Koniocellular pathway contributions to saccadic and manual responses to threat faces

Poster F112

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Introduction

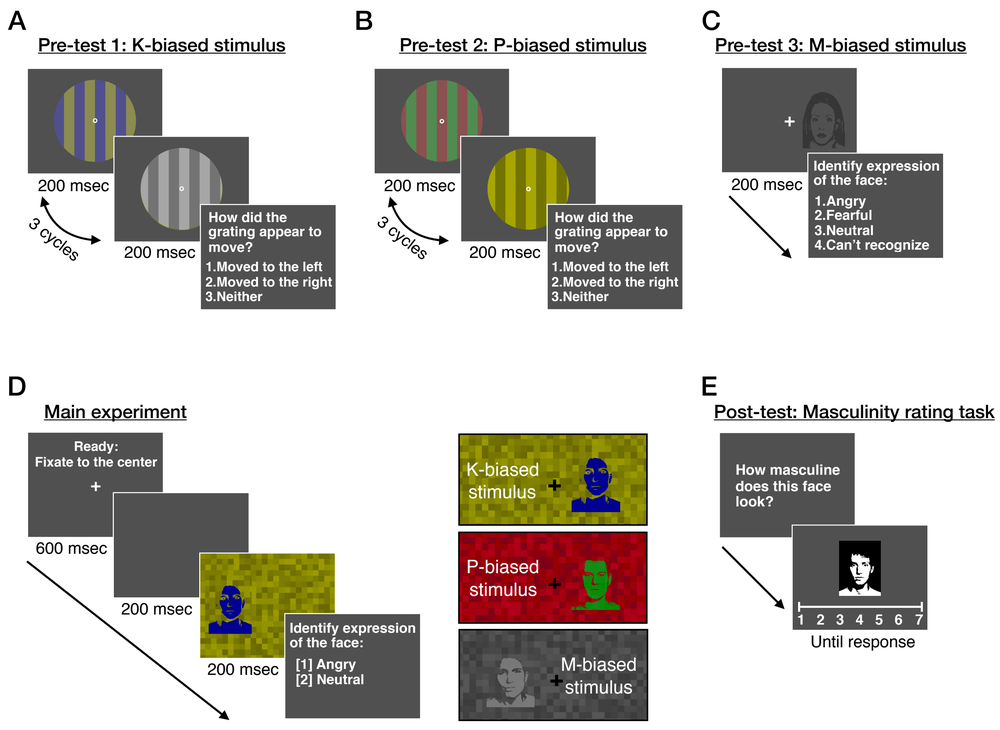
- Our visual system receives input via three major channels – the magnocellular (M), parvocellular(P), and koniocellular (K) visual pathways.
- M cells have lower spatial and high temporal resolution, and are sensitive low-contrast luminance differences
- P cells have high spatial and lower temporal resolution, and can resolve high-contrast luminance and contrast between long (red) and medium (green) wavelength cones
- K cells respond to short (blue) wavelength and luminance differences (Casagrande, 1994)
- The M and P pathways are biased towards clear and ambiguous threat cues, respectively (Kveraga 2014; Im et al., 2017; Cushing et al., 2019; Adams et al., 2019)
- The role of the K pathway in threat processing is unknown, but it has been hypothesized to be involved in preattentional detection and orienting to threat (Isbell, 2006).
- Simple K stimuli evoked activity and saccades in the superior colliculus, a key oculomotor and attentional orienting structure, in monkeys (Hall & Colby, 2016)

Research Questions

- Do threat stimuli (faces) presented to the K pathway evoke fast saccadic and manual responses?
- Are saccadic responses sensitive to threat cues in faces when they are presented to the K pathway?
- Do threat cues interact with visual pathway presentation?

Methods

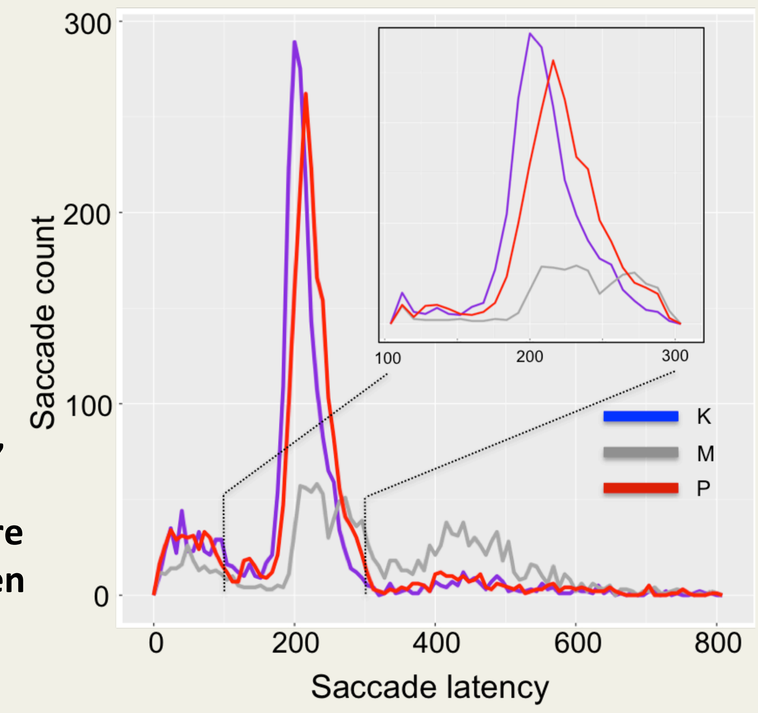
- 30 observers had their eye movements and manual responses recorded while they viewed face images
- Pretests established stimulus thresholds for each condition for the K, P, M conditions (panels A-B below)
- During the main experiment observers were presented with angry or neutral, male and female face images biased to the K, P, and M pathways. The images were presented on a dynamically changing equal-energy-gray background to minimize edge luminance artifacts (panel D).
- After the experiment, observers rated the faces, presented in black-and-white, to report their perceived masculinity (panel E). These ratings were used to evaluate how identity cues interacted with facial expression, and whether these interaction differed by visual pathway

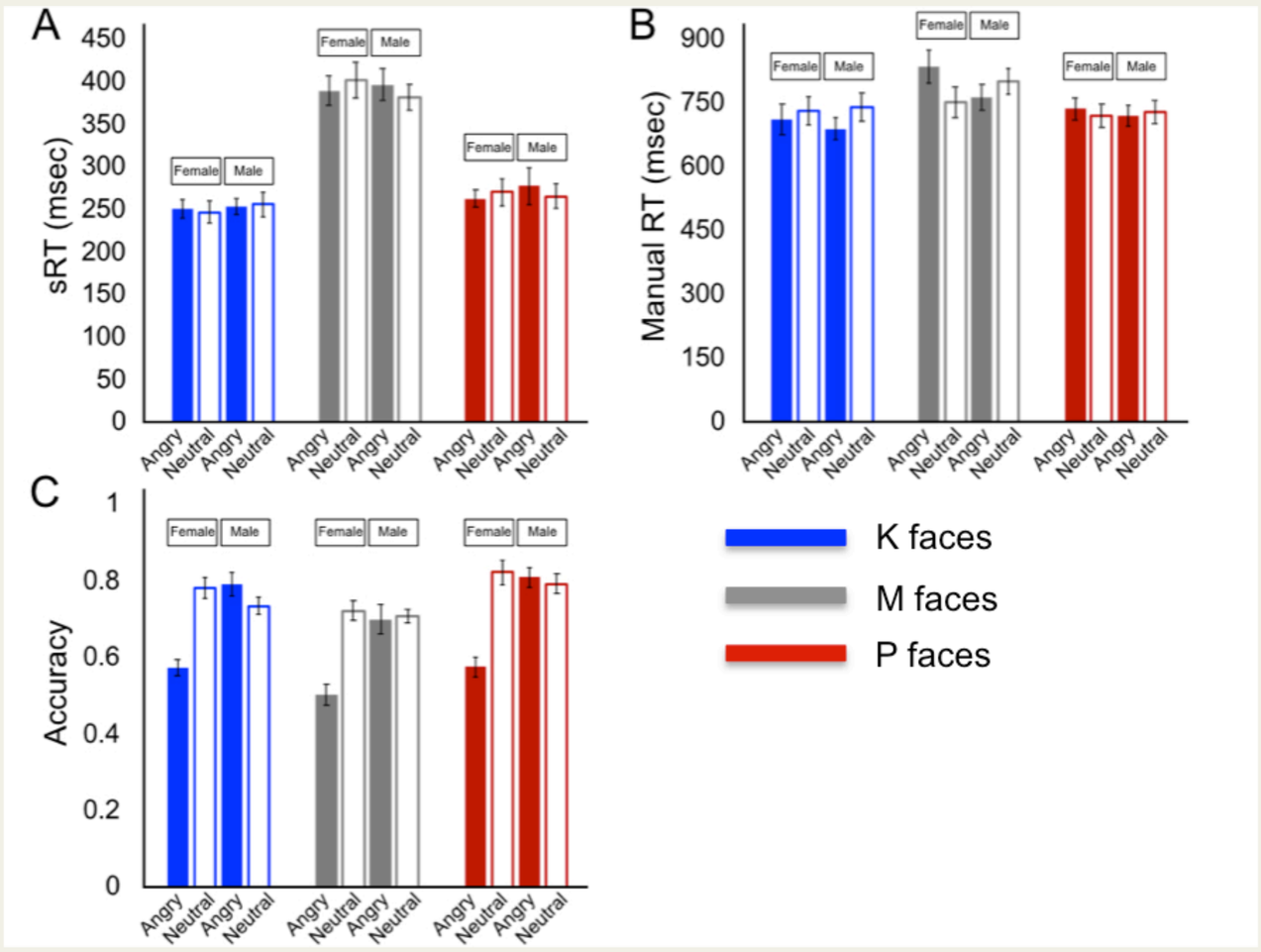


Results

Key findings:

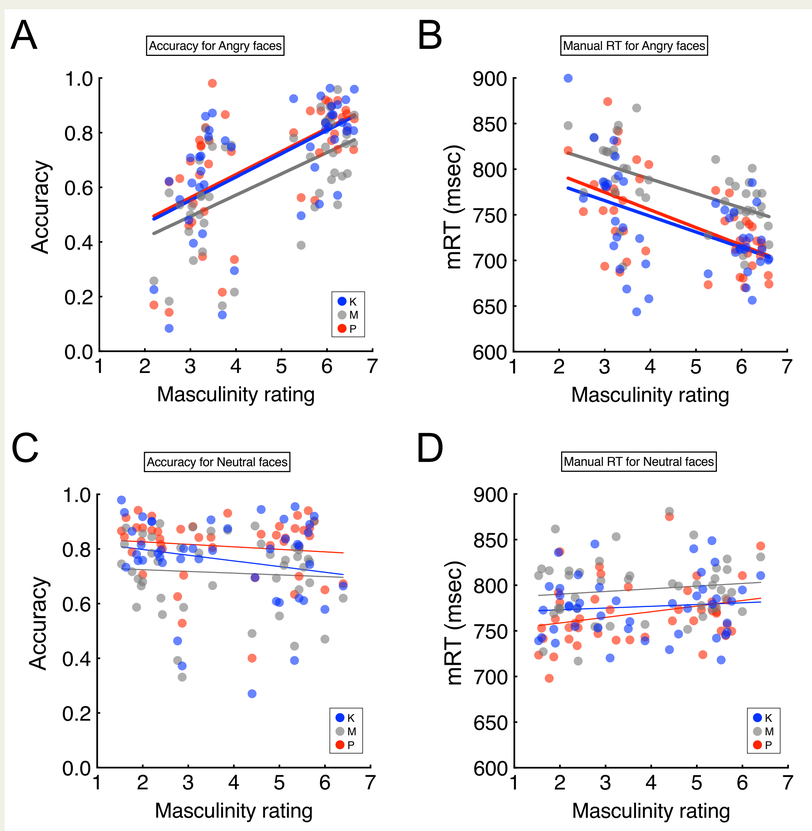
1. **Saccadic responses were fastest to K faces (top)**
2. **Manual responses were also faster to K faces**
3. **Saccadic responses are NOT sensitive to facial threat cues (figure below, panel A)**
4. **In manual responses, there were interactions between pathway and threat cues (figure below, panel B).**





Key findings, continued:

5. **Facial masculinity was associated with increased accuracy (A) and speed (B) in manual responses.**
6. **This was only true for angry faces (A & B), not neutral faces (C & D, bottom right figure).**



Summary

- **Subjects make fastest saccades and manual responses to K biased faces**
- **Saccadic responses are not significantly affected by facial threat cues, but manual responses are.**
- **Facial threat cues interact with visual pathway presentation, with manual responses to K pathway presentation sensitive only to facial expression**
- **Full details can be found in the paper (Kveraga, Im, Ward, Adams, 2020, *J. Vision*)**

Funding Sources

This research was supported by a NIMH Grant R01MH101194 to Kestas Kveraga and Reg Adams. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIMH.

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