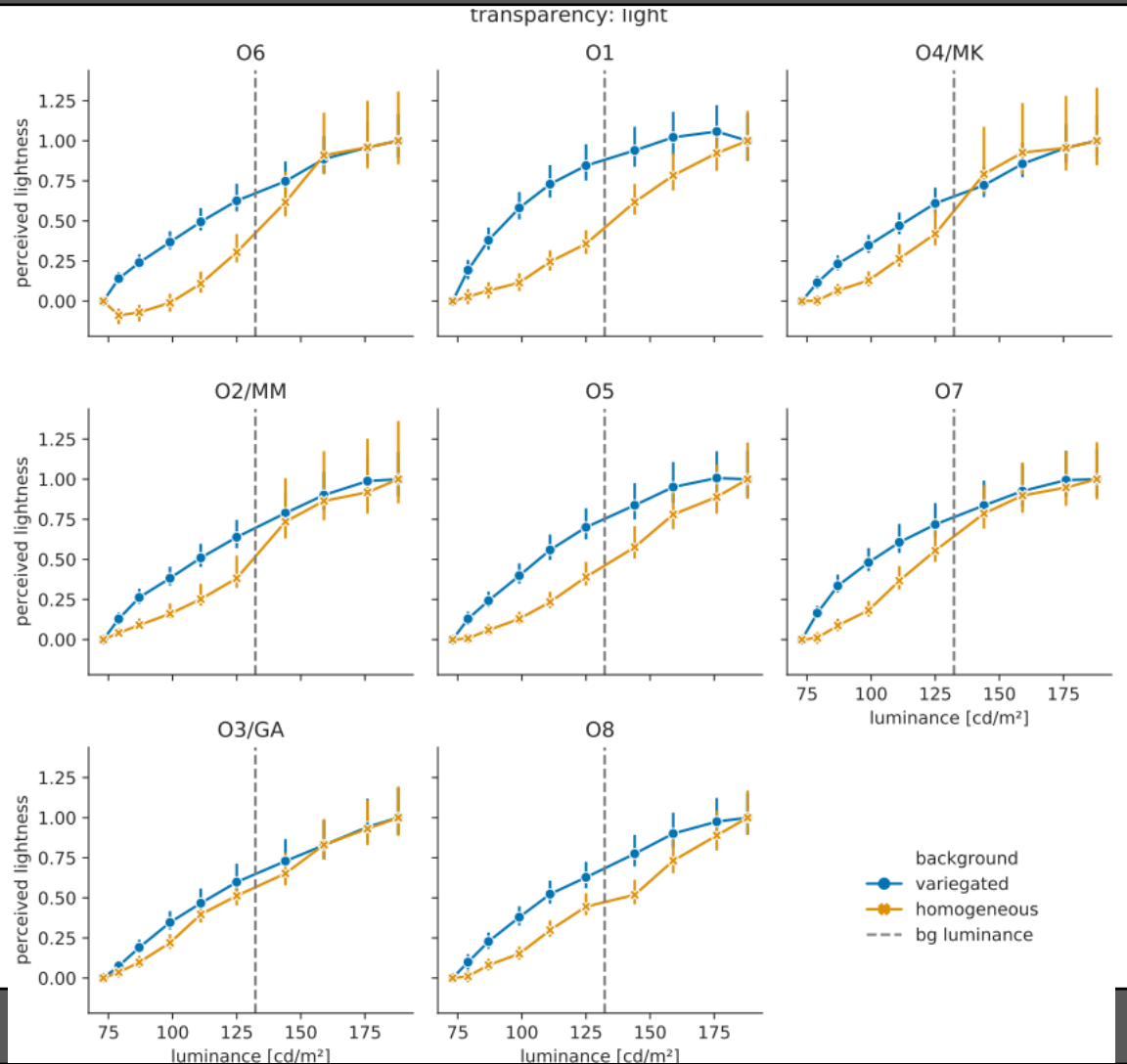
Reanalysis: MLDS data - dark



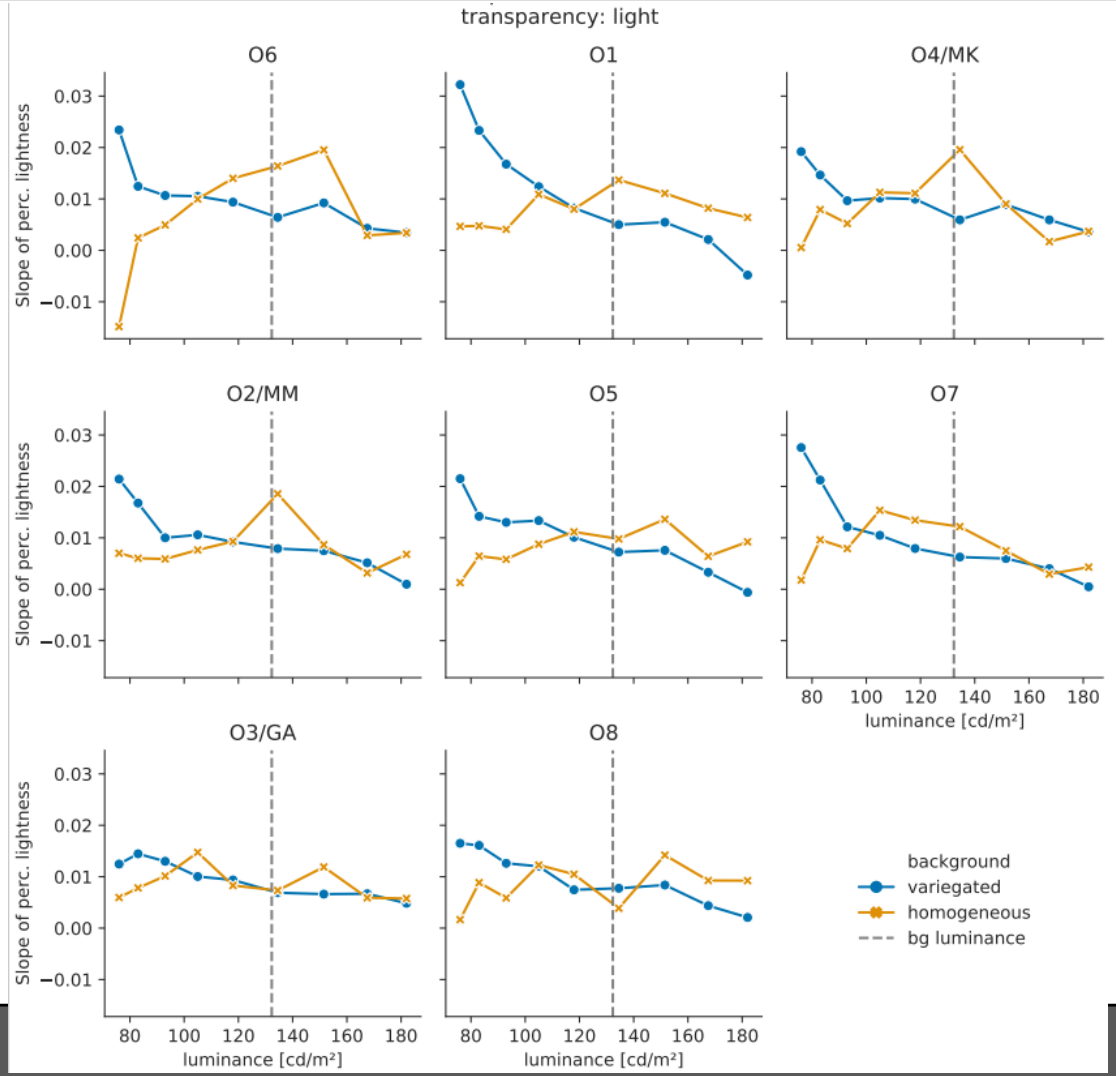
Reanalysis: MLDS slope - dark



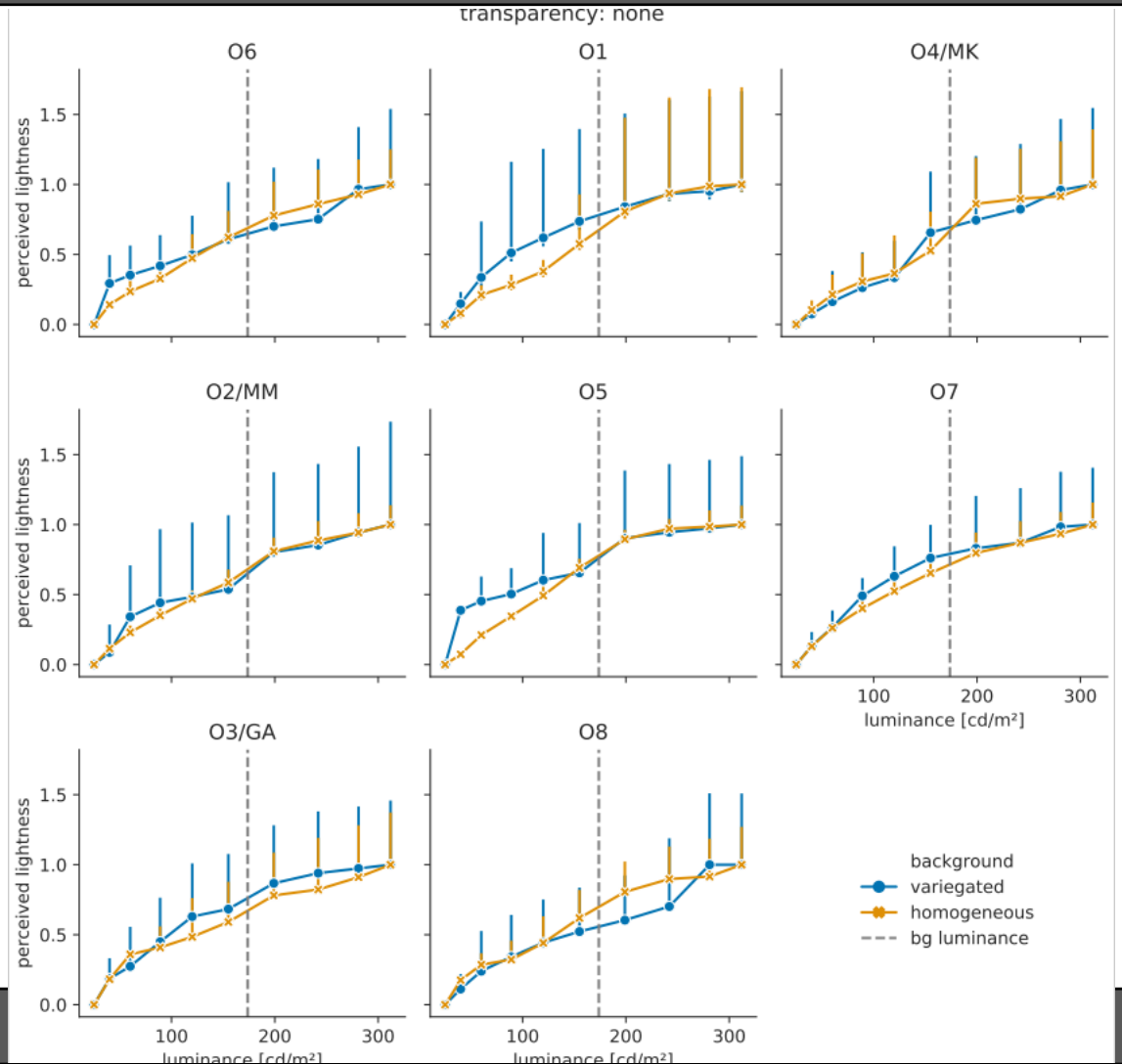
Reanalysis: MLDS data - light



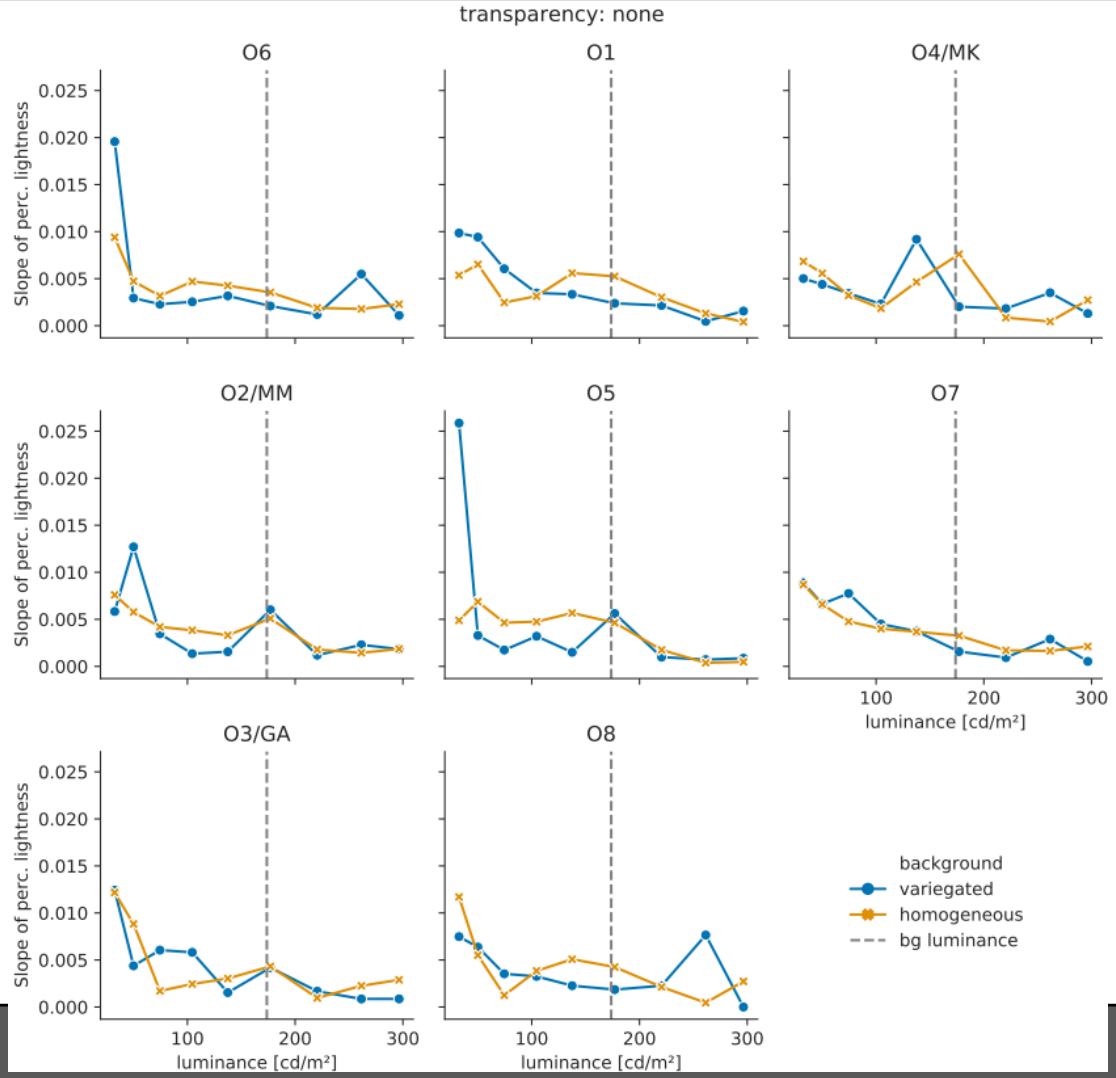
Reanalysis: MLDS slope - light



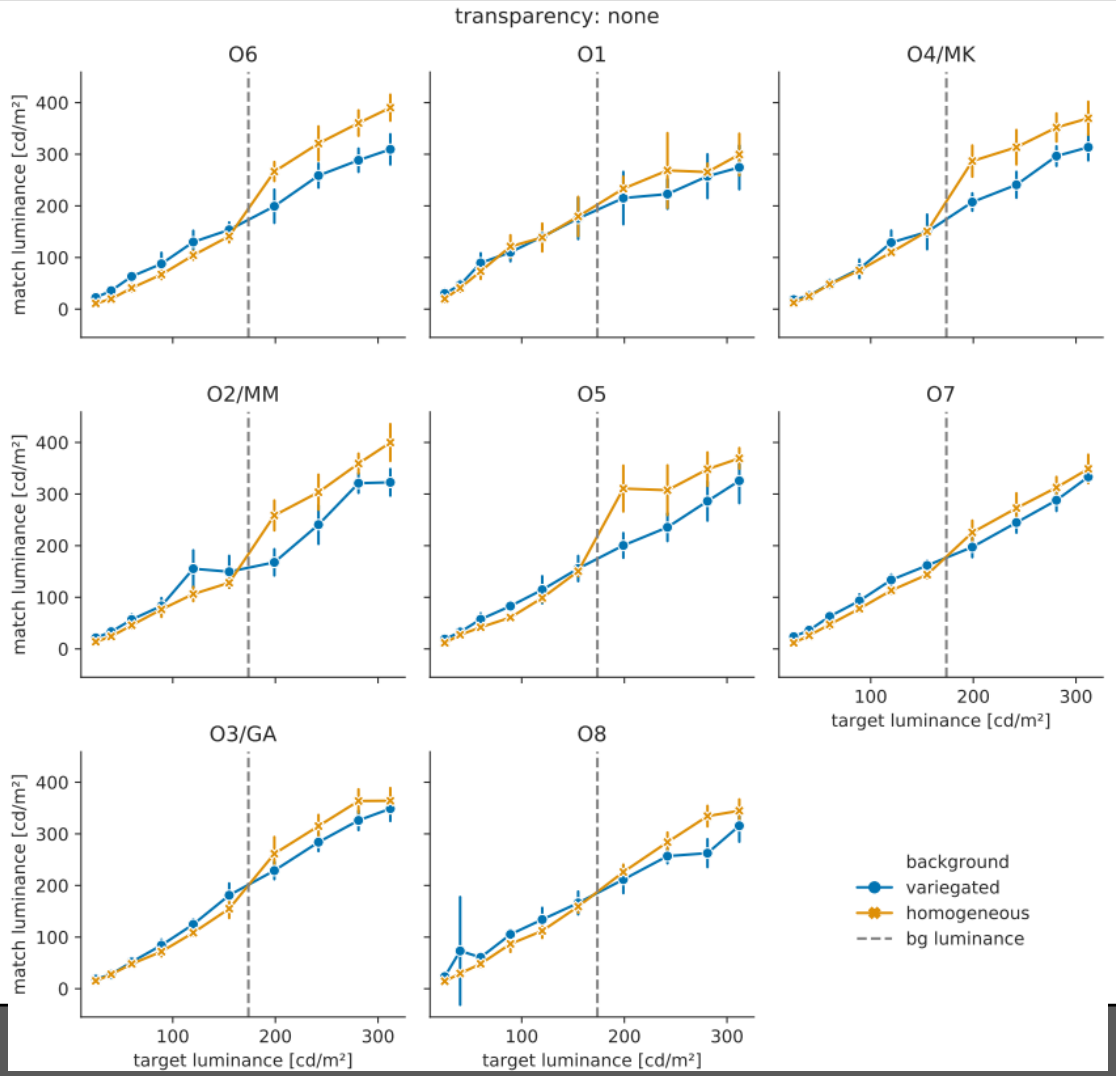
Reanalysis: MLCM data - plain



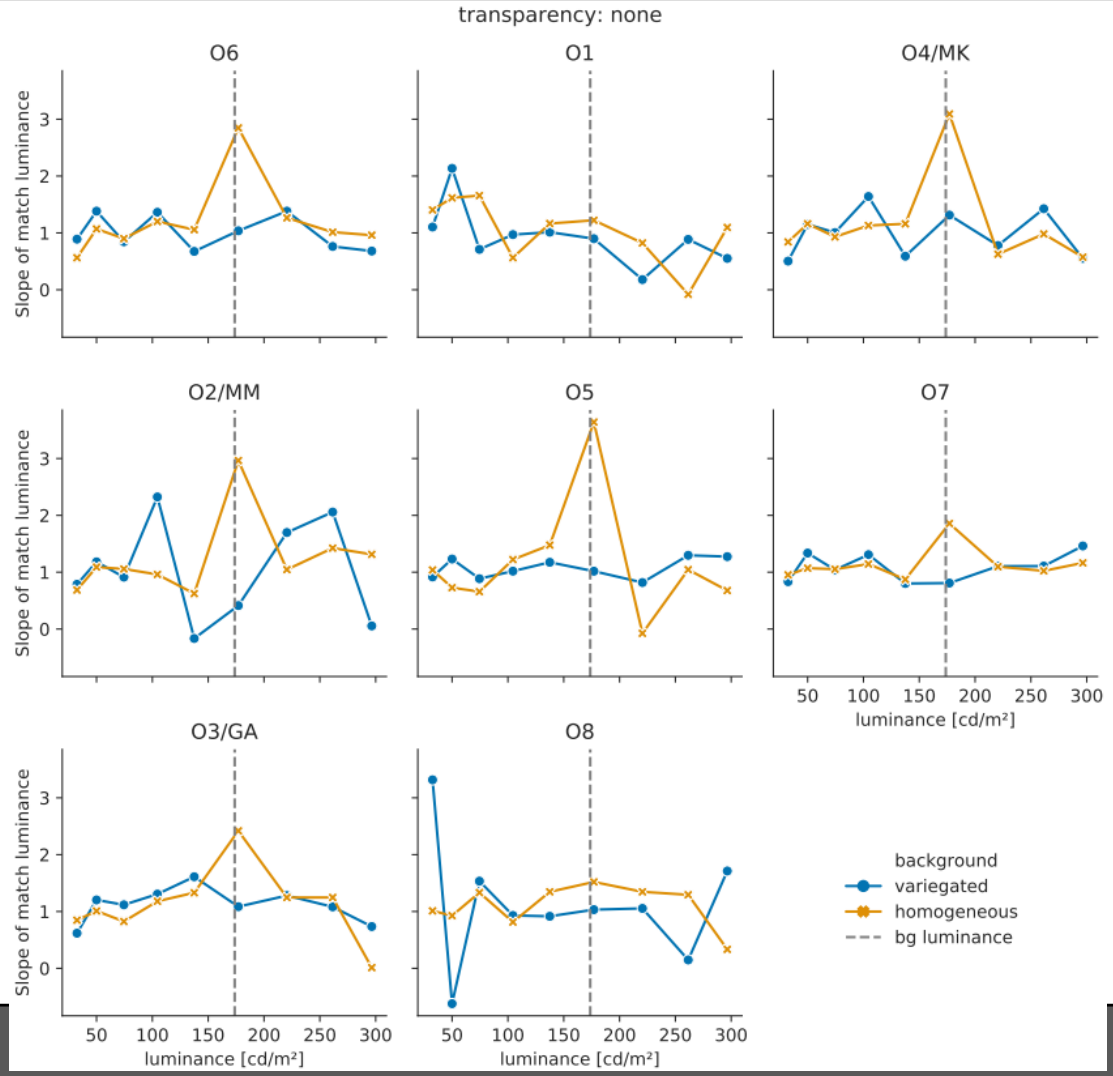
Reanalysis: MLCM slope - plain



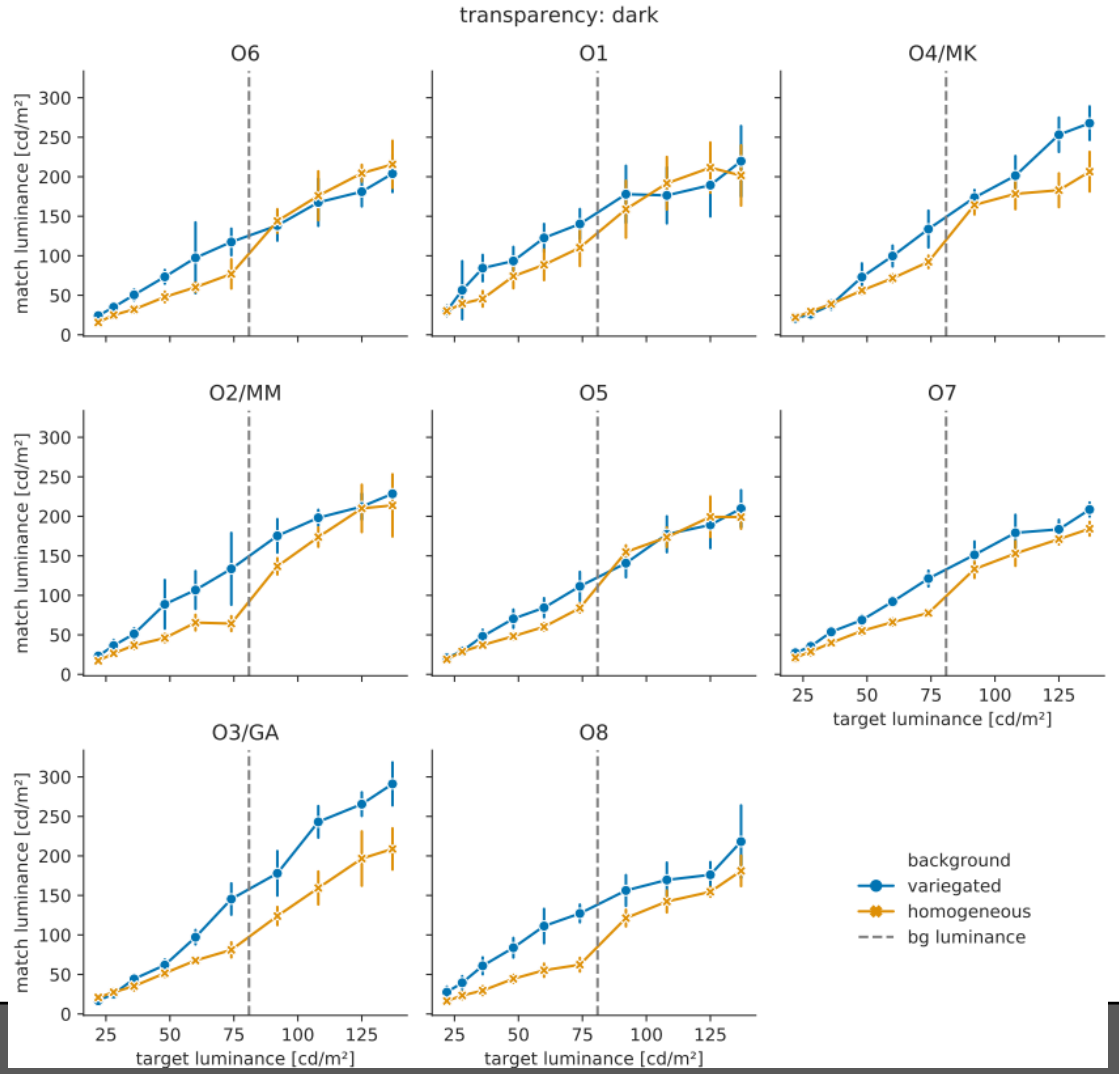
Reanalysis: Asymmetric Matching- plain



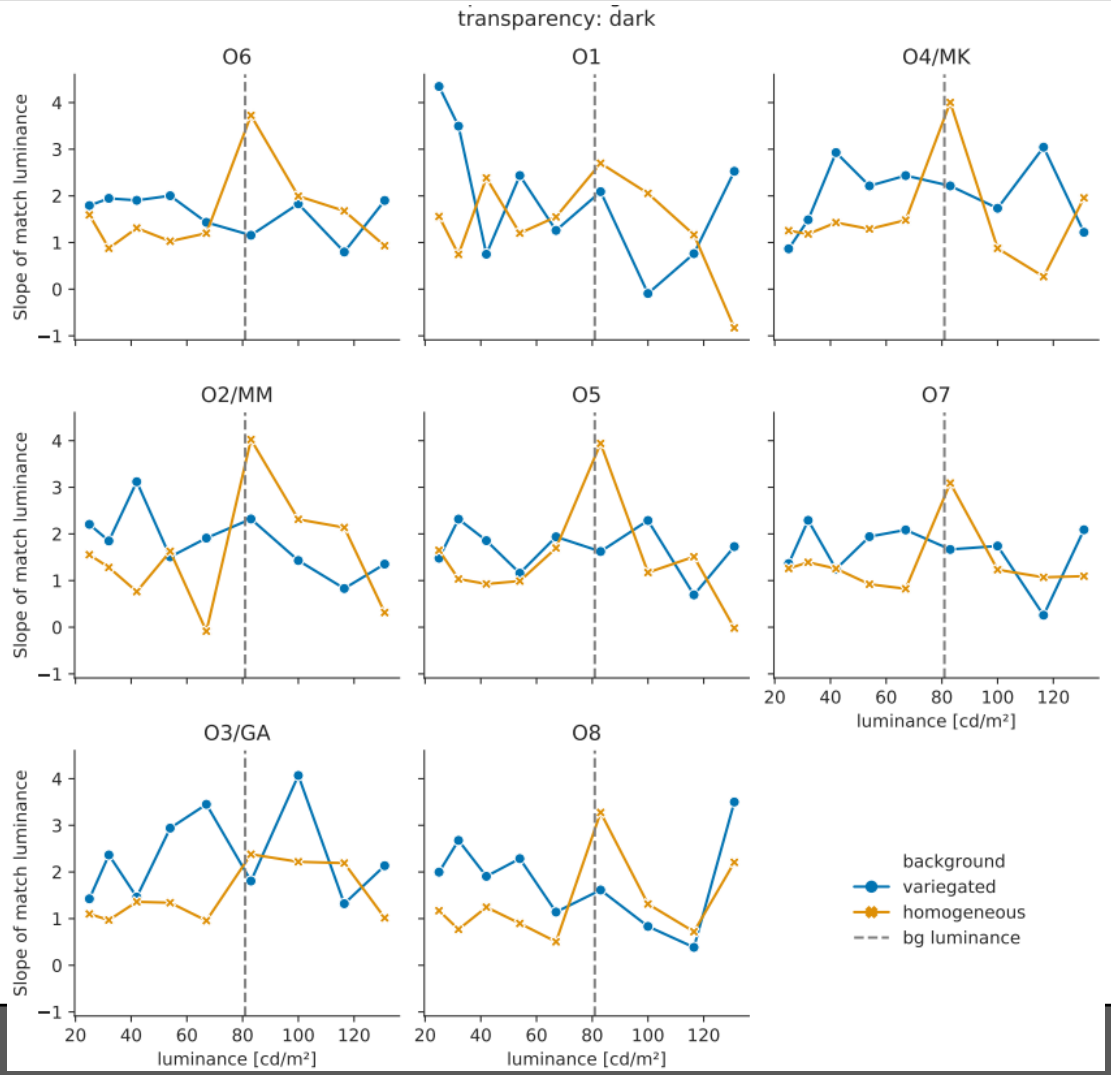
Reanalysis: Asym. M. Slope- plain



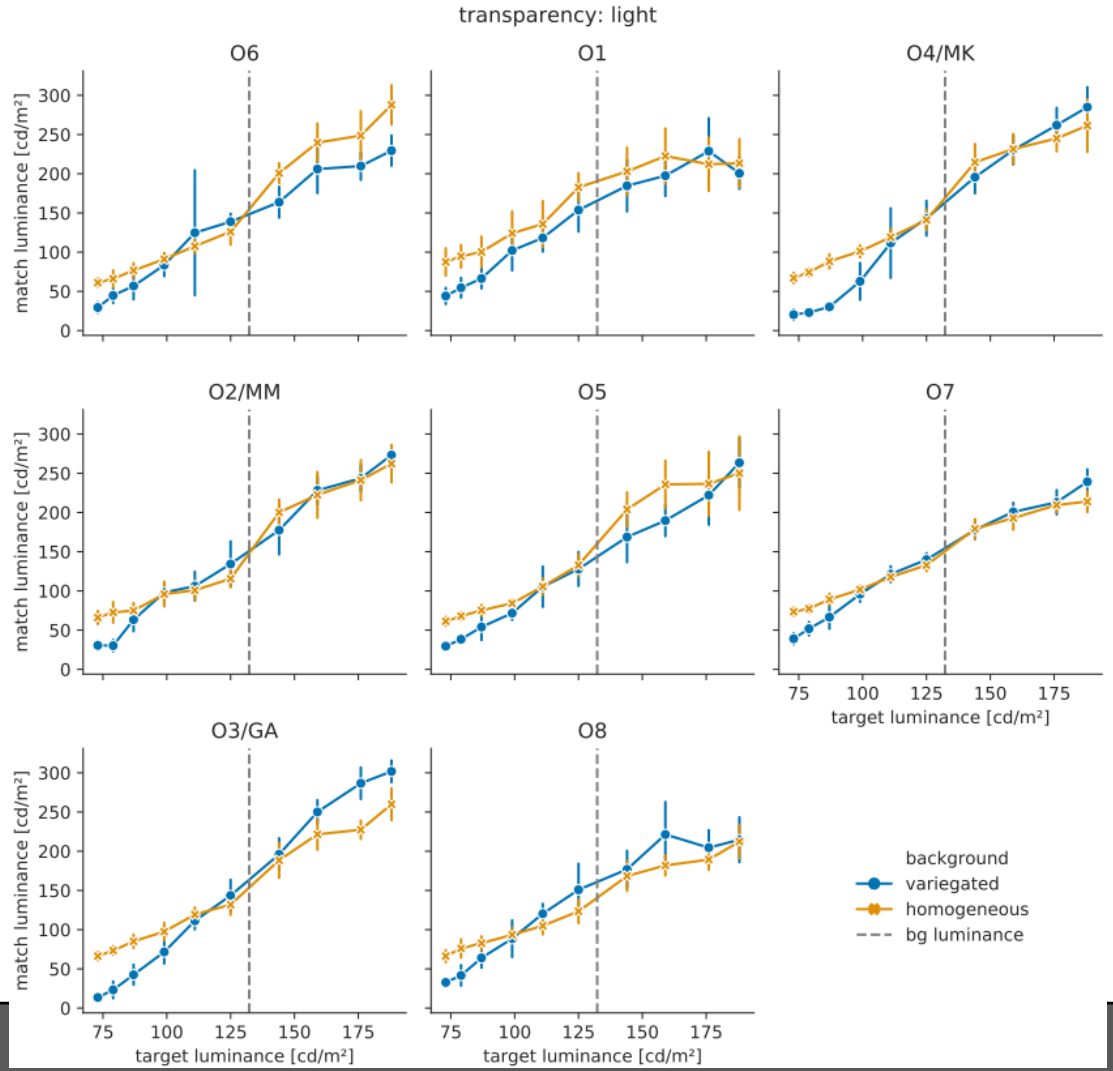
Reanalysis: Asymmetric Matching- dark



Reanalysis: Asym. M. Slope- dark



Reanalysis: Asymmetric Matching- light



Reanalysis: Asym. M. Slope- light