Relating discrimination with perceved magnitude on simultaneous brigthness contrast displays

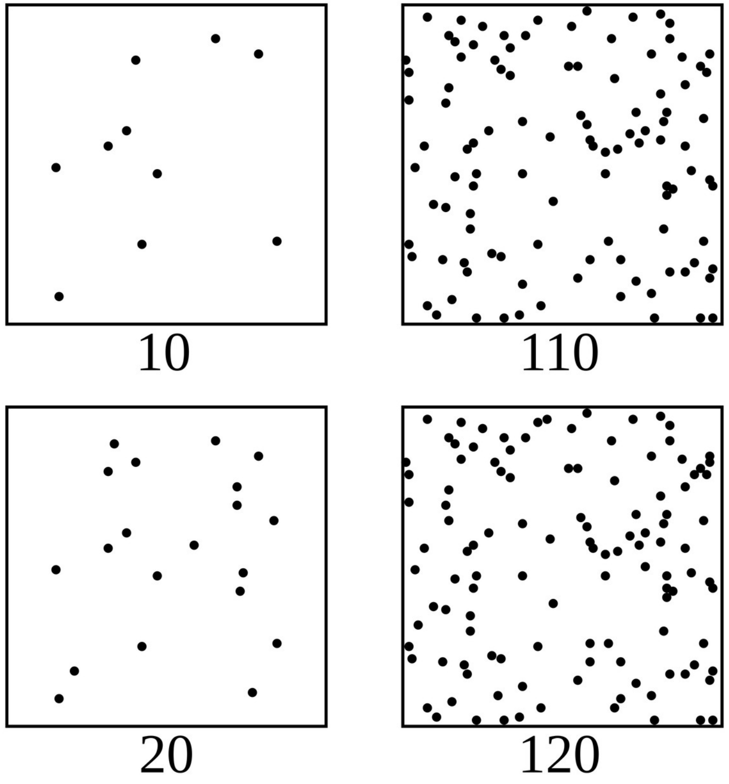
Jannis Röhl

Stimulus intensity

Sensitivity

perceived intensity

How many dots



(Webers Law)

Dots numerosity

Stimulus intensity

Sensitivity

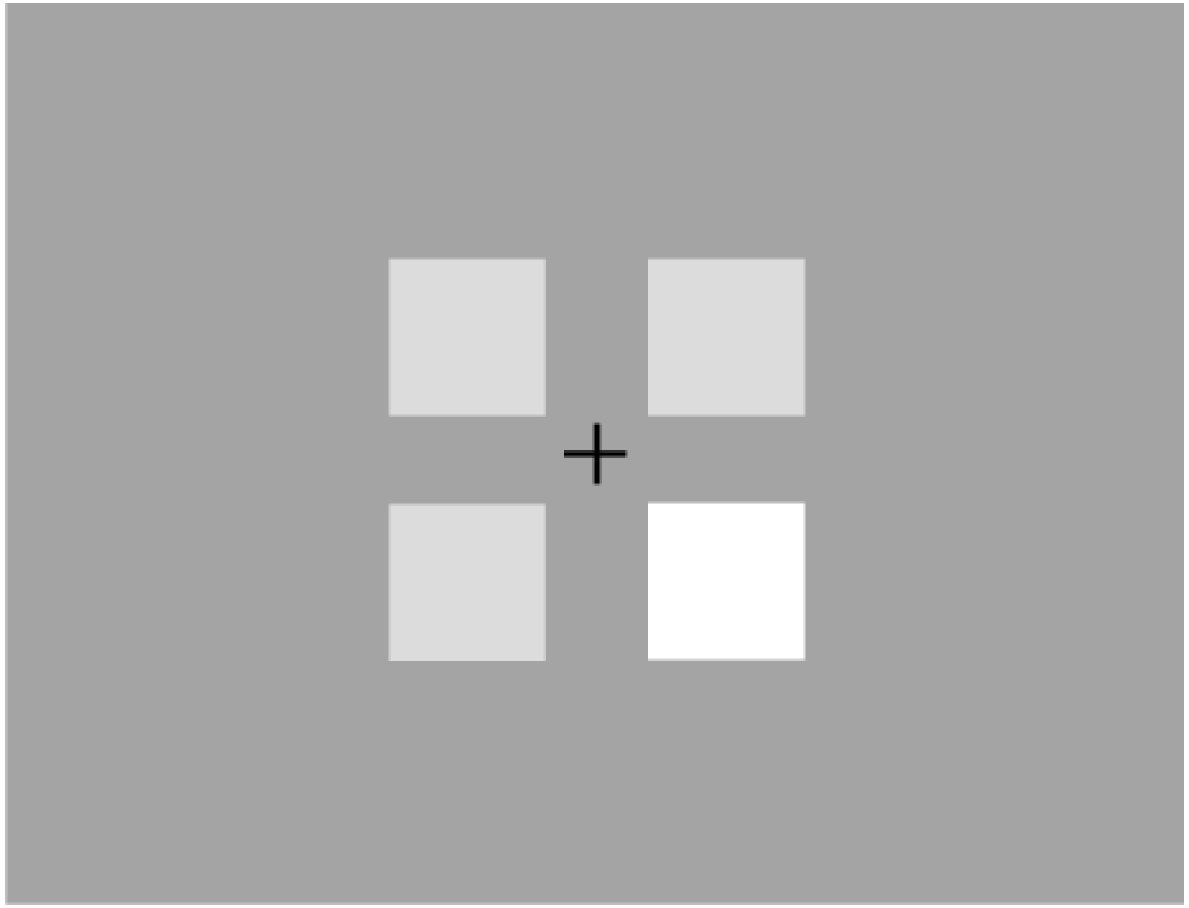
Perceived intensity

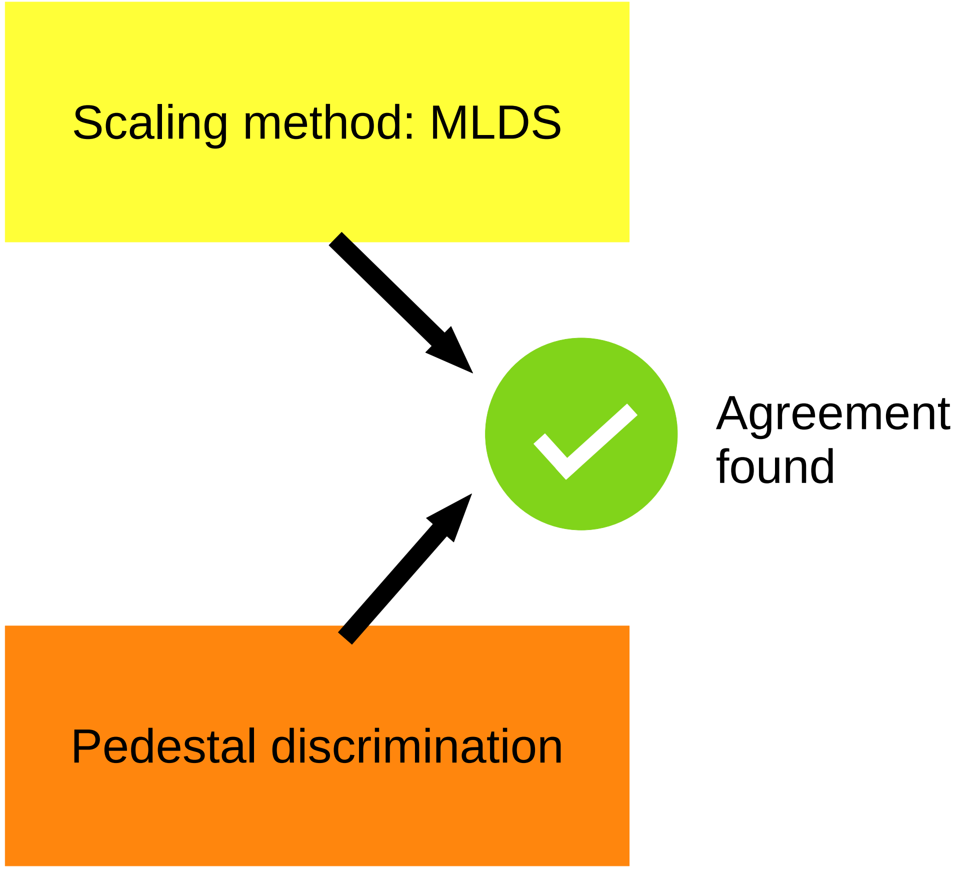
Luminance

Thresholds

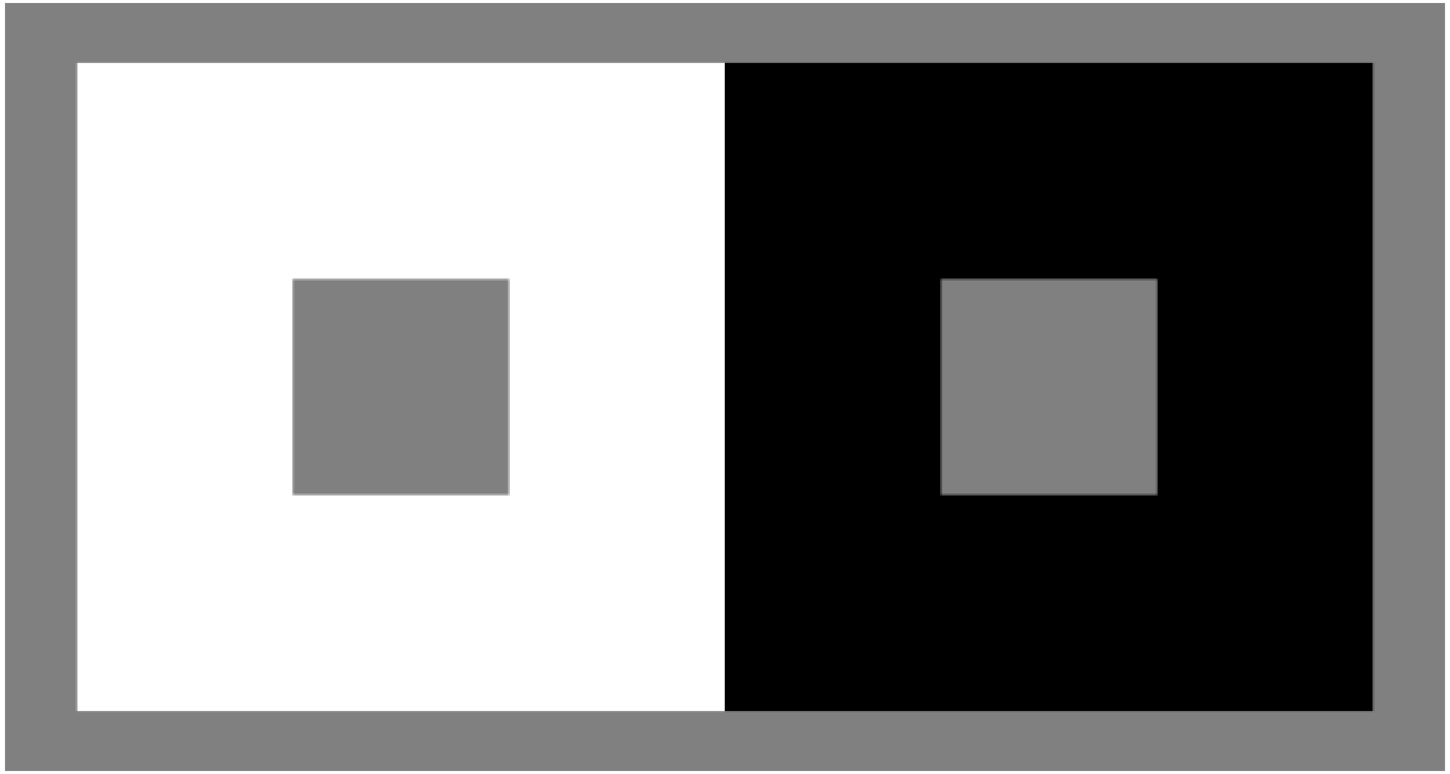
Brightness

Shi and Eskew (2024)





Simultaneous brigthness contrast

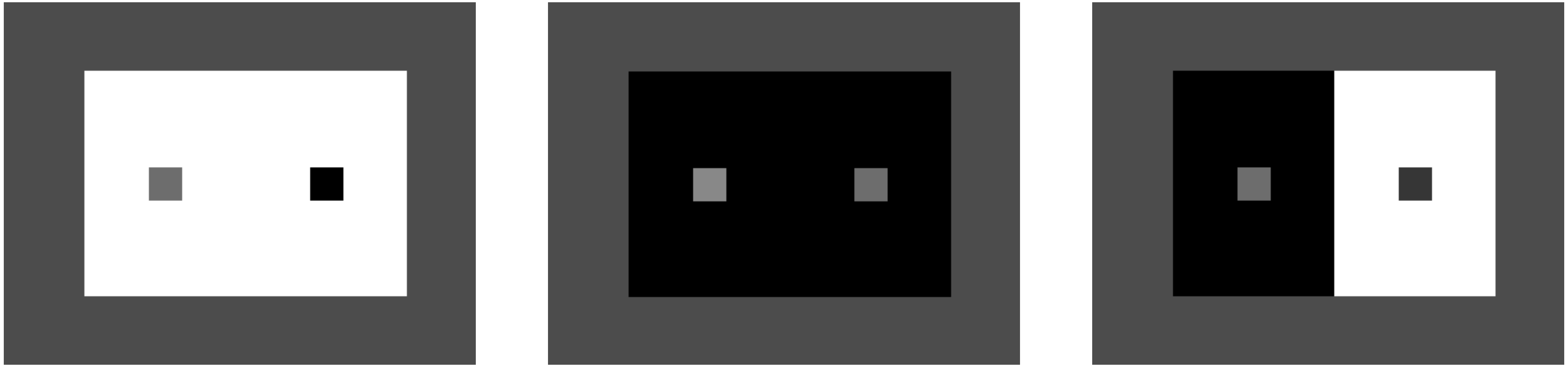


Research question

„How is the relation between sensitivity and perceived intensity influenced by the simultaneous brightness contrast?“

Methods

1. perceived intensity: MLCM

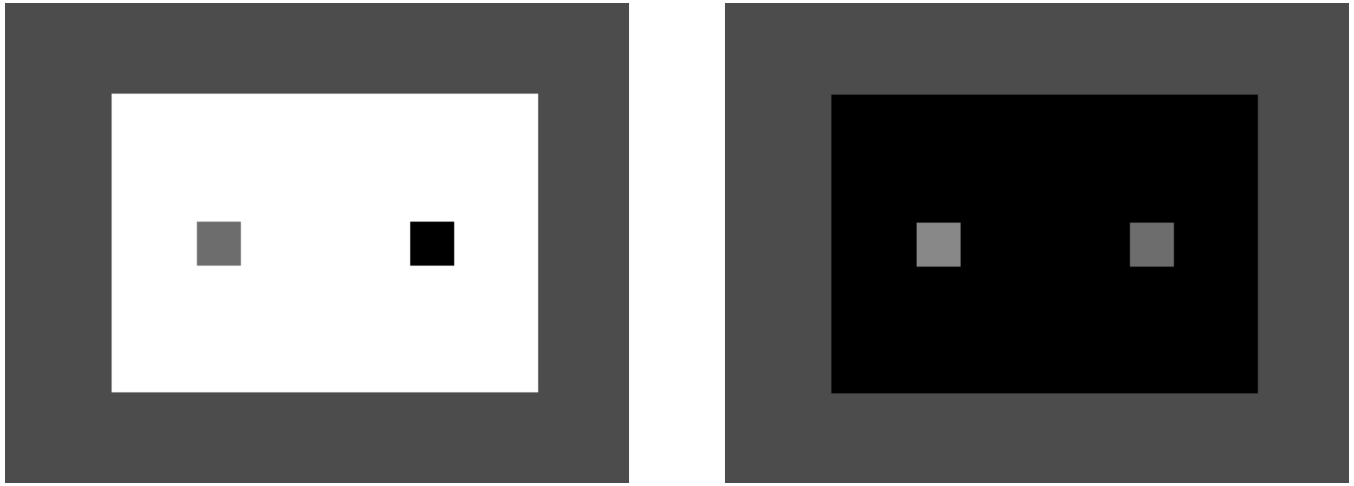


8 values x 2 context = 16 variations

Task: *Which square looks brighter?*

Methods

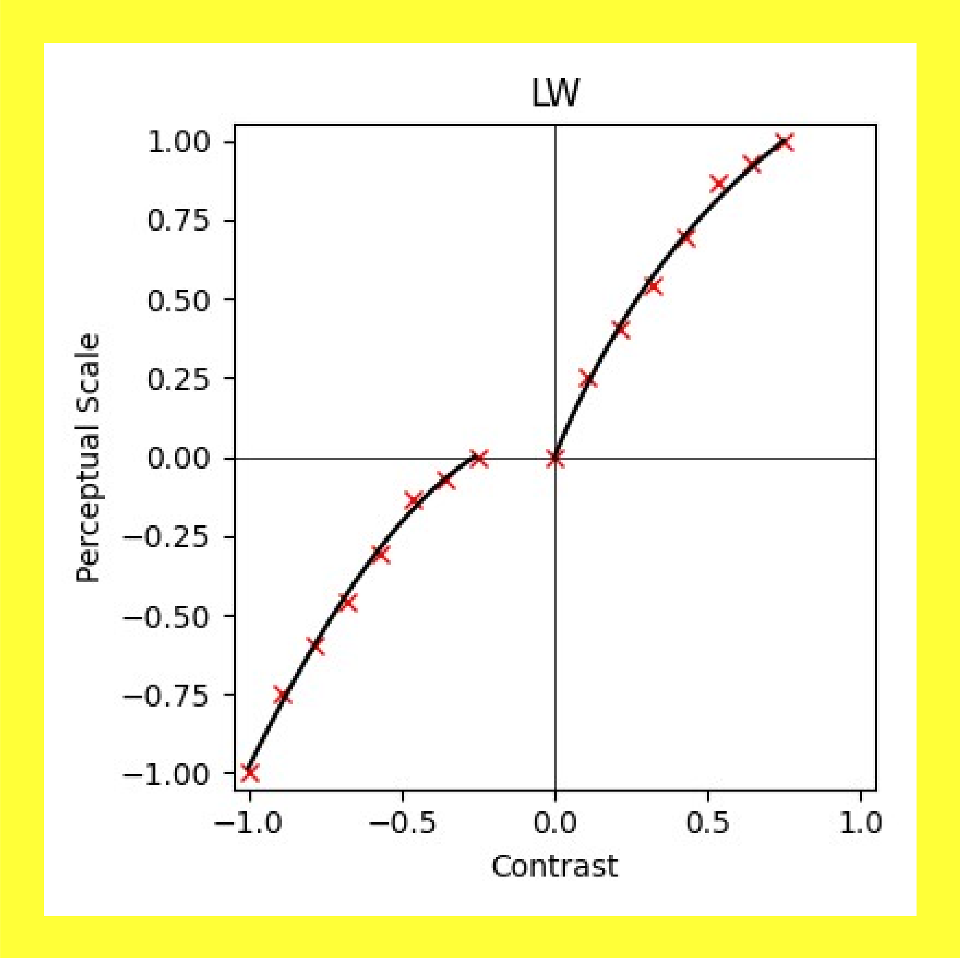
2. sensitivity: pedestal discrimination



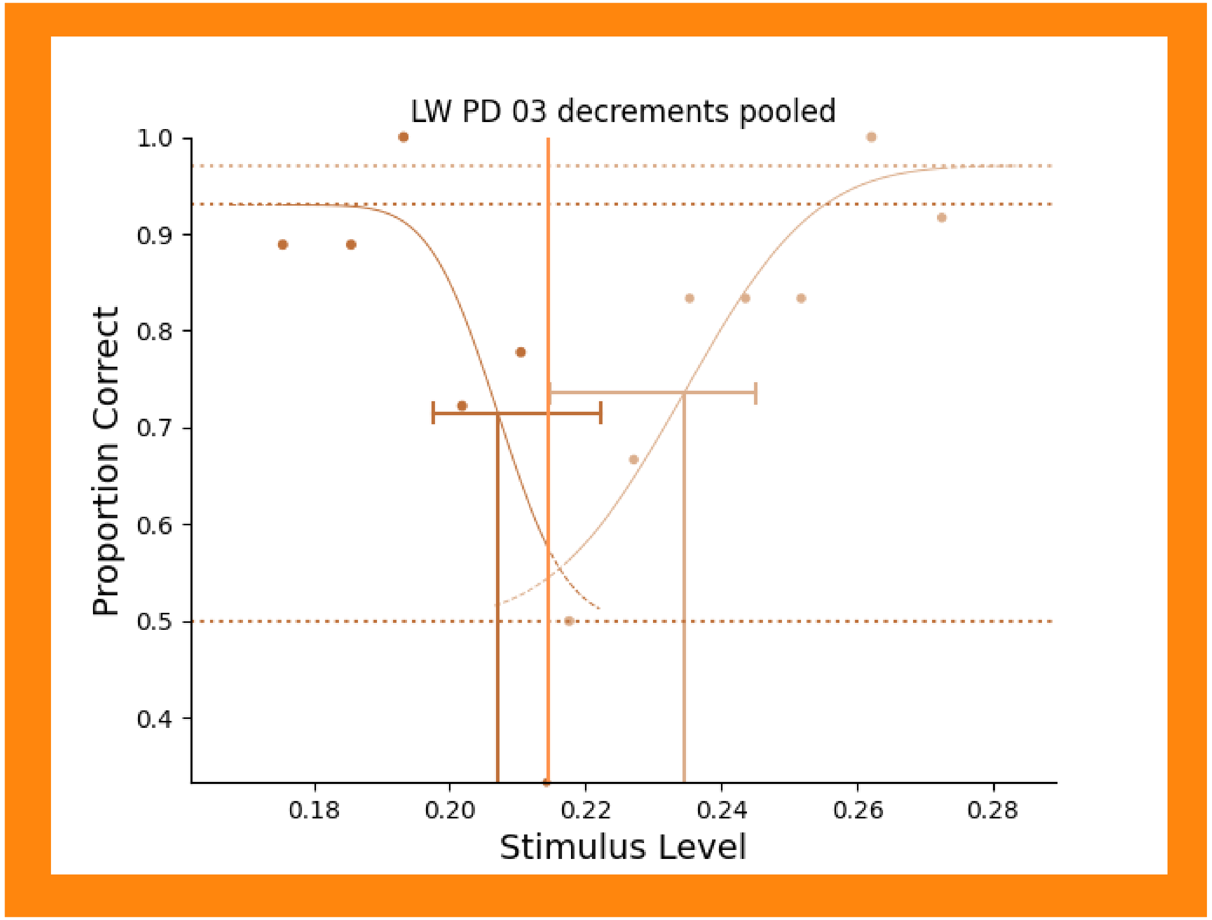
For each of the 16 variations (pedestals) increment and decrement test

Task: *Which square looks brighter?*

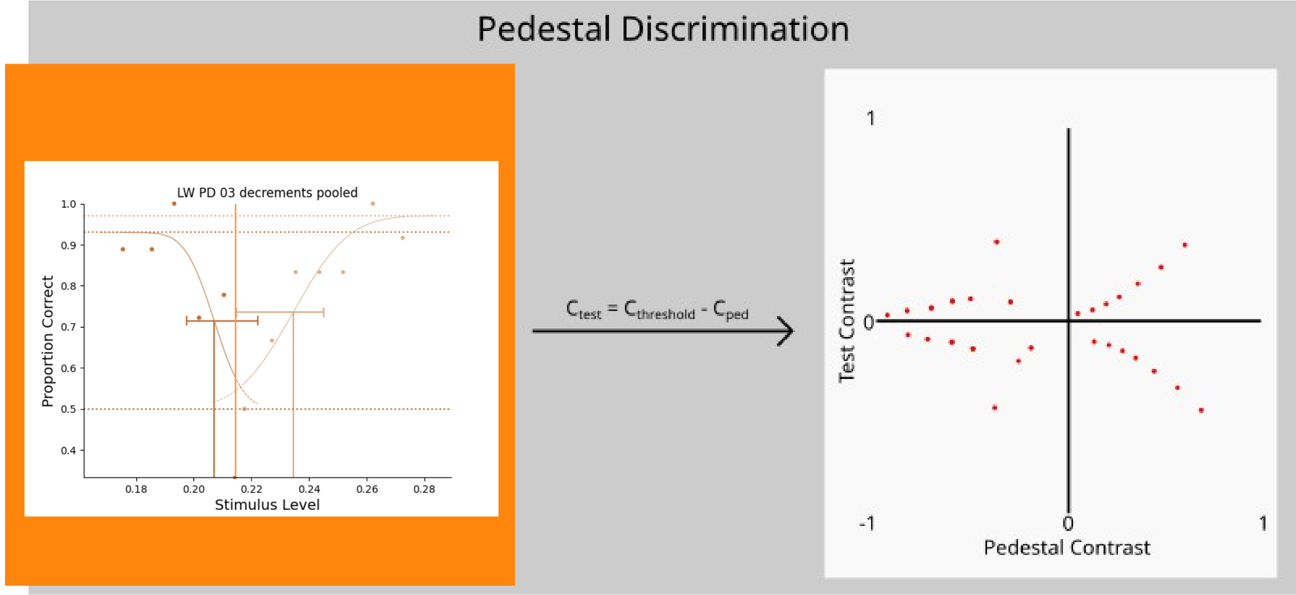
Results: MLCM



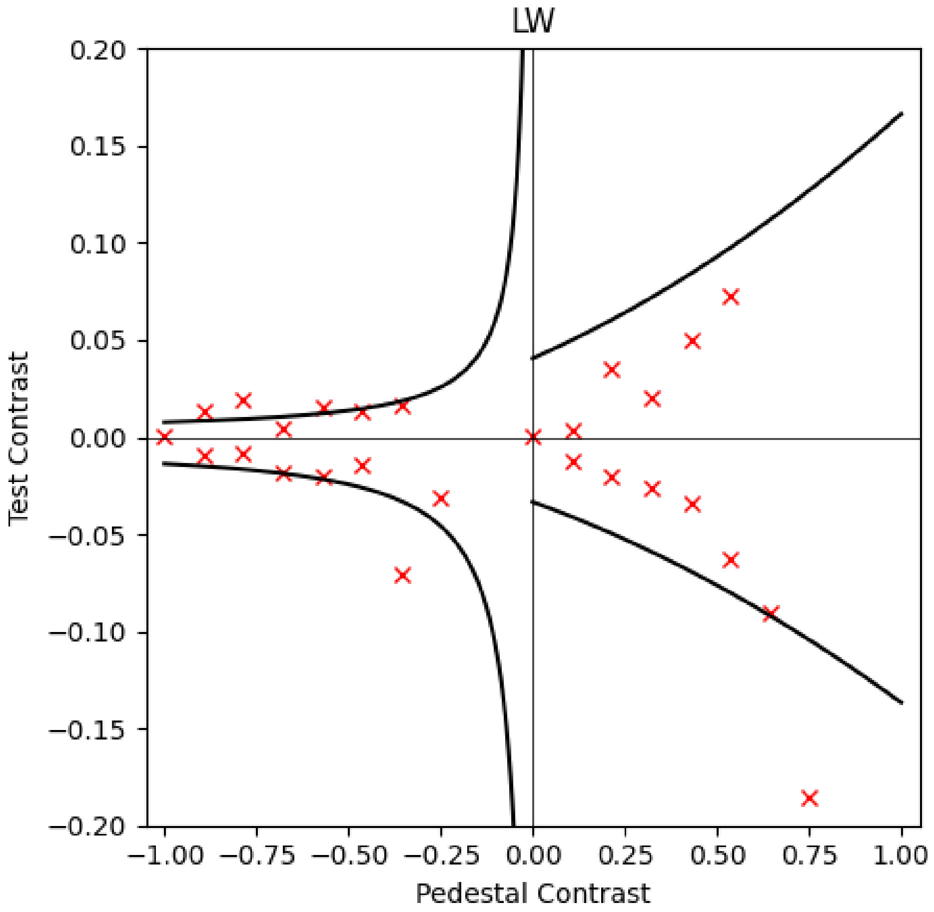
Results: pedestal discrimination



Pedestal discrimination

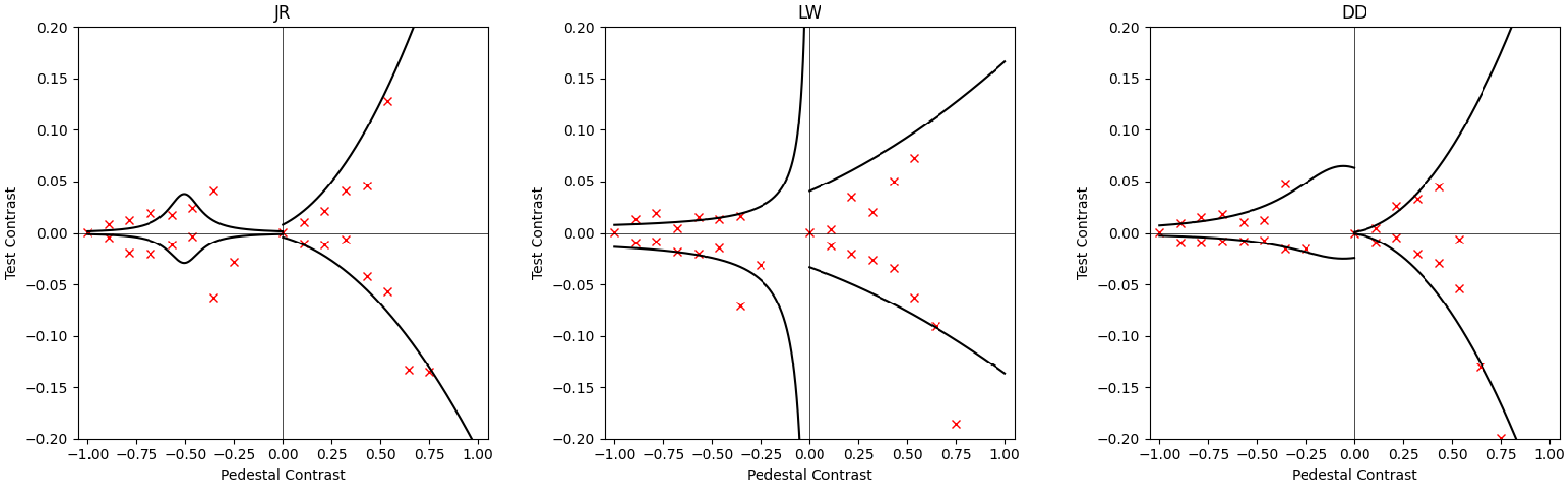


Results



LW
0.20
0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
−0.20
Test Contrast
−1.00 −0.75 −0.50 −0.25 0.00 0.25 0.50 0.75 1.00
Pedestal Contrast

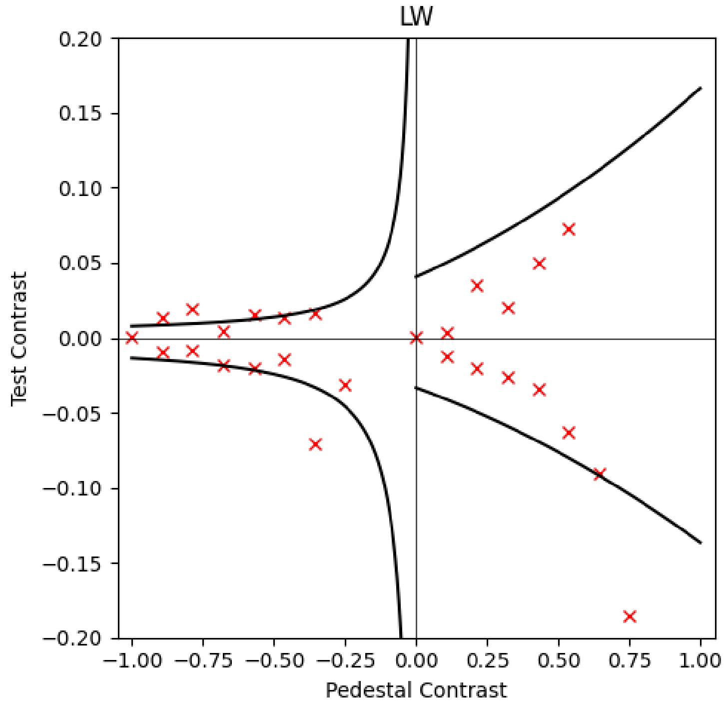
Results



JR
LW
DD
Test Contrast
Pedestal Contrast
0.20
0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
−0.20
−1.00
−0.75
−0.50
−0.25
0.00
0.25
0.50
0.75
1.00

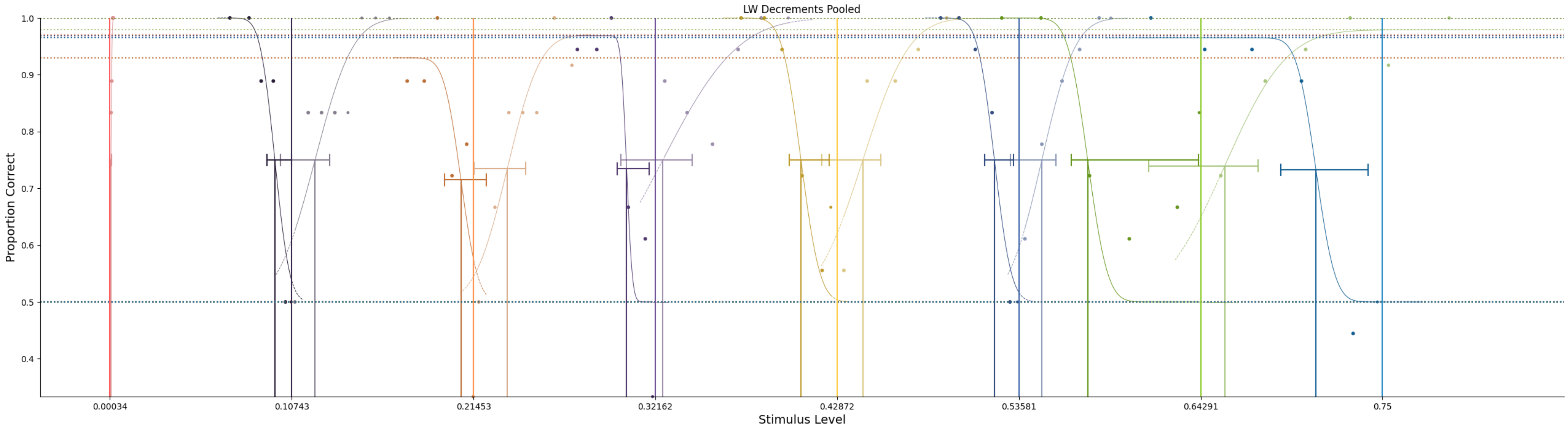
Discussion

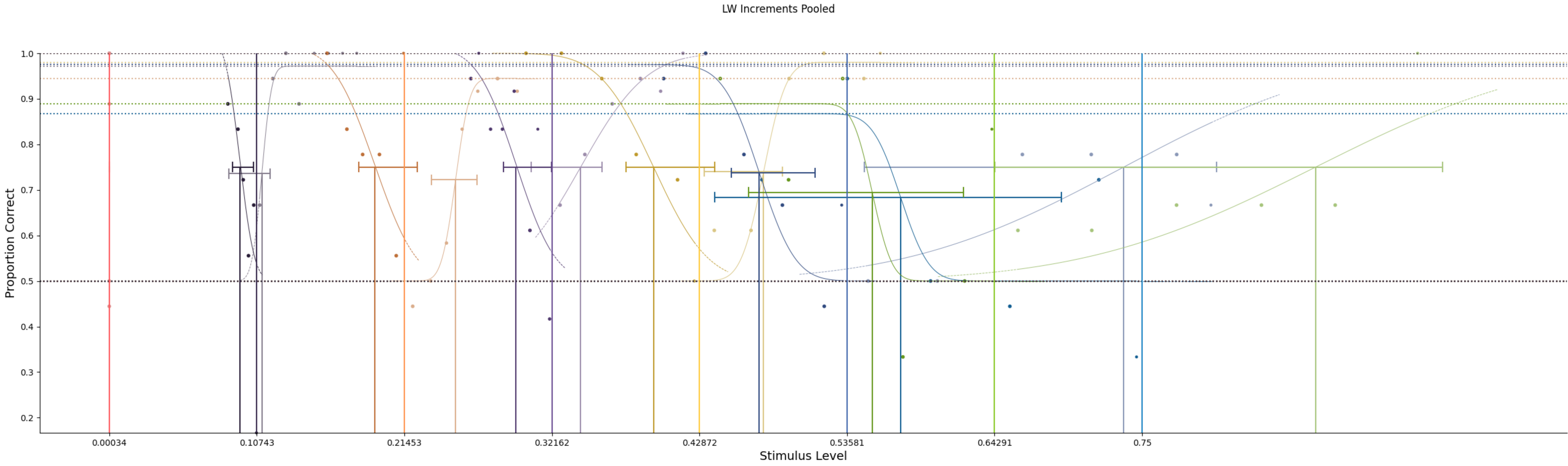
- Prediction is different for each observer
- difference in prediction to Shi and Eskew (2024)
- SBC influence is different per person



Thank you for your attention.

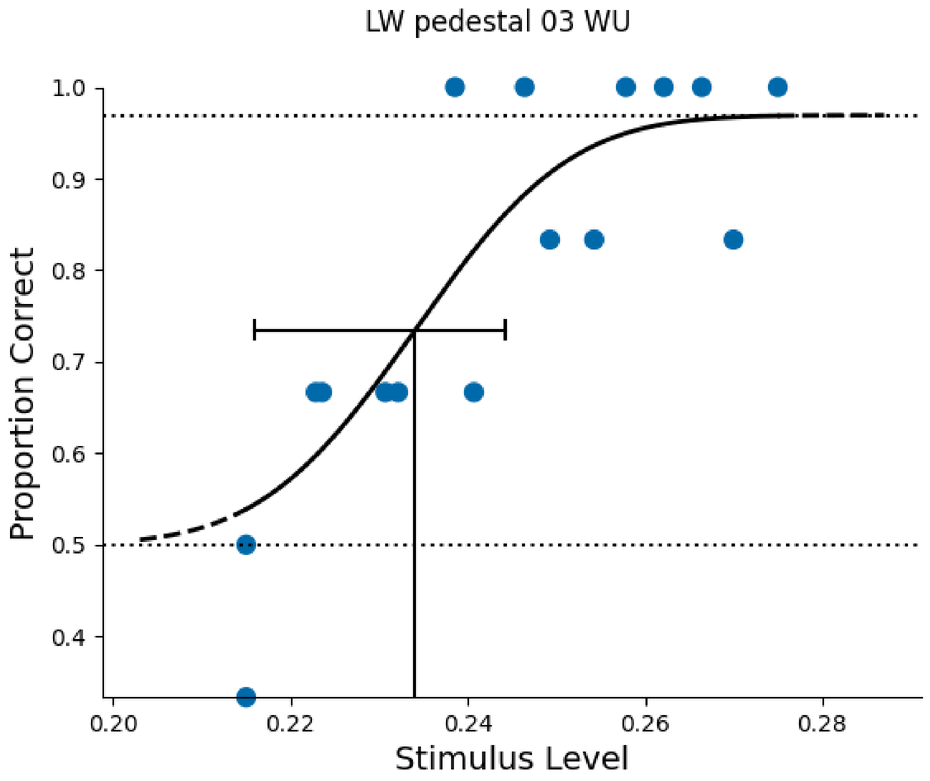
Results: pedestal discrimination

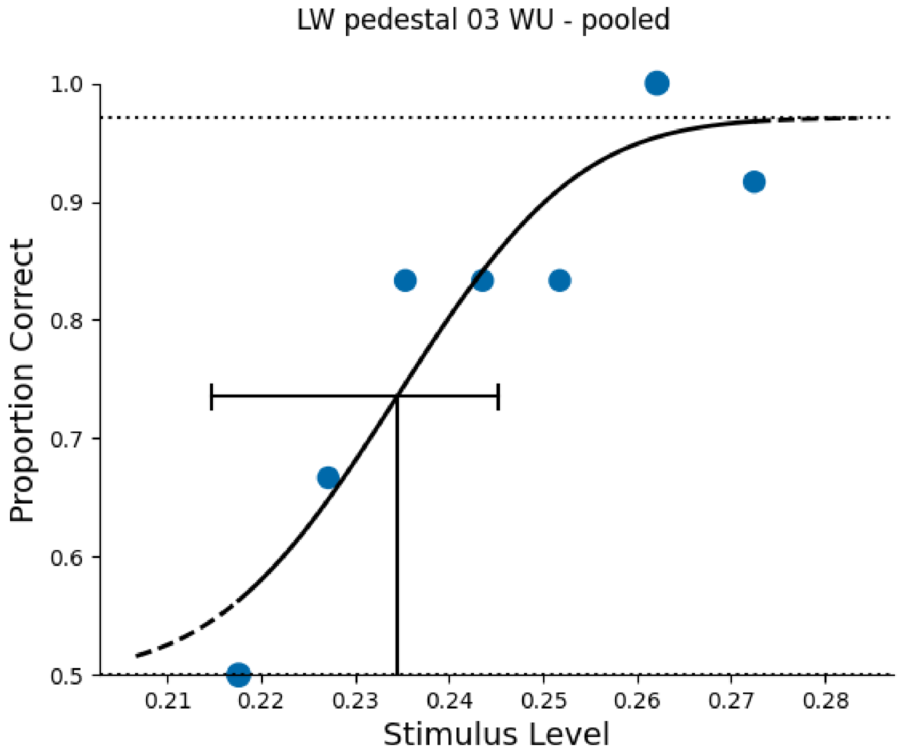




LW Increments Pooled
Proportion Correct
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.00034
0.10743
0.21453
0.32162
0.42872
0.53581
0.64291
0.75
Stimulus Level

Evaluation sensitivity (pedestal discrimination)





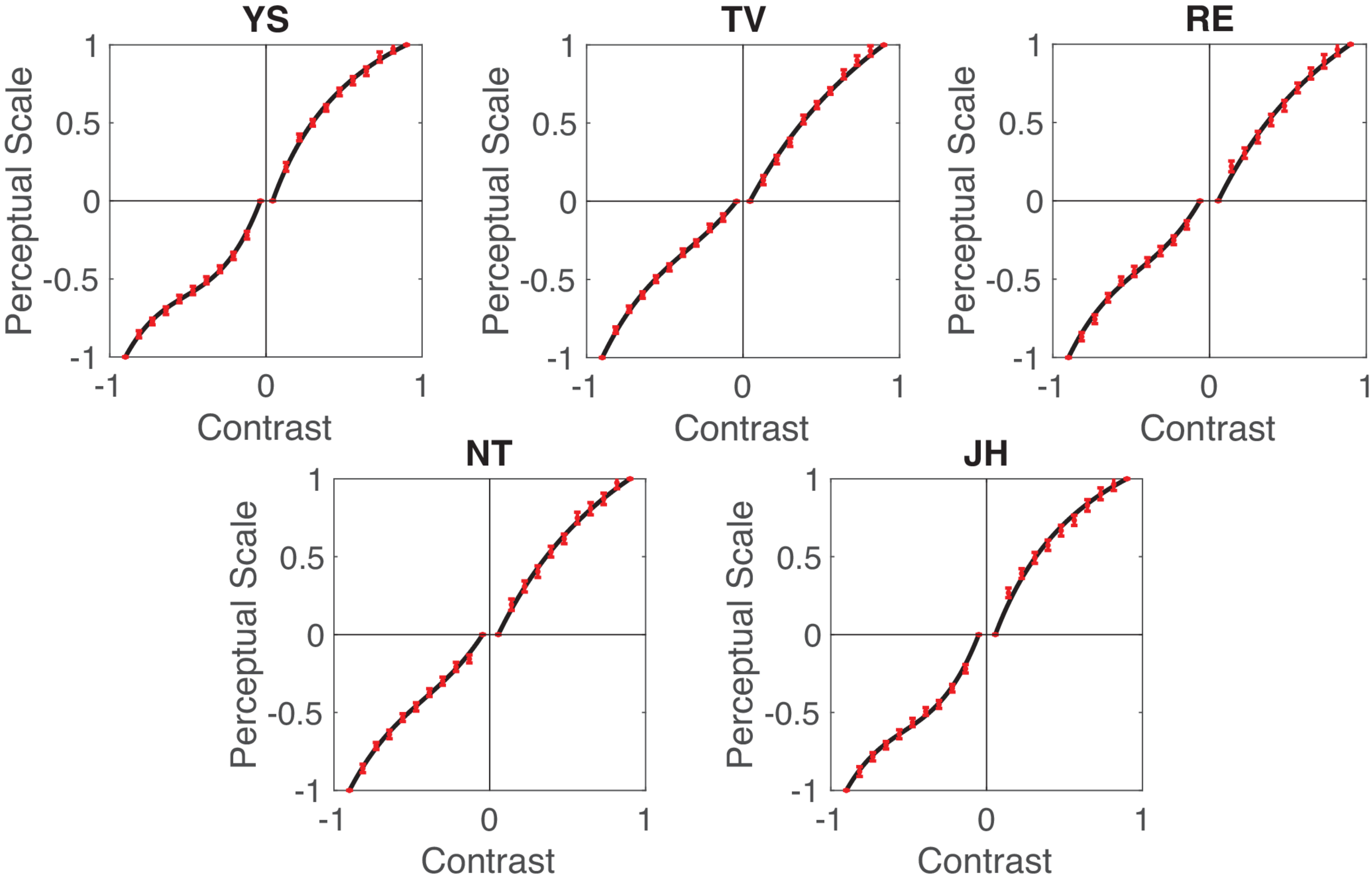
modified Naka–Rushton and cubic – Fit MLDS Shi and Eskew (2024)

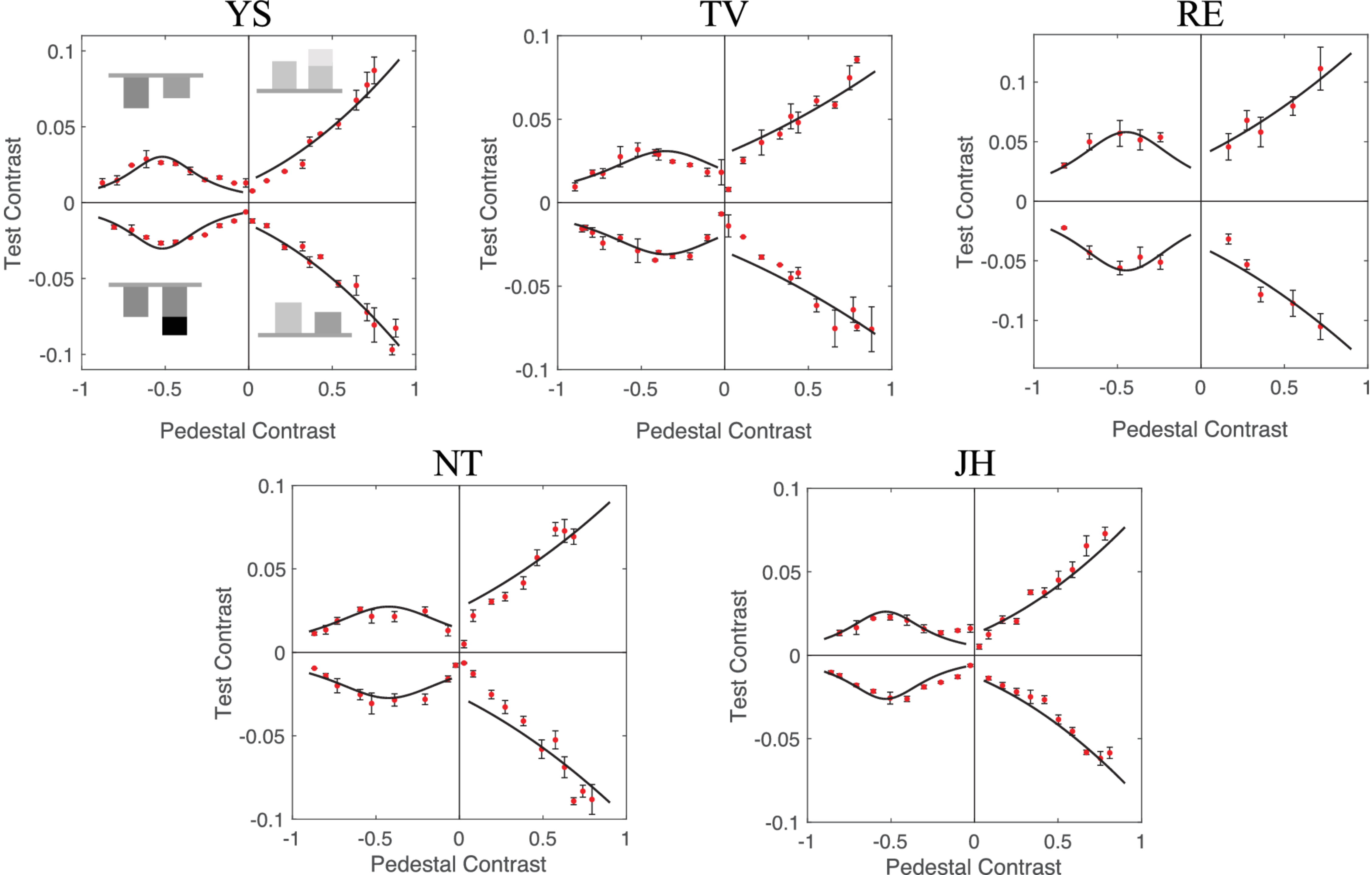
$$P_+ = \left[1 + \frac{m_+}{(C_m - 2C_{0+})}\right] \times \frac{(C_+ - 2C_{0+})}{(C_+ - 2C_{0+}) + m_+} \tag{2a}$$

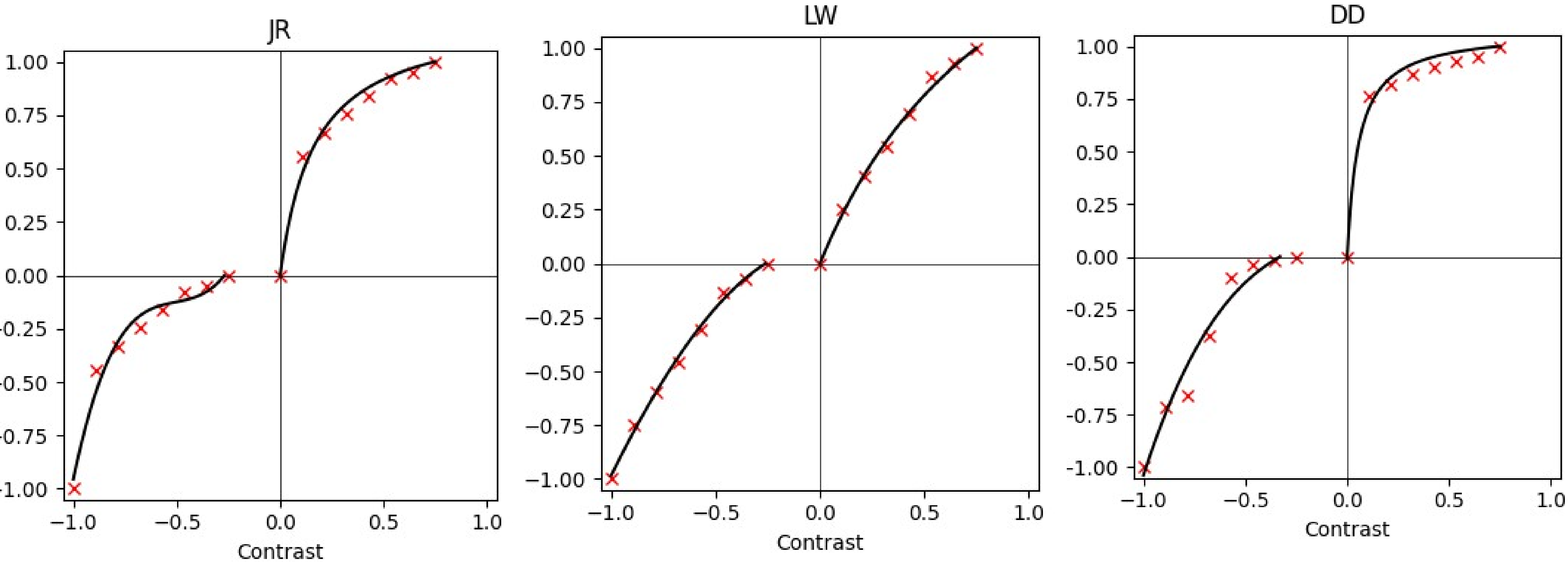
$$P_- = b \times C_-^3 + d \times C_-^2 + e \times C_- + f \tag{2b}$$

Prediction Model:

$$C_t = k_{A_\pm} \times \sigma_{A_\pm} \times \frac{1}{\frac{d}{dc} p\left(C_{ped}\right)} \tag{3}$$


YS
TV
RE
NT
JH
Perceptual Scale
Contrast
1
0.5
0
-0.5
-1
-1
0
1


YS
TV
RE
NT
JH
Test Contrast
Pedestal Contrast
0.1
0.05
0
-0.05
-0.1
-1
-0.5
0
0.5
1


JR
1.00
0.75
0.50
0.25
0.00
-0.25
-0.50
-0.75
-1.00
−1.0
−0.5
0.0
0.5
1.0
Contrast
LW
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
−1.0
−0.5
0.0
0.5
1.0
Contrast
DD
1.00
0.75
0.50
0.25
0.00
-0.25
-0.50
-0.75
-1.00
−1.0
−0.5
0.0
0.5
1.0
Contrast