Figures and figure supplements

Emotional faces guide the eyes in the absence of awareness

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Continuous flash suppression was used to suppress low-contrast emotional face stimuli from awareness: when a high-contrast colored flickering mask is presented to the dominant eye (using a stereoscope) the viewer will not be aware of the picture presented to the non-dominant eye for several seconds. (B) Face stimuli with either a neutral, angry, or fearful expression (10 identities, five male, five female; see Materials and methods) were presented to the non-dominant eye. Faces were placed in any of the 4 quadrants of the stimulus field, either upright or upside down (to control for low-level visual features). (C) After a mandatory fixation period of 200 ms, the face stimulus was gradually faded in for 500 ms and fully presented to the non-dominant eye for 1000 ms while the flickering mask was continuously presented to the dominant eye. The mask was displayed for a further 200 ms to prevent aftereffects of the face stimulus. At the end of each trial, participants indicated the location of the face stimulus, its emotional expression, and its visibility by a button press.

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Figure 2. Objective and subjective measures of awareness of face stimuli presented under continuous flash suppression (CFS; circles) or on top of the flickering mask (squares). Proportion correct values for the position (y-axis) and emotion (x-axis) tasks are shown for each subjective rating of visibility (note that not all visibility ratings were selected in every condition). The area of the symbols corresponds to the average number of trials with the respective visibility rating per participant. Grey lines indicate chance level. Error bars show standard errors of the mean (SEM).

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Figure 3. Time course of gaze distance from target. Mean distance of gaze position from the center of the face stimulus is plotted for all time points (±1 SEM shaded area) separately for upright (top panel) and upside down (bottom panel) presented face stimuli displaying fearful (blue), angry (red), or neutral (grey) emotions. Gaze data were included only for trials in which faces were fully suppressed from awareness (see Figure 1). After the fixation period, mean gaze distance increased in all conditions, as participants moved their eyes freely, and most areas of the display were located further away from the target than the initially-fixated center point. After ~400 ms of full stimulus display, mean gaze distance to upright fearful faces decreased, indicating an orienting towards fearful faces. In contrast, mean gaze distance to upright angry faces increased, indicating gaze aversion from an angry face. Grey bars represent significant clusters (p < 0.001) of adjacent time points (1 ms temporal resolution). At all time points within a cluster, a significant difference in distance between the two respective emotional expressions (colored textboxes) emerged (p < 0.05, corrected for multiple comparisons).

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Figure 3—figure supplement 1. Time course of gaze distance from target overlaid with time course of average gaze distance from possible target locations for trials in which no target was presented (green). This line closely resembles the timeline for trials in which a neutral upright or any upside-down face was presented.

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Figure 4. Spatial distribution of mean dwell time differences. Differences in dwell time between upright and upside down presented faces across the stimulus field, divided into four quadrants and three eccentricities. Data were aligned such that the target position is in the upper right quadrant (red square). Dwell time differences show an orienting towards the position of upright fearful faces (upright 62.82 ± 10.80 ms SEM, upside down 36.37 ± 6.45 ms; red dots: p < 0.05, corrected for multiple comparisons), and an aversion of gaze away from the position of upright angry faces (upright 51.57 ± 8.72 ms; upside down 33.62 ± 4.36 ms), both compared to upside-down presented faces of the same emotion.
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