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The influence of emotion and empathy on gaze patterns when exploring controlled static and ecological dynamic faces

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Introduction

The influence of facial emotions on gaze patterns when exploring faces is still debated.

Previous research reported that the relative proportion of fixations on the different face areas is (1,2) or is not (3,4) modulated by the expression processed. While most previous studies used static face images or simulated dynamic facial expressions (3), we propose to test how these findings generalize to more ecological spontaneous dynamic expressions of emotion.

Methods

We recorded the eye movements of 170 participants, while they categorized the valence of static and dynamic emotional faces. Static emotions were performed by actors from the classic Karolinska Directed Emotional Faces database (5), while dynamic emotions were genuine natural facial expressions from ordinary people, filmed in natural but standardized conditions (DynEmo database, (6)). Participants completed a questionnaire to evaluate their empathy profile. We used the Questionnaire of Cognitive and Affective Empathy (7) and clustered participants into 4 empathy profiles: Mature (N=55, 15 males), Affective (N=45, 25 males), Cognitive (N=44, 30 males), and Low (N=22, 15 males).

Effect of emotion in static faces

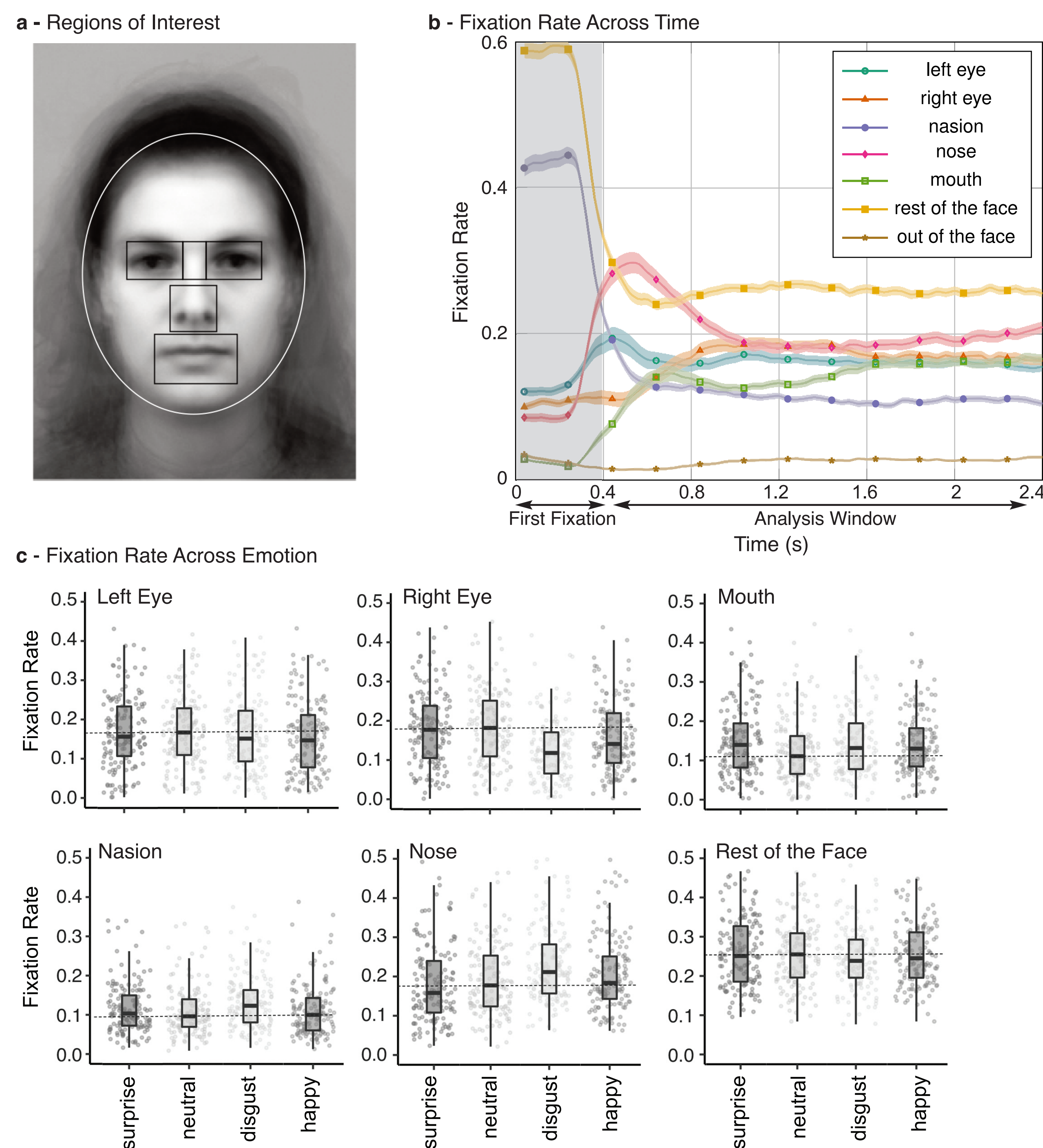


Figure 1 - Eye movements in static stimuli | a- Average static face with the Regions of Interest (ROIs). b- Fixation rate in each ROI across time, averaged across all static stimuli. Fixation rates have been averaged within 40 ms time windows (to simplify the plot, the curve markers do not correspond to the sampling rate). Error bars represent standard errors. b- For each emotion, averaged across time within the analysis window. The horizontal dashed lines represent the fixation rate for the Neutral condition.

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Effect of emotion in dynamic faces

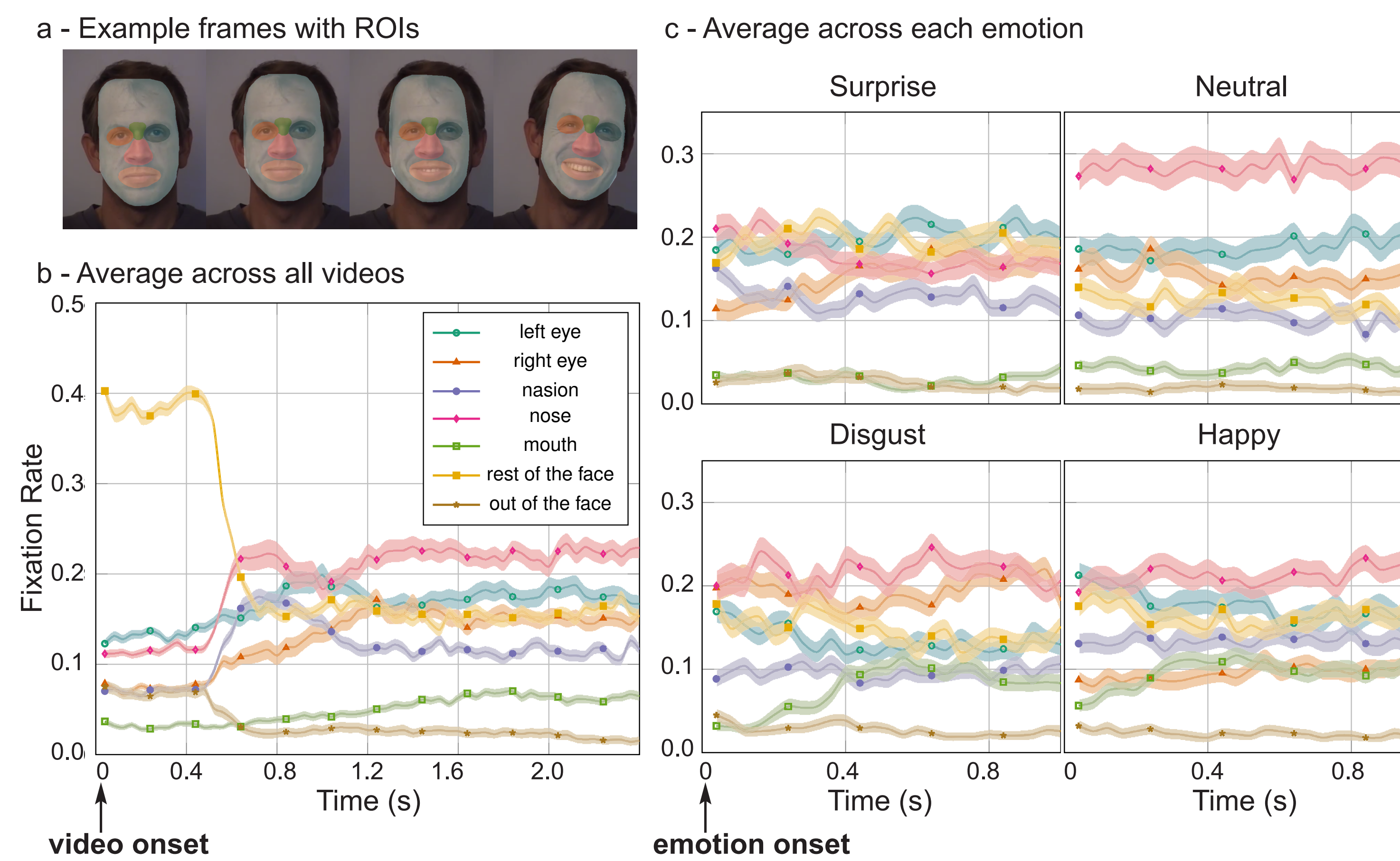


Figure 2 - Eye movements in static stimuli | a- Four illustrative frames of a 'happy' dynamic face with the Regions of Interest (ROIs). b- Fixation rate in each ROI across time, averaged across all dynamic stimuli. Dynamic stimuli have been aligned on the beginning of the video. c- Fixation rate in each ROI across time, averaged within each emotion. Dynamic stimuli have been aligned on the beginning of the emotion (neutral starts have been randomly sampled in the video). Fixation rates have been averaged within 40 ms time windows (to simplify the plot, the curve markers do not correspond to the sampling rate). Error bars represent standard errors.

Results

We found strong similarities between the gaze patterns in static (Fig 1) and dynamic (Fig 2) conditions.

We used Linear Mixed Models with fixation rate in ROI as response, gender, emotion, and empathy profile as fixed effects and participants id as random effect. We found a main effect of emotion on fixation rate on all facial regions of interest (left and right eye, nasion, nose, mouth, rest of the face).

In both static and dynamic stimuli, participants in the Mature empathy group gazed more at the left eye than participants in the Low empathy group. In static stimuli Hedge's $g = 0.50$, 95%CI=[0.43 0.56], in dynamic stimuli Hedge's $g = 0.34$, 95%CI=[0.22 0.46].

Effect of empathy in static faces

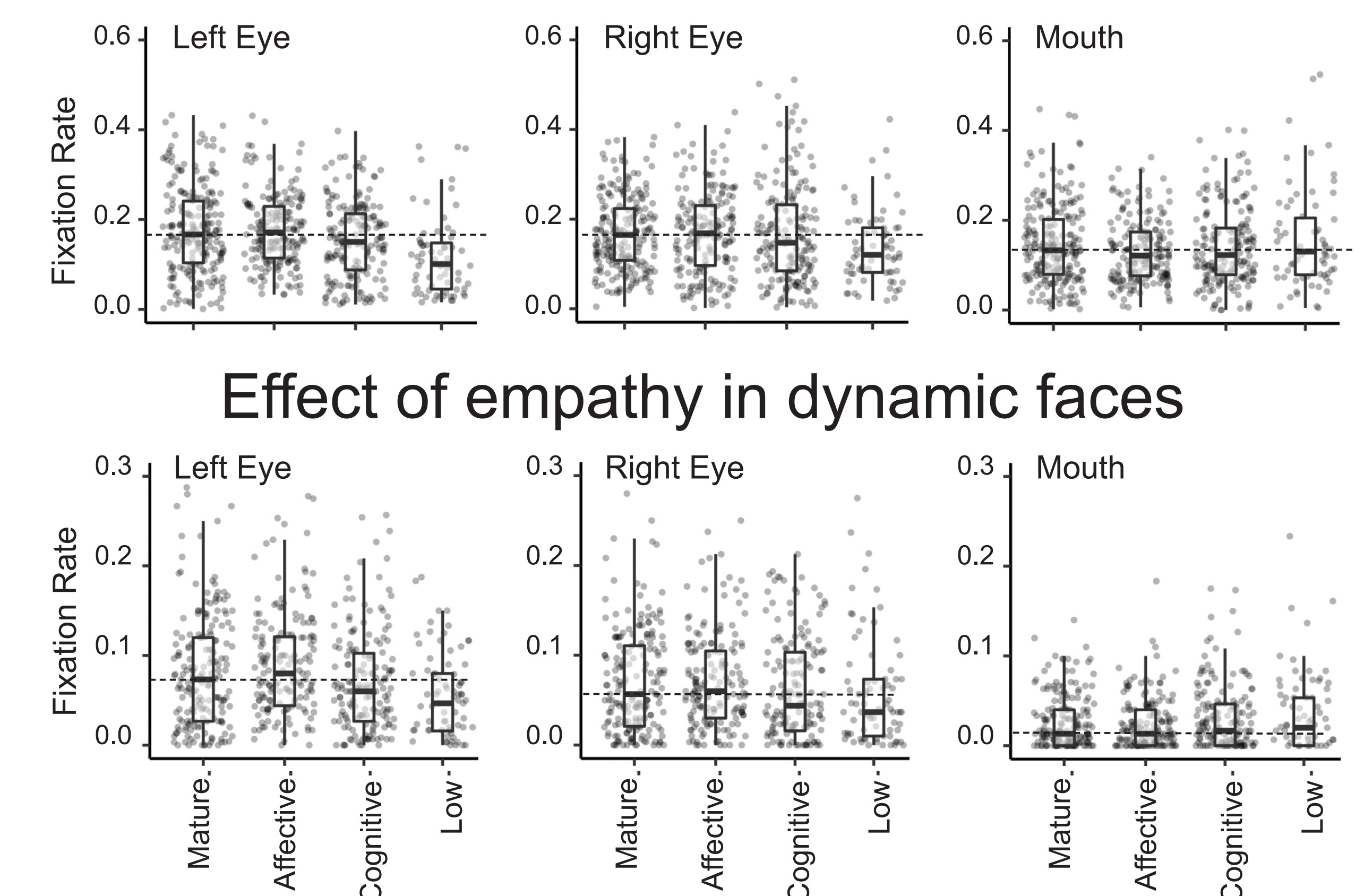


Figure 3 - Effect of empathy on eye movements | For each empathy profile, fixation rate per ROIs averaged across time within the analysis window. The horizontal dashed lines represent the fixation rate for the Mature profile.

Conclusions

Our results suggest that moderate differences in gaze behavior like the ones associated with the observer's empathy profile can generalize from a classic and well controlled static dataset, to a more ecological and dynamic dataset.

Furthermore, we did not find any effect of gender on fixation rates. This suggests that the previously reported stronger left eye bias in females [8,9] may well be the due to women being on average more empathetic than men.

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