Self-face recognition in attended and unattended conditions: an event-related brain potential study

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This study investigated whether neural mechanisms of self-face recognition are modulated by attention by recording event-related brain potentials associated with self-face recognition. Participants identified head orientations of self-faces and familiar or unfamiliar other faces presented briefly at the center of the visual field. Event-related brain potentials to self-faces and other faces were recorded when self-faces and familiar or unfamiliar other faces were either task relevant (attended) or irrelevant (unattended) in separate blocks of trials. We found that early face-specific event-related brain potential components such as the N170 and vertex positive potential did not differ between self-faces and other faces. Relative to familiar faces, however, self-faces induced an increased positivity over the frontocentral area at 220–700 ms. The increased positivity to self-faces relative to familiar faces between 500 and 700 ms was reduced in the attended relative to the unattended conditions, which arose from the fact that the amplitude to familiar faces during this time window was increased in the attended relative to the unattended conditions, whereas the event-related brain potential amplitude to self-faces was not influenced by attention. The event-related brain potential results suggest an automatic process of self-face recognition in human brains that occurs after face structure encoding and is independent of task relevance. *NeuroReport* 17:423–427 © 2006 Lippincott Williams & Wilkins.

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Introduction

Human beings are extremely good at recognition of human faces that provide affective and social information. For example, humans respond faster to self-faces than to other faces, and this self-face advantage has been demonstrated over that for familiar or unfamiliar faces and persists even when face stimuli are presented in unfamiliar views [1,2]. It has been suggested that recognition of self-faces is an indicator of high levels of self-awareness and involves similar brain structures to those involved in face recognition and self-recognition in monkeys [3–6].

While neuropsychological studies suggest that self-face recognition is dominantly lateralized in the right hemisphere [4,5,7], functional magnetic resonance imaging (fMRI) studies have found activations in the right prefrontal cortex to self-face recognition [10,11]. Right anterior cingulate cortex, left parietal, superior temporal, and inferior parietal cortex also show strong activation to the morphed version of self-faces than to the new faces or partners' faces [6,12]. Event-related brain potentials (ERPs) have also been used to address the temporal mechanisms of early self-face recognition. It has been shown that self-faces evoke a positivity peaking at 400 ms after stimulus onset (P3) relative to unfamiliar faces [13]. As self-faces appear less (30%) than unfamiliar faces (60%) in the study by Tanaka et al. [13], the enhanced P3 to self-faces might arise from the difference in stimulus probability. Passively viewing self-faces produces a positivity at 200–300 ms (P2) with smaller amplitude relative to passively viewing a famous face (the president's face) [14]. As familiarity of self-faces and famous faces may not be equally matched (e.g. participants saw themselves in mirrors more frequently than they saw the president in the media), the results of Caharel et al. [14] may reflect the processing of face familiarity rather than self-specific processing.

This study examined the temporal aspects of the neural mechanisms of self-face recognition with control for the possible flaws of the previous work. We recorded ERPs to self-faces and other faces showing equal probability. In addition, to match familiarity of self-faces and other faces, we took photos from the participants in this study and their classmates or roommates, whom the participants saw every day. We also investigated whether the neural mechanisms underlying self-face recognition are modified by attention by comparing the ERP differences between self-faces and other-face recognition in attend and unattend conditions. Previous work required participants to passively view self-faces [13,14] and this report on self-face effect

To examine the self-specific ERP effects, ERPs to self-faces were compared with those to familiar faces. A significant main effect of face owner at 220–[illegible]00 ms at FCz, Cz, CPz, Pz, FC3–FC4, C3–C4, CP3–CP4, and P3–P4 (F(1,14)=6.65–54.4[illegible], all P<0.05) was found, indicating that the long-latency positivity was of larger amplitudes to self-faces than to familiar faces. A significant main effect of attention at 220–[illegible]00 ms at FCz, Cz, CPz, Pz, FC3–FC4, C3–C4, CP3–CP4, and P3–P4 (F(1,14)=5.46–31.14, all P<0.05) was observed, suggesting that the long-latency positivity was of larger amplitudes in the attended than in the unattended conditions. A significant interaction was also noted between face owner and attention at 500–[illegible]00 ms at Cz, CPz, Pz, and CP3–CP4 (F(2,28)=4.2[illegible]–[illegible].62, all P<0.05): the self-face ERP effect during this time window was larger in the attended relative to the unattended condition. This interaction stemmed from the fact that the mean amplitude to familiar faces was increased in the attended relative to the unattended conditions at Cz, CPz, Pz, and CP3–CP4 (F(1,14)=[illegible].5–20.55, all P<0.005), whereas attention did not influence the amplitude to self-faces (P>0.05). The voltage topographies of the difference wave obtained by subtracting ERPs to familiar faces from those to self-faces showed that the enhanced positivity in association with self-face recognition had a focus over the frontocentral scalp [illegible]