Behavioural Analysis

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1.Performance across different tasks.

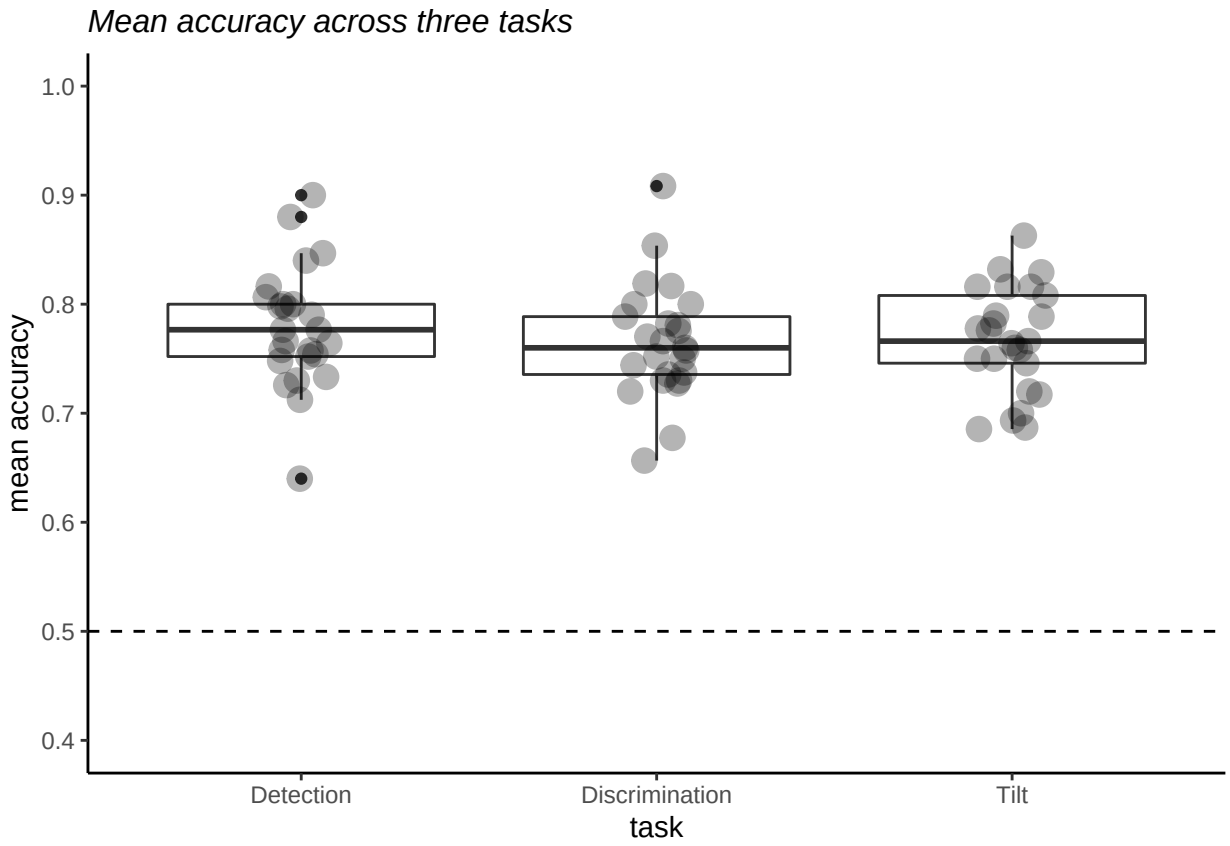


Figure 1: Mean accuracy across three tasks

Detection (accuracy= 0.78, d'= 1.80), discrimination (accuracy= 0.77, d'= 1.54) and tilt recognition (accuracy = 0.77, d'= 1.96) was similar. A one-way ANOVA failed to detect a significant difference between the accuracy of these three tasks $F(2, 72) = 0.47$, $MSE = 0.00$, $p = .629$, $\hat{\eta}^2_G = .013$ and d' (F= 3.20, p= 0.05; see Figure 1)).

The probability of responding YES in detection was 0.46 (± 0.07), and was significantly different from 0.5 (ADD T TEST RESULTS). The probability of responding CLOCKWISE was 0.51 (± 0.11) and was not significantly different from 0.5. For the tilt recognition task, the probability of responding TILTED was (0.43 ± 0.07).

Response time was faster for correct response (1st quartile= 866.66, median= 916.63, 3rd quartile= 951.57 milliseconds) than incorrect responses (1st quartile= 925.50, median= 1000.10, 3rd quartile= 1075.16 milliseconds). A one-way analysis of variance failed to detect a significant overall effect of responses type in detection (YES vs. NO, t=0.44 p=0.66), discrimination (CLOCKWISE vs. ANTICLOCKWISE, t=0.82, p= 0.41) and tilt recognition (VERTICAL vs. TILTED, t=-1.69, p= 0.09) on response time.

2.Confidence distributions

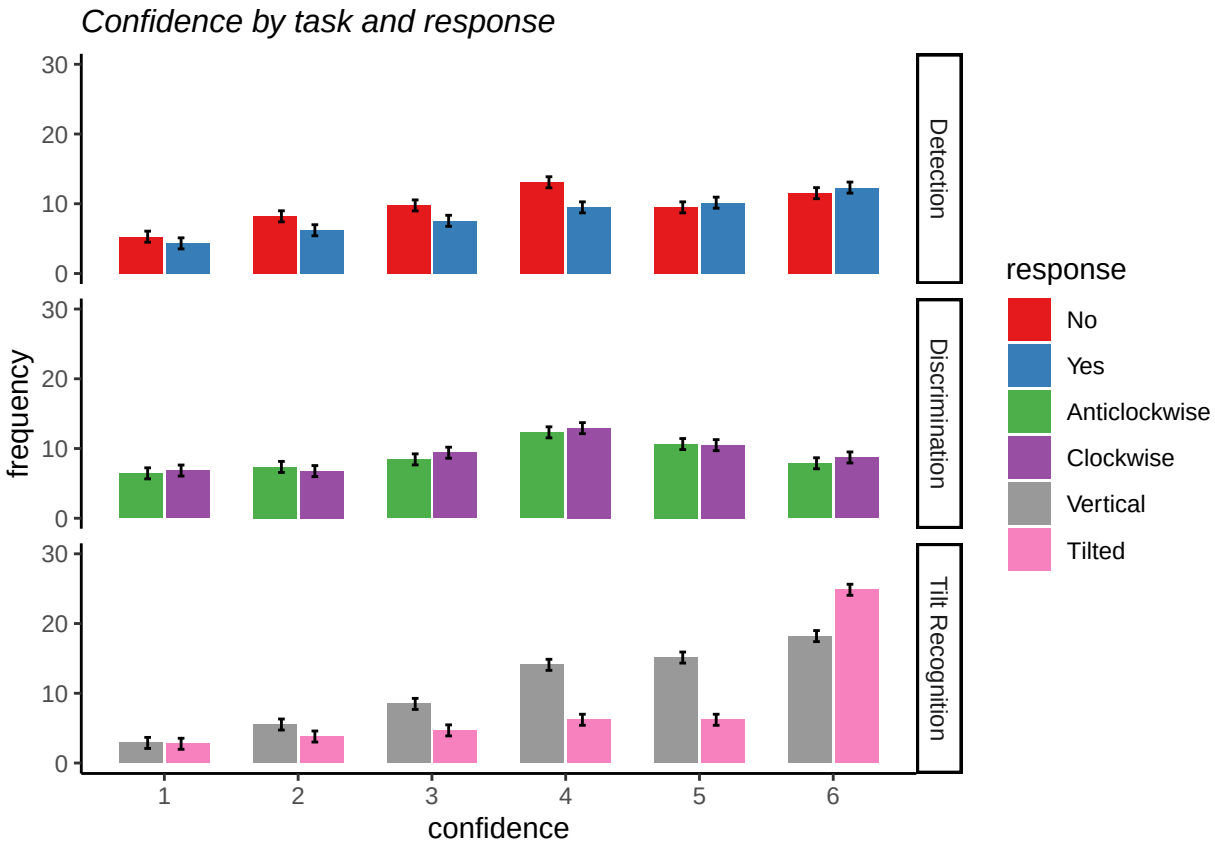


Figure 2: Confidence distributions across three tasks and responses. Error bars represent the standard error of the mean.

Fig.2 Detection

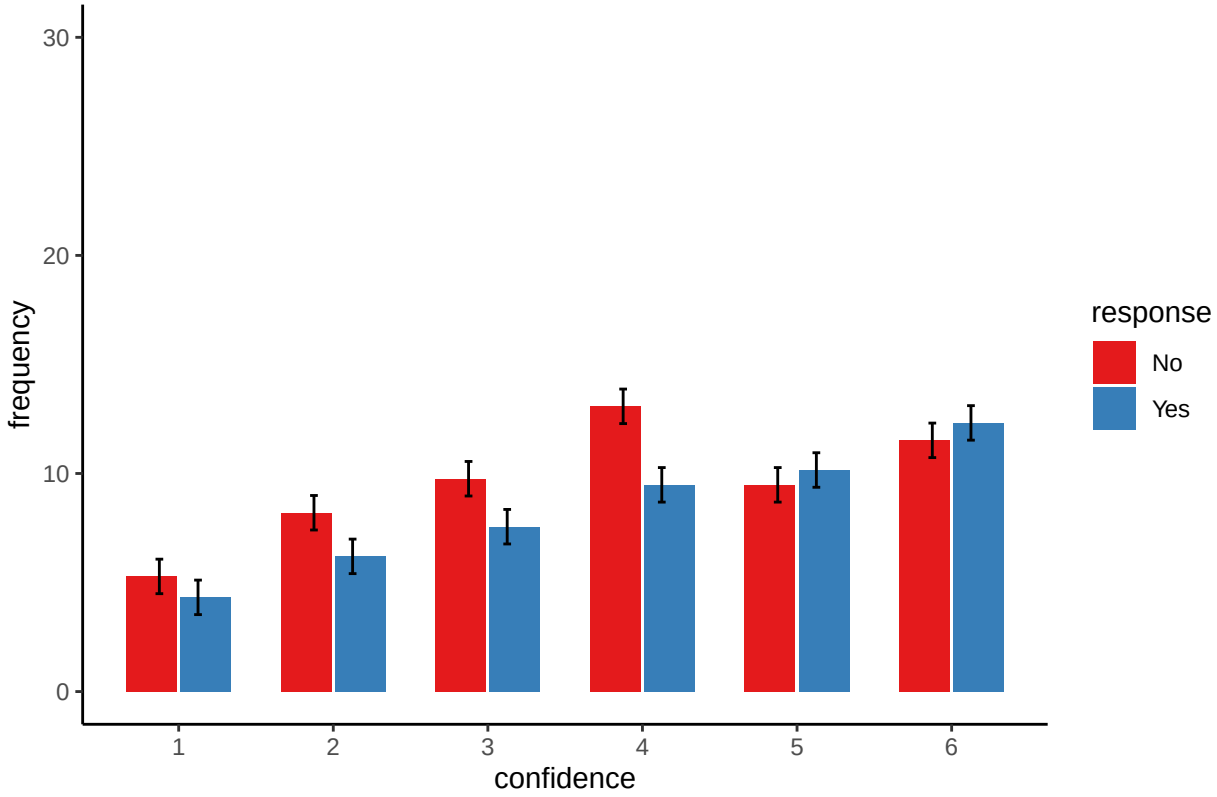


Fig.3 Discrimination

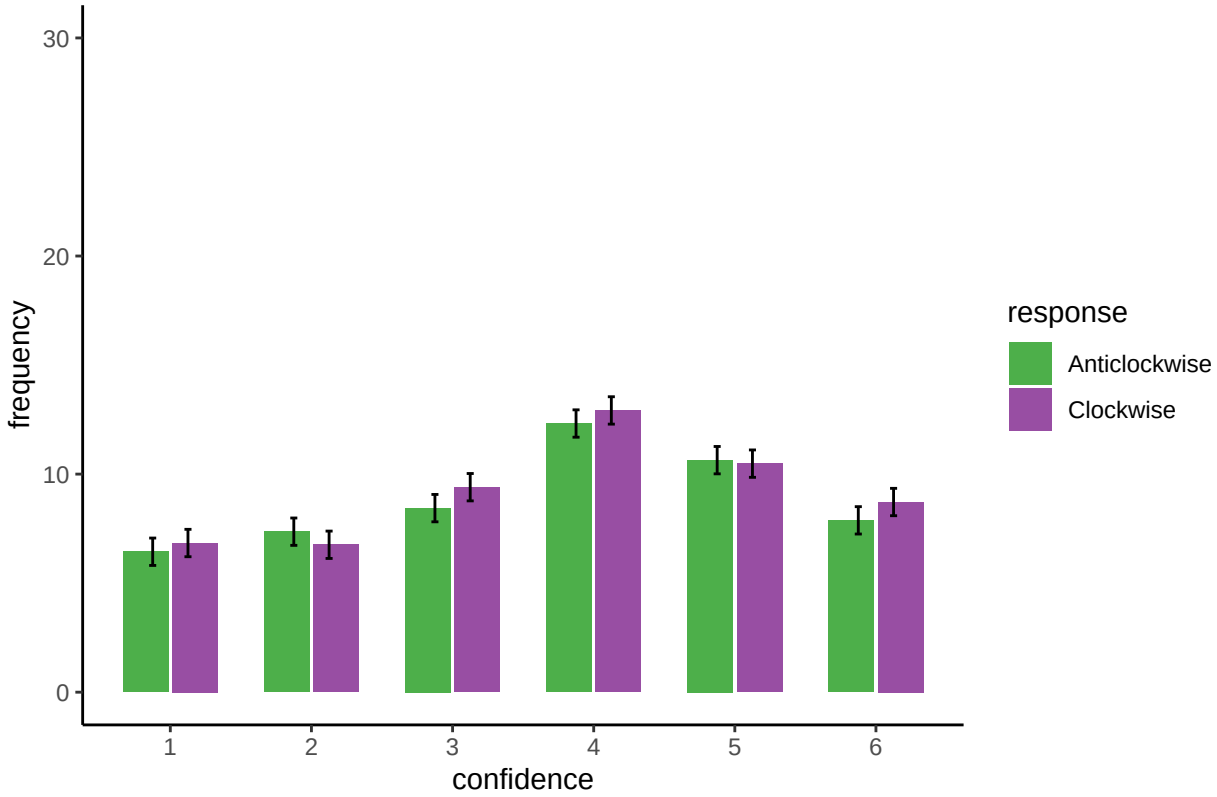
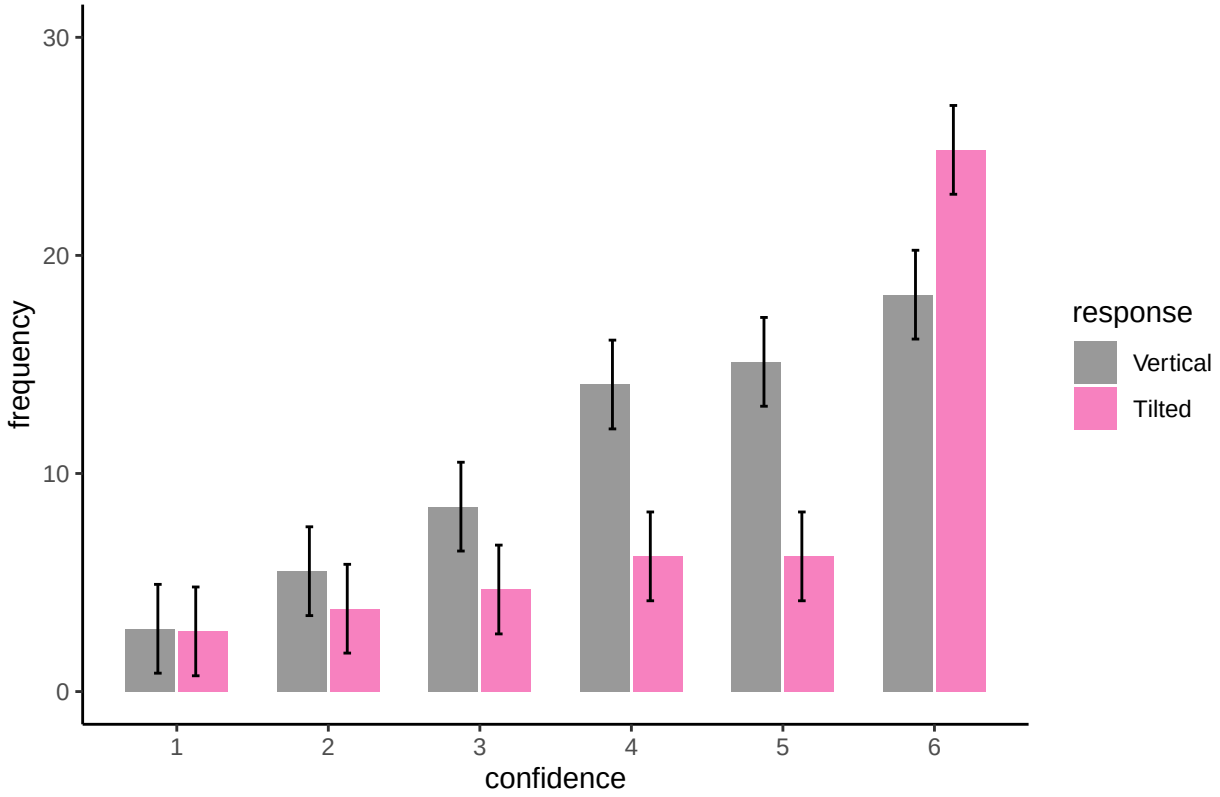


Fig.4 Tilt recognition



Within detection, a significant difference in mean confidence was observed between YES (target present) and NO (target absent) responses (see Fig.4 above) (t=-3.27, p = < 0.001) , such that participants are more confident in their YES responses than NO response and a statistical significance was also observed in the tilt recognition task between TILTED and Vertical response (t=-6.23, p = < 0.001; see Figure 2).

3.Type 1 ROC curves

Fig.5 Type 1 ROC Detection

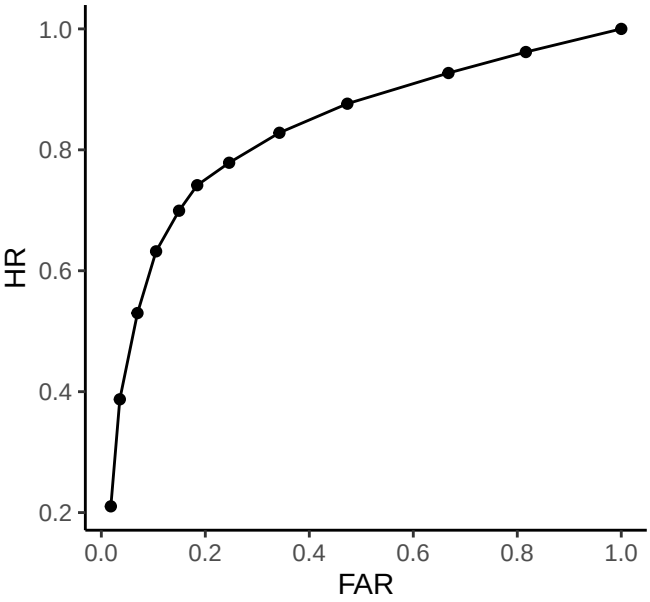


Fig.6 Type 1 ROC Discrimination

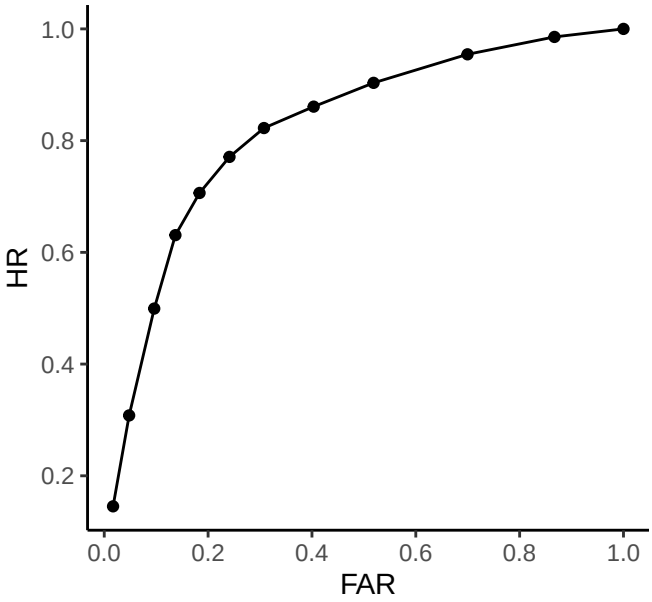
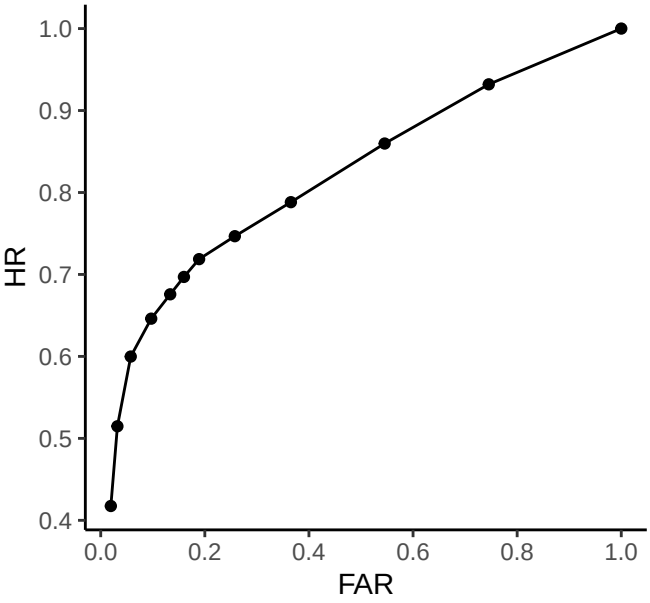


Fig.7 Type 1 ROC Tilt Recognition



4.Type 2 ROC curves

Fig.8 Type 2 ROC Detection

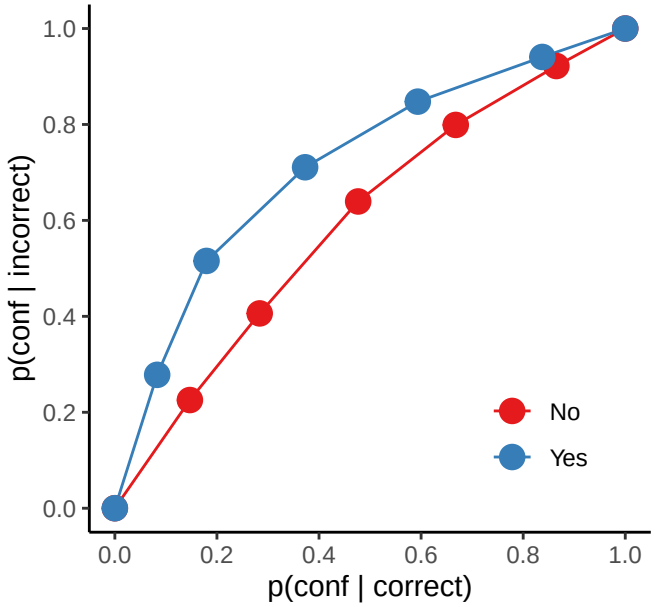


Fig.9 Type 2 ROC Discrimination

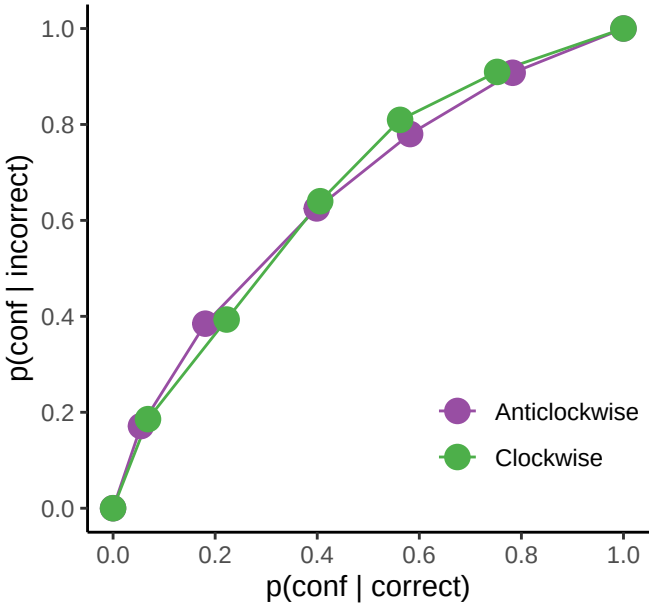
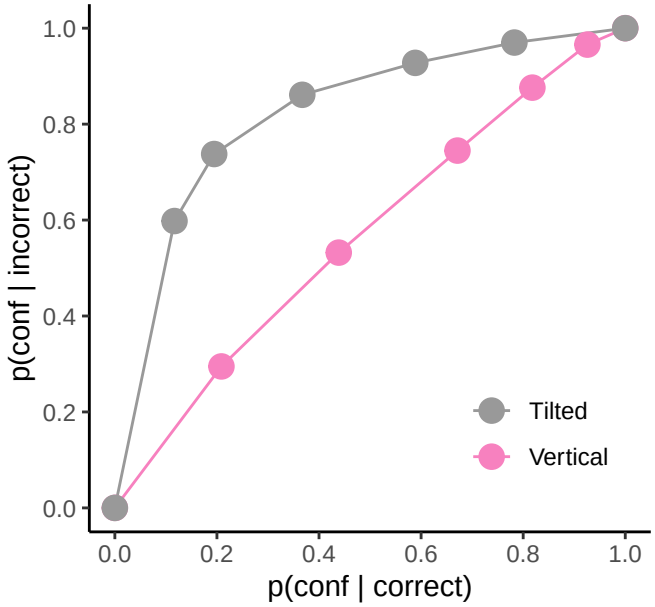
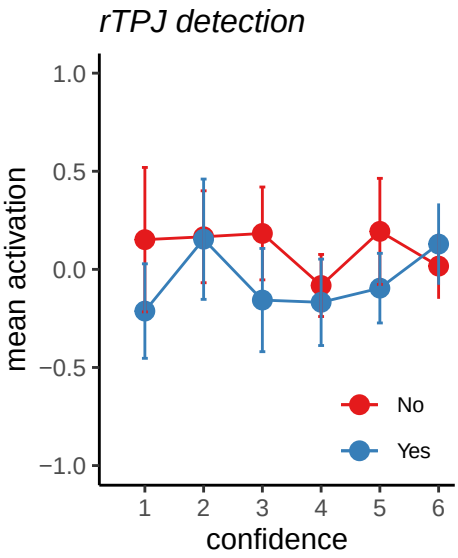


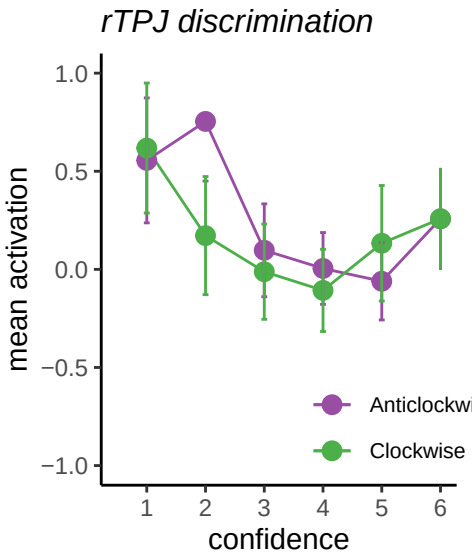
Fig.10 Type 2 ROC Tilt

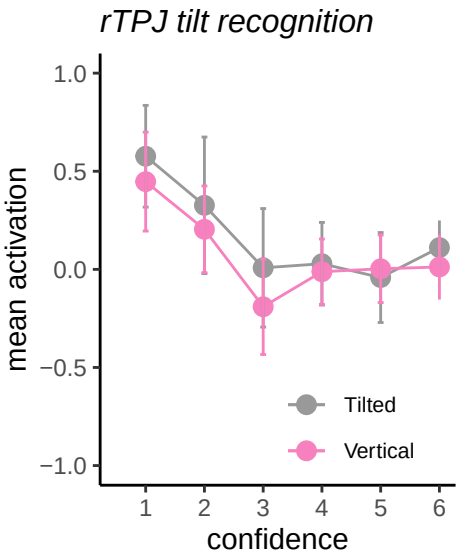


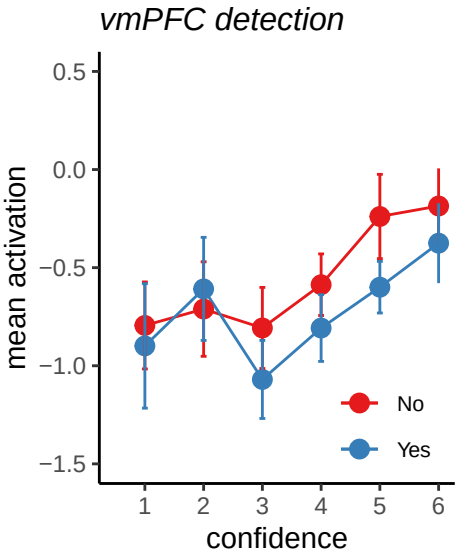
Metacognitive sensitivity, which is quantified as the area under Type 2 ROC curve, is significantly higher for Yes (NA) than No (NA) response. Similar pattern is observed in the tilt recognition task, where the AUC is significantly higher for Tilted (NA) than Vertical (NA) responses.

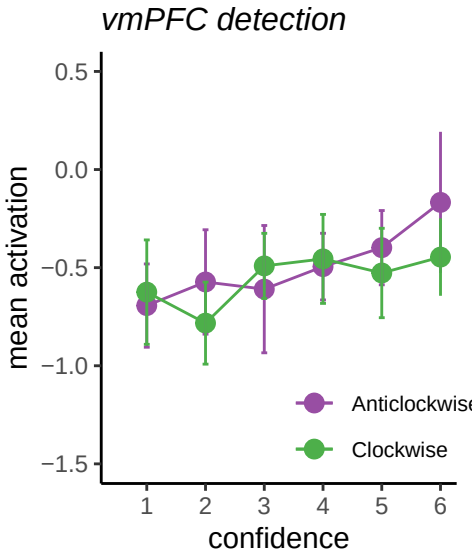
5.BOLD signal in ROIs

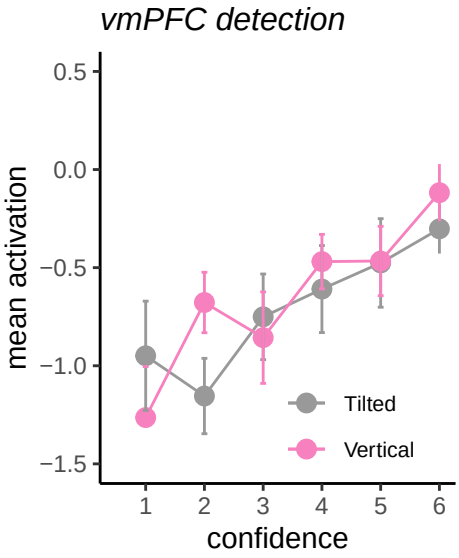


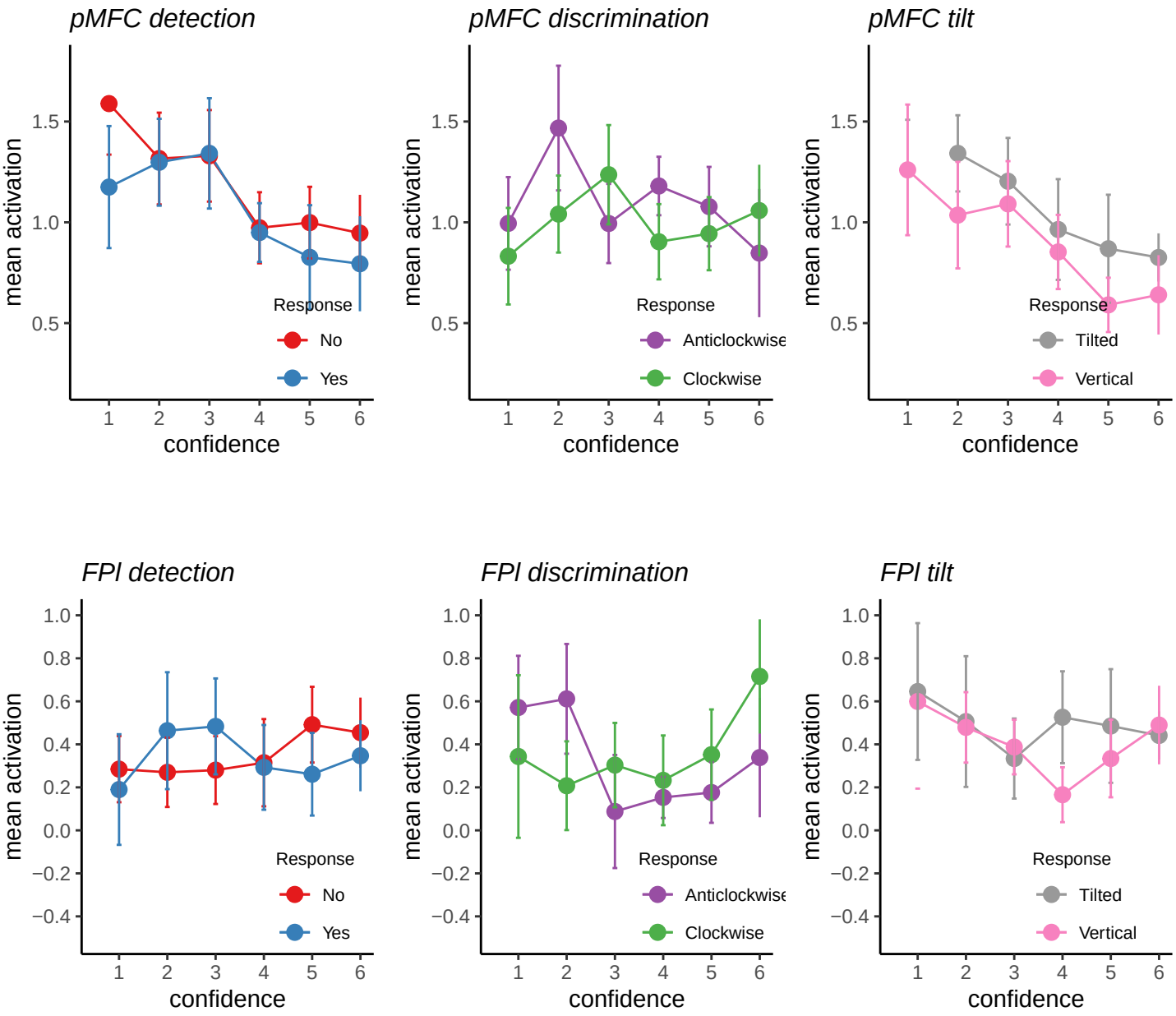


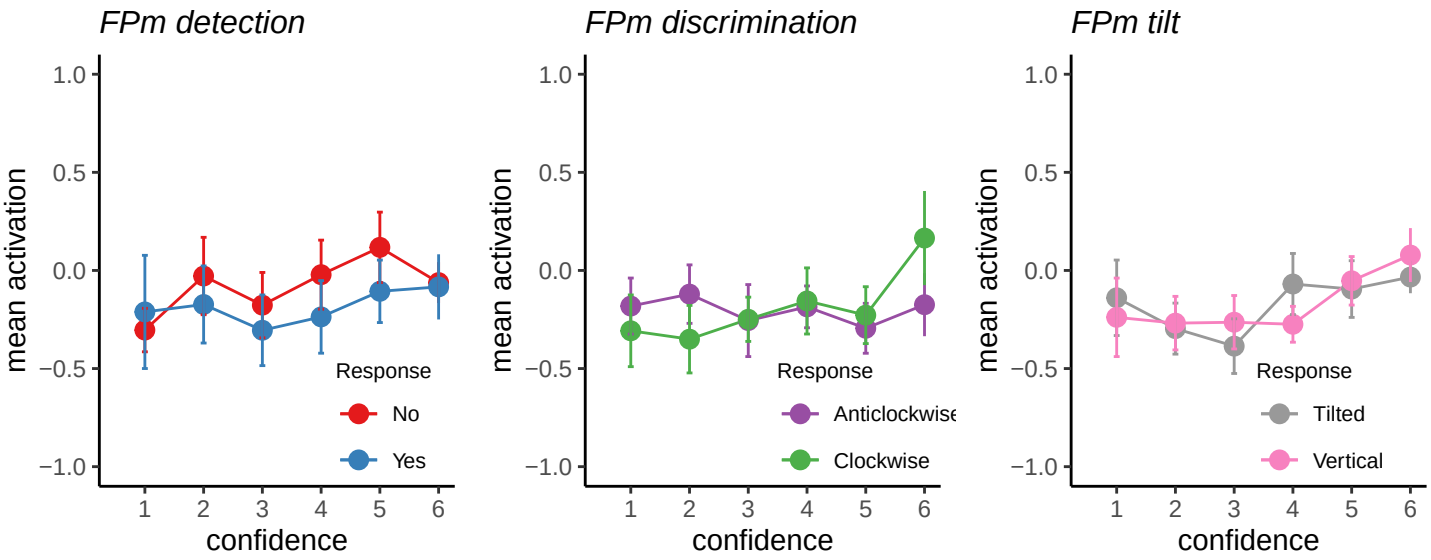









pMFC detection
pMFC discrimination
pMFC tilt
FPI detection
FPI discrimination
FPI tilt
mean activation
confidence
Response
No
Yes
Anticlockwise
Clockwise
Tilted
Vertical



Citation

(Denison et al. 2018)(Mazor, Friston, and Fleming 2020)

Reference

Denison, Rachel N., William T. Adler, Marisa Carrasco, and Wei Ji Ma. 2018. "Humans Incorporate Attention-Dependent Uncertainty into Perceptual Decisions and Confidence." *Proceedings of the National Academy of Sciences of the United States of America* 115 (43): 11090–5. https://doi.org/10.1073/pnas.1717720115.

Mazor, Matan, Karl J Friston, and Stephen M Fleming. 2020. "Distinct Neural Contributions to Metacognition for Detecting, but Not Discriminating Visual Stimuli." Edited by Thorsten Kahnt, Joshua I Gold, and Michael Graziano. *eLife* 9 (April): e53900. https://doi.org/10.7554/eLife.53900.