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Is it about me? Time-course of self-relevance and valence effects on the perception of neutral faces with direct and averted gaze

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Highlights

- -Direct and averted gaze faces were primed with contexts varying in self-relevance and valence
- -Contextual self-relevance and valence impacted emotional responses to neutral faces
- -Self-relevance and valence interacted to impact face processing just 150ms post-face
- -Neural and emotional responses were altered depending on the faces' gaze direction

ABSTRACT

Most face processing research has investigated how we perceive faces presented by themselves, but we view faces everyday within a rich social context. Recent ERP research has demonstrated that context cues, including self-relevance and valence, impact electrocortical and emotional responses to neutral faces. However, the time-course of these effects is still unclear, and it is unknown whether these effects interact with the face gaze direction, a cue that inherently contains self-referential information and triggers emotional responses. We primed direct and averted gaze neutral faces (gaze manipulation) with contextual sentences that contained positive or negative opinions (valence manipulation) about the participants or someone else (self-relevance manipulation). In each trial, participants rated how positive or negative, and how affectively aroused, the face made them feel. Eye-tracking ensured sentence reading and face fixation while ERPs were recorded to face presentations. Faces put into self-relevant contexts were more arousing than those in other-relevant contexts, and elicited ERP differences from 150-750ms post-face, encompassing EPN and LPP components. Self-relevance interacted with valence at both the behavioural and ERP level starting 150ms post-face. Finally, faces put into positive, self-referential contexts elicited different N170 ERP amplitudes depending on gaze direction. Behaviourally, direct gaze elicited more positive valence ratings than averted gaze during positive, self-referential contexts. Thus, self-relevance and valence contextual cues impact visual perception of neutral faces and interact with gaze direction during the earliest stages of face processing. The results highlight the importance of studying face processing within contexts mimicking the complexities of real world interactions.

KEYWORDS:

face processing, self-relevance, valence, gaze, context, ERP, N170, EPN, LPP

1. INTRODUCTION

Faces are the most important and richest social stimuli we encounter daily, and the information that we extract from them is critical for our social interactions. A growing body of evidence supports the view that our perception of faces is strongly influenced by the context under which we view them, including cultural context, body language, visual scene, and simultaneously presented auditory or visual words (see Barrett, 2011; Wieser & Brosch 2012 for reviews).

The bulk of the research investigating context effects on face perception has primarily focused on how emotional context cues impact facial expressions of emotion. For example, emotional faces paired with emotion labels tend to be perceived as displaying the labelled emotion (Halberstadt and Niedenthal, 2001) and vocal cues have been similarly shown to bias perceived facial expressions (Massaro and Egan, 1996; Carroll and Russel, 1996). However, as noted by Wieser and Brosch (2012), context is likely more important in altering an observer's perception in the absence of overt emotional face information, i.e. when the facial expression is ambiguous (Trope 1986; Massaro & Egan, 1996) or when the expression is neutral, as neutral faces can mean very different things depending on the context (Carrera-Levillain & Fernandez-Dols 1994). Recent studies support the view that context can impact the processing of neutral faces. For instance, neutral faces are rated as more arousing after being systematically paired with positive or negative, relative to neutral, statements such as "He thinks you're smart/stupid" (Davis et al., 2009). It is important to note that this type of statement is relevant to the person who is processing it. This so called self-relevant information, which engages introspective processes including self-evaluation and reflection (Schmitz & Johnson, 2007), can act as a powerful context cue.

Indeed, self-relevance biases information processing and affects many domains of cognition, such that self-relevant stimuli are more attention grabbing (Humphreys & Sui, 2015), memorable (Conway, 2005; Turk, Cunningham & Macrae, 2008; Symons & Johnson, 1997) and receive enhanced emotional processing (Herbert, Pauli, & Herbert, 2010) compared to stimuli that are relevant to other people (hereafter other-relevant stimuli). It has been proposed that self-referential processing is adaptive during social situations because reflecting on the self allows an observer to draw upon their own experience to infer the mental states of others (Frith & Frith, 2001; Mitchell, Banaki & Macrae, 2005), and recent studies have shown that self-relevance interacts with other contextual cues to impact the processing of neutral faces (Schwarz et al., 2013; Weiser et al., 2014). In these studies, participants reported their emotional response (arousal and valence ratings) to neutral faces primed by contextual sentences varying in self-relevance (referring to the participant or someone else) and valence (positive or negative sentences). They found that faces preceded by negative statements were responded to even more negatively if the statement was self-relevant instead of other-relevant. Similarly, faces preceded by positive statements were responded to more positively if the statement was self-relevant. Both studies also found general main effects of valence and self-relevance. Faces preceded by negative sentences made participants feel more negative than those preceded by positive sentences, and faces preceded by self-relevant statements were rated as more arousing than those preceded by other-relevant statements. The present study follows up on these two seminal studies to further assess the impact of self-relevance and contextual valence on the processing of neutral faces, at the behavioural and neural levels, using Event related potentials (ERPs).

ERPs involved in early face perception and emotional processing can indeed be used to track the time-course of these context effects on face processing. The N170 is the earliest reliable face sensitive component, occurring over occipitotemporal sites between 130-200ms after face presentation (Bentin et al., 1996). It is sensitive to face configuration and is thought to reflect the initial process of integrating facial features into a holistic percept (Eimer, 2000; Sagiv & Bentin 2001). In contrast, the Early Posterior Negativity (EPN) and Late Positive Potential (LPP, or Late Positive Complex/LPC in some studies), are thought to reflect later, more elaborate cognitive processes and are sensitive to the emotional content of stimuli, including faces. The EPN is characterized by an enhanced negativity over occipitotemporal sites that starts around 150ms but is typically maximal around 180-350ms following the presentation of positive or negative stimuli relative to neutral stimuli, (e.g., Herbert et al. 2008; Kissler et al. 2009; Sato et al., 2001; Schupp et al. 2006; Neath & Itier, 2015; Neath-Tavares & Itier, 2016) or negative stimuli relative to positive stimuli (Rellecke, Palazova, Sommer, & Schacht, 2011; Rellecke, Sommer, & Schact, 2013; Schupp, Junghöfer, Weike, & Hamm, 2004a). This enhanced negativity has been found with a variety of stimuli including emotional faces (Neath & Itier, 2015; Neath-Tavares & Itier, 2016; Itier & Neath-Tavares, 2017; Schupp, Ohman, Jundhofer, Weike, Stockburger & Hamm, 2004b), verbal material (Herbert et al. 2008; Kissler et al. 2009; Schact & Sommer, 2009) and visual scenes (Junghöfer et al., 2001; Schupp et al., 2003, 2004a). Recent studies suggest that the emotion effects often reported on the N170 (Hinojosa et al., 2015; Calvo & Nummenmaa, 2016) might even be due to EPN activity superimposed onto the structural encoding of neutral faces (Rellecke et al., 2011; Rellecke, Sommer, & Schacht, 2012; Schacht & Sommer, 2009; Neath-Tavares & Itier, 2016). The LPP most often measured around 400-600ms (but sometimes lasting up to 1000-1200ms) over frontocental and centroparietal sites, is similarly enhanced for positive and negative stimuli relative to neutral stimuli (Dillon, Cooper, Grent, Woldorff, & LaBar, 2006; Cuthbert, Schupp, Bradley, Birbaumer, & Lang, 2000; Schact & Sommer, 2009; Schupp et al., 2003). The current view is that the EPN reflects enhanced processing of the emotional stimulus linked to attentional effects while the LPP reflects more elaborate cognitive appraisal of the emotional content and its meaning.

The recent studies focusing on context effects on neutral faces have reported that the N170, and thus the early extraction of face configuration, was unaffected by the valence and self-relevance of the context in which those faces were presented (Weiser et al., 2014; Weiser & Moscovitch, 2015; Klein et al., 2015). While the EPN modulation by valence is still unclear, with some reporting greater EPN for negative relative to neutral contexts (Weiser et al., 2014; Weiser & Moscovitch, 2015) whereas others found no such modulation (e.g. Klein et al., 2015), the EPN seems reliably enhanced by self-relevance (Weiser et al., 2014; Klein et al., 2015). Similarly, the LPP is sometimes modulated by contextual valence (Weiser & Moscovitch, 2015; Klein et al., 2015), and sometimes not (Weiser et al., 2014), but seems more reliably modulated by self-relevance (Weiser et al., 2014; Klein et al., 2015). Thus, although those faces have no explicit affective cues (neutral expressions), the valence and self-referential context they are placed into enhance several stages of cognitive processing.

However, despite self-relevance and valence interacting with each other at the behavioural level (Schwarz et al., 2013; Weiser et al., 2014), no early interaction was found at the ERP level, leading Weiser et al., (2014) to conclude that contextual valence and self-relevance are first processed independently in the brain (see Klein et al., 2015 for an interaction between 700-1000ms). It is possible that self-relevance and valence interacted within a time window that was not analyzed. In particular, a visual examination of the ERP waveforms in this study (Weiser et al., 2014, figure 6) suggests that self-relevance might actually impact face processing earlier than 220ms (the lower limit of their earliest time-window). Furthermore, possible N170 context effects might have been eliminated as a result of where participants were fixating. The N170 is indeed influenced by where participants look on the face (de Lissa et al., 2014; Nemrodov, Anderson, Preston & Itier, 2014; Neath & Itier, 2015; Neath-Tavares & Itier, 2016), and it is possible that context cues may influence where participants visually sample information. For example, Aviezer et al. (2008) demonstrated that even the first face fixation was affected by visual context cues presented at the same time as the face; faces placed on a body with angry body language received more initial fixations on the eyes than on the mouth, while faces placed on a body holding a soiled object received similar amounts of initial eye and mouth fixations. It is possible that situational context cues presented before the face impact face fixations in a similar manner, hereby modulating N170 responses.

The studies by Schwarz et al. (2013) and Wieser et al. (2014) were instrumental in beginning to understand when important contextual cues such as self-relevance and valence impact face processing. How these context cues might interact with specific facial cues, however, remains to be determined. In particular, these studies used faces with a direct gaze, an important social cue itself implicated in self-referential processing (see Conty et al. 2016 and Hamilton 2016 for relevant reviews). For example, Kampe et al. (2003) showed that making eye-contact actually activates similar brain regions as hearing one's own name. Similar to hearing someone say our name, we can infer, from someone's gaze direction, that the object of their attention is us (making their face self-relevant) or someone else (making their face other-relevant). Gaze has also been associated with emotional processing. Direct gaze is associated with increased activation in brain areas implicated in reward processing (e.g., Strick et al. 2008; Kampe et al. 2001), and faces with direct gaze are rated as more affectively arousing (Nichols & Champness 1971; Conty et al. 2010), attractive (Jones et al. 2006; Kampe et al. 2001) and as having happier facial expressions (Adams & Kleck 2005; Adams & Kleck 2003) than faces with averted gaze.

To summarize, the gaze literature suggests that direct gaze is a positive, self-referential cue, suggesting that it might interact with contextual self-relevance and valence to impact face processing. The present study adapted the contextual sentence paradigm (Schwarz et al., 2013; Wieser et al., 2014; Wieser et al., 2015) to include neutral faces with either direct or averted gaze. Following up on recent studies (Weiser et al. 2014; Klein et al., 2015), we used ERPs to track when gaze, valence and self-relevance cues interacted. We analyzed N170 peak amplitudes and also performed a series of mean amplitude analyses across six time intervals from 150ms to 750ms post-face onset, hereby spanning completely the EPN and LPP components. This allowed us to better track the time-course of contextual effects around and after the initial face processing stage indexed by the N170. We also used an eye-tracker to control fixation location in order to address possible concerns about fixation location on the N170. Finally, to maximize our chances of detecting an interaction between valence and self-relevance at the ERP level, we increased the number of trials per condition and chose sentences that maximized this interaction at the behavioural level, based on results from a separate online study (see section 2.1.2).

We expected to replicate most of the behavioural (Schwarz et al., 2013; Weiser et al. 2014; Weiser & Moscovitch, 2015) and ERP (Weiser et al. 2014; Weiser & Moscovitch, 2015; Klein et al., 2015) findings previously reported, but predicted that these effects would be larger for direct than averted gaze faces, due to the self-referential nature of direct gaze (Conty et al., 2016; Hamilton, 2016; Kampe et al., 2003) and its impact on arousal and emotion (Nichols & Champness 1971; Conty et al. 2010; Adams & Kleck 2005; Adams & Kleck 2003). In particular, we expected larger arousal ratings in response to self-relevant faces than other-relevant faces, but further predicted that this effect would be larger for direct than averted gaze faces. We also predicted that, compared to averted gaze, direct gaze would result in more negative valence ratings in negative contexts, but more positive valence ratings in positive contexts. As direct gaze is also associated with reward processing (Strick et al. 2008; Kampe et al. 2001), we hypothesized that the interaction between gaze and situational valence might be asymmetrical. That is, the increase in positive affect for direct gaze relative to averted gaze faces in positive trials might be larger than the increase in negative affect for direct gaze faces than averted gaze faces during negative trials.

At the ERP level, we expected to replicate the enhanced EPN (larger negativity) and enhanced right-lateralized LPP (larger positivity) for self-relevant faces compared to other-relevant faces (Weiser et al. 2014). If seeing direct gaze also puts one into a self-referential processing mode, direct gaze may work additively with contextual self-relevance, resulting in larger self-relevance effects for direct gaze compared to averted gaze conditions. Based on the observations discussed above, we also expected that these effects would start earlier than the EPN time-window used by Weiser et al., (2014), which would suggest that self-relevance affects earlier stages of cognitive processing than previously assumed. The possibility remained that, after controlling for fixation location, self-referential processing may even modulate the earliest processing stage of faces indexed by the N170, given this component's sensitivity to gaze direction (e.g., Watanabe et al., 2002; Itier et al. 2007b; Conty et al., 2007; Puce et al., 2000). Finally, we predicted that our study design would allow us to detect a valence and self-relevance ERP interaction, which would provide the first indication of when contextual self-relevance and valence interact in the brain.

2. METHODS

2.1 Online Sentence Validation Study

2.1.1 Participants

Ninety [90] University of Waterloo (UW) undergraduates participated in this study for course credit and 22 were rejected for not responding to more than 25 of the 156 questions. The final sample included 68 participants (36 female, *M* = 20.7 years, *SD* = 1.5), with 33 (18 female) randomly assigned to the male pronoun group and 35 to the female pronoun group (18 female) – see below. The study was approved by the UW Research Ethics Board.

2.1.2 Sentence Construction

Sentences were constructed to later prime the face stimuli in the EEG-Eye tracking study, providing the context under which faces would be viewed. All sentences were six words long, and varied in valence (positive and negative) and self-relevance (referring to the participant –self-relevant, or to someone else –other-relevant). When they referred to a male having an other-relevant opinion, the pronouns 'her' or "she" were always used mid-sentence so that it was clear that the individual was expressing an opinion of someone else, and not of himself (e.g., "He thinks she looks really refreshed."). The equivalent was done for sentences referring to a female having an other-relevant opinion (e.g., "She thinks he looks really refreshed."). Self-relevant sentences were created by exchanging the pronouns 'his/her' and 'she/he' for 'your' or 'you' (e.g., "She thinks *you* look really refreshed", "He thinks *your* eyes are pretty"). Valence was manipulated by exchanging the key descriptors in the sentence with positive or negative words describing a similar construct (e.g., "look really refreshed/sweaty", "are really boring/interesting").

Although this was not the goal of the current study, the intention was to create sentences which could later be used in an investigation of how individual differences in social anxiety impact the contextual modulation of face processing. Thus, the sentences were designed to target three categories of core fears heightened in those with high social anxiety, including one's social competency, physical appearance, and behavioural displays which signal to others that an individual is anxious (Moscovitch, 2009; Moscovitch et al., 2013). *Social competence* sentences had descriptors referencing an individual's personality traits or social skills (e.g., "really intelligent", "very antisocial"). *Physical attractiveness* sentences had descriptors referencing physical traits (e.g., "eyes are pretty", "smell bad"). *Signs of anxiety* sentences had descriptors referring to behaviours or visual cues of nervousness (e.g., "look really sweaty", "are panicking"). Sentences were adapted from key words described by Moscovitch (2009), and structured similarly as the sentences used by Weiser et al. (2014).

Thirteen descriptors were created for each of the three core categories, with self-relevant positive, self-relevant negative, other-relevant positive and other-relevant negative variations of each (Table 1; e.g., "He/she thinks you are socially adept.", "He/she thinks you are socially awkward.", "He/she thinks she/he is socially adept.", "He/she thinks she/he is socially awkward."). This resulted in 52 sentences for each core category, for a total of 156 sentences.

2.1.3 Study Design and data analysis

Participants were randomly assigned to one of two study versions. In version one, all 156 sentences began with male pronouns, referring to a male having opinions of the participant and others. In version two, all sentences began with female pronouns. This kept the study length under an hour, while ensuring that the gender of the individual expressing all the opinions would be consistent for each participant. Sentences were presented in random order.

Participants were asked to rate the valence of the emotion each sentence elicited by selecting a button on a 9-point Likert scale. A rating of 1 (far left button) meant very negative and a rating of 9 (far right button) meant very positive. Participants were also asked to rate how exciting or stressful the emotion elicited was on a similar scale, where a rating of 1 meant not at all exciting or stressful (very unarousing) and a rating of 9 meant very exciting or stressful (very arousing). On average, each participant rated 154.18 (*SD* =4.30) sentences.

Data from the two study versions were combined for analysis. For each descriptor, participants were shown four sentences – a self-relevant positive, self-relevant negative, other-relevant positive and other-relevant negative variation. First, the ratings of valence and arousal were averaged across participants for these four variations of each descriptor (Table 1). A valence by self-relevance "interaction" score was then calculated[1]. The eight descriptors with the largest interaction score in each category were chosen for the later EEG-eye tracking study (bolded in Table 1) and were analyzed statistically as described below. This was done to maximize the chances of finding a valence by self-relevance interaction at the ERP level.

For each participant, average *arousal ratings* obtained across the 28 selected descriptors (bolded in Table 1, regardless of category) were calculated for the self-relevant positive, self-relevant negative, other-relevant positive and other-relevant negative variations. These ratings were then entered into a repeated measures Analysis of Variance (ANOVA) with the within-subject factors of self-relevance (2; self, other) and sentence valence (2; positive, negative). Similarly, the average *valence ratings* were calculated for each participant and for the four conditions and were analysed using a 2 (self-relevance; self, other) by 2 (sentence valence; positive, negative) repeated measures ANOVA.

[1] Taken by subtracting the self-other positive difference from the self-other negative difference for valence ratings. The larger this score, the stronger the "interaction" between valence and self-relevance for that descriptor.

2.1.4 Results

***Arousal ratings* -** There was a significant main effect of sentence valence (Figure 1a), $F(1,67) = 16.564$, $MSE = 4.231$, $p < .001$, $\eta_p^2 = .198$, with positive sentences rated as eliciting higher arousal ($M = 5.53$, $SD = .19$) than negative sentences ($M = 4.51$, $SD = .23$). As expected, there was also a main effect of self-relevance, $F(1,67) = 23.127$, $MSE = 1.307$ $p < .001$, $\eta_p^2 = .257$, with higher ratings in response to the self-relevant sentences ($M = 5.35$, $SD = .18$) than to other-relevant sentences ($M = 4.69$, $SD = .19$). There was no interaction between self-relevance and sentence valence on arousal ratings ($p = .924$).

V*alence ratings* - A significant main effect of sentence valence (Figure 1b), $F(1,67) = 302.694$, $MSE = 3.089$, $p < .001$, $\eta_p^2 = .819$, confirmed that sentences with positive descriptors elicited more positive emotions ($M = 6.88$, $SD = .11$) than those with negative descriptors ($M = 3.17$, $SD = .12$). There was no main effect of self-relevance, $F(1,67) = .181$, $MSE = .142$, $p = .672$, $\eta_p^2 = .003$, though as intended by the preselection of sentences, there was a strong valence by self-relevance interaction, $F(1,67) = 20.822$, $MSE = 1.490$, $p < .001$, $\eta_p^2 = .237$. A paired t-test, $t(67) = 3.795$, $p < .001$, confirmed that positive sentences were rated as eliciting more positive emotions when they referred to the participant ($M = 7.21$, $SD = .92$) compared to someone else ($M = 6.55$, $SD = 1.34$). Similarly, negative sentences that were self-relevant elicited more negative emotions, $t(67) = -5.163$, $p < .001$; $M = 2.82$, $SD = .11$, than negative sentences that were other-relevant ($M = 3.52$, $SD = 1.21$). In summary, the effect of descriptor valence was amplified when the descriptors were also self-relevant.

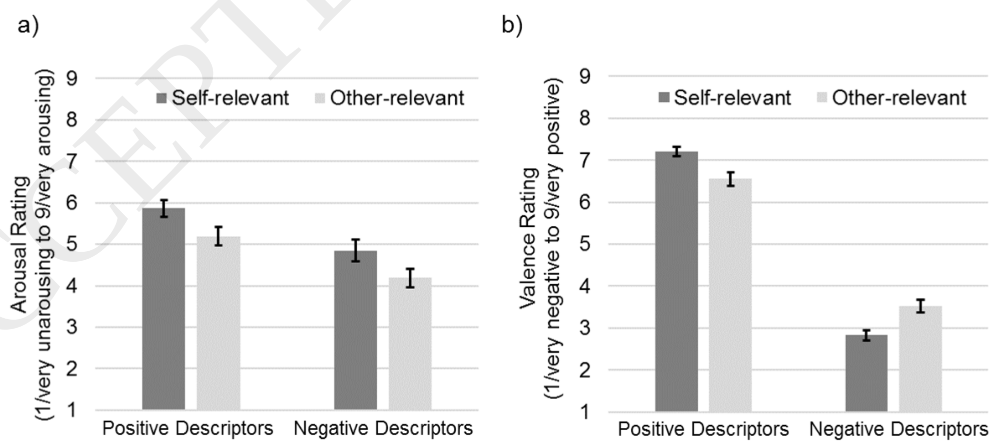


Figure 1. a) *Arousal* ratings obtained in the sentence validation study. **b)** *Valence* ratings obtained in the sentence validation study.

2.2 EEG-Eye tracking Study

2.2.1 Participants

Ninety [90] UW undergraduate students who had not participated in the online sentence validation study, took part in this EEG-Eye tracking study. Participants were between the age of 18-29, right-handed, and reported normal or corrected-to-normal vision, no history of psychiatric or neurological illness, no past loss of consciousness spanning more than 5 minutes, and no psychiatric or recreational drug use. All participants had lived in Canada or the United States for the past 5 years, were fluent in English and reported an ability to recognize individuals and facial expressions of at least 7 on Likert-type scales ranging from 0 (extremely poor) to 10 (extremely good). Participants gave written informed consent and received course credit and an additional CAN$5.00 upon completion. The study was approved by the UW Research Ethics Board.

A total of 34 participants were excluded, due to eye-tracking calibration issues (*N*=7), too high electrode impedances (*N*=4), lack of appropriate cap size (*N*=1), loss of data (*N*=4), illness during or before the study (*N*=3), too many eye movements (*N*=9) or other (*N*=6) artifacts. The final sample included 56 participants (27 female, *M* = 20.3 years, *SD* = 1.7).

2.2.2 Face Stimuli

Images from four male and four female identities were selected from the Radboud database (Langer et al., 2010; identities 09, 10, 19, 30, 31, 32, 33, 61). Images from an additional male and female were used in the practice block (identities 26 and 71). For each identity, direct, averted left and averted right gaze images were selected, and cropped to display the head, neck, and upper shoulders with the GNU Image Manipulation Program (GIMP 2.8). All images had a neutral expression. To control for any asymmetry between the left and right sides of the stimuli, each image was flipped about the y-axis to create another image (e.g., the flipped averted left gaze image became a second averted right image). This resulted in two left, two right, and two direct gaze images for each identity (Figure 2).

Each image was presented on a white background in the centre of the monitor, subtending 10.64° horizontally and 15.08° vertically. In between trials, a fixation cross appeared 13.59° down on the horizontal midline, chosen so that participants' eyes would be fixated between the nasion and the nose when the face stimuli appeared. Colour images were used to increase ecological validity. The SHINE package (Willenbockel, Sadr, Fiset, Horne, Gosselin, & Tanaka, 2010) was used to minimize the influence of low-level image features on face-related ERPs. All pictures were converted to greyscale and equalized on mean pixel intensity (*M* = 0.61, *SD* = 0.0005) and root mean square (RMS) contrast (*M* = 0.45, *SD* = 0.0006). Custom matlab scripts were then used to add the colour information back into each image.

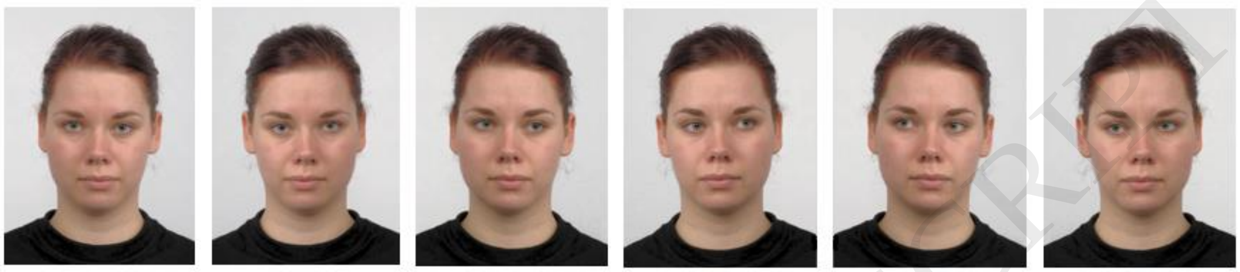


Figure 2. Sample stimuli for the direct, averted right and averted left gaze conditions and their mirror-reversed versions.

2.2.3 Experimental Design

After providing informed consent, participants completed a demographics questionnaire and were fitted with an EEG cap. The computer task took place in a dimly-lit, sound-attenuated Faraday cage. Screen resolution was set to 1600x1200, with an 85Hz refresh rate. An Eyelink 1000 eye-tracker tracked eye-movements at a sampling rate of 1000Hz. The Miles test (Miles, 1930) was used to determine each participant's dominant eye for tracking. A chinrest minimized head movement and maintained a constant distance of 65cm from the screen.

Participants were informed that they would be reading sentences expressing an individual's opinion of the participant or of someone else (Figure 3). They were asked to press the spacebar after reading, and then to fixate on the following fixation cross, which would trigger a picture of the person who had expressed the opinion. They were instructed to not move their eyes during face presentation and until a prompt appeared, asking them to use the number keys from 1-9 to rate how positive or negative the face made them feel (1 corresponding to 'very negative' and 9 to 'very positive'). After responding, a second prompt would appear asking them to rate how affectively aroused the face made them feel using the same number keys from 1-9 (1 corresponding to 'very unaroused' and 9 to 'very aroused'). Affective arousal was defined as a feeling of excitement or stress and explained further until the participant correctly understood the meaning. Participants completed a minimum of four practice trials to ensure they were comfortable with the task.

Each trial began with the sentence that remained on screen until participants pressed the space bar, after which the trial advanced to the fixation cross screen. Participants had to maintain fixation on the cross (which appeared between the nasion and the nose) for 300ms within a region of interest of 0.98º x 0.98º to trigger the face stimulus onset. If these requirements were not met within 10 seconds, a drift correct occurred, cancelling that trial. Eye-tracking re-calibrations were performed when necessary. The face remained on screen for 500ms, followed immediately by a 300ms blank screen. The valence rating screen then appeared and remained until the participant responded, followed by the arousal rating screen, which also remained until the response.

Contextual sentences varying in self-relevance (referring either to the participant or to someone else) and valence (positive or negative) were chosen from the online sentence validation study (see section 2.1.3; bolded descriptors in Table 1). Face stimuli had either direct or averted gaze and there were an equal number of direct and averted gaze trials. Half of the averted gaze trials consisted of faces looking to the left and half to the right (grouped together for analysis). Thus, there were a total of eight within-subject conditions (2 self-relevance x 2 valence x 2 gaze directions).

The study was programmed using SR Research's Experiment Builder 1.10.1385 and consisted of 8 blocks of 96 trials (12 trials x 8 conditions) presented randomly, for a total of 96 trials per condition. Throughout the experiment, the same identities were always associated with either positive or negative statements, with each one referring an equal number of times to the participant as to someone else. Half of the identities (4) appeared in each block, with one male and one female assigned to the positive valence condition, and the other male and female assigned to the negative condition. Six different versions of the experiment were created to ensure that the identities paired with positive or negative statements were counterbalanced across participants.

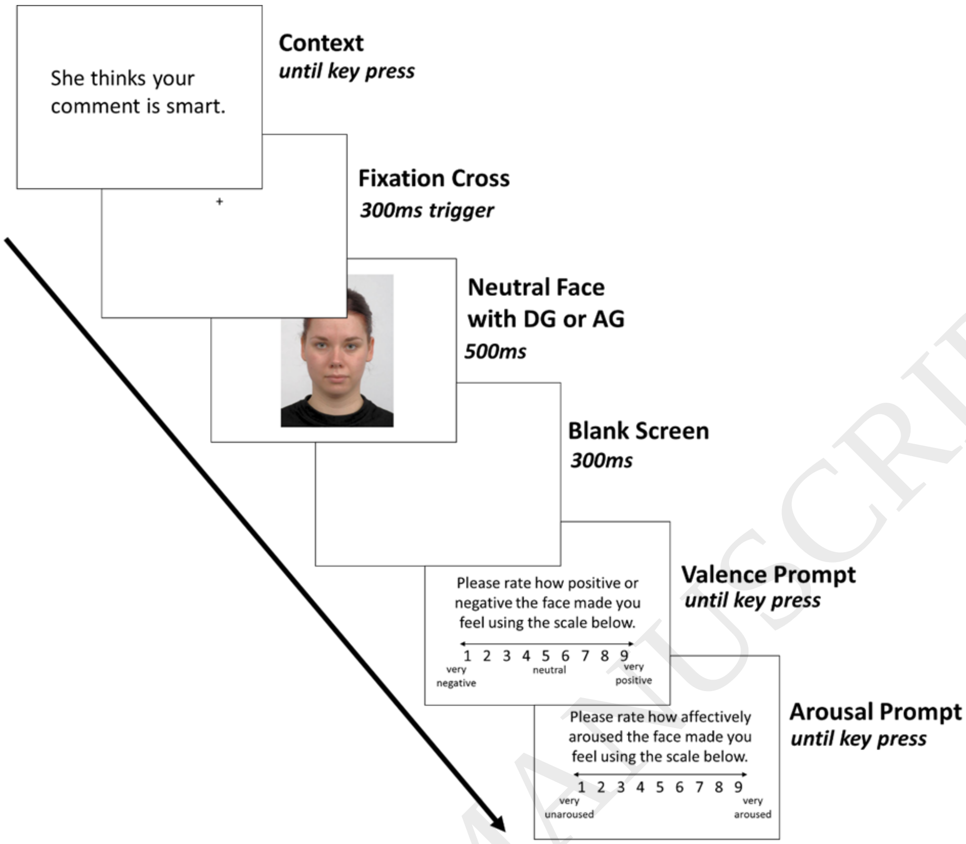


Figure 3. Sample progression for a positive self-relevant trial. ERPs were time-locked to the onset of the face stimulus.

2.2.4 Electroencephalography recording and pre-processing

An Active-two Biosemi system with 72 channels was used for EEG recordings. Caps had 66 channels under the extended 10/20 system including two posterior electrodes to help pick up activity elicited by face-presentation (PO9 and PO10). One electrode was also placed on the outer canthus of each eye, one over each infra-orbital ridge, and one over each mastoid. Data were collected at a 512Hz sampling rate, with a Common Mode Sense (CMS) active-electrode and a Driven Right Leg (DRL) passive-electrode as the ground[2]. Electrode "impedances" were kept within a ±20µV[3] range, whenever possible.

Eye-tracking interest area reports were created for the sentence screen, with a rectangular region of interest (ROI) that covered the text (subtending 22.35° horizontally and 2.24° vertically,

[2] The Biosemi Active-Two system does not use an actual recording reference site like other classic systems.
[3] The ActiveTwo system does not use actual impedances in KΩ as other systems like Neuroscan.

positioned 18.18 ^{o} down and centered horizontally). Trials where participants made less than 2 fixations in this region (i.e. the sentence was not read) were excluded, resulting in an average of 13.02 (*SD* = 34.29) trials removed per participant. Interest area reports were also used to ensure that participants were fixated always within the same facial area during the N170 time window following face presentation, as this component has been shown to display sensitivity to fixation location on the face (de Lissa et al., 2014; Nemrodov, Anderson, Preston & Itier, 2014; Neath & Itier, 2015; Neath-Tavares & Itier, 2016). Trials in which participants fixated outside of a circular 1.57^{o} ROI (a small region situated between the nasion and the nose, which did not include the eyes or eyebrows) within the first 250ms after face onset, were removed. This resulted in an average of 19.44 (*SD*=11.07) trials per condition removed per participant at this stage.

The EEGLab (Derlome & Makeig, 2004) and ERPLab (http://erpinfo.org/erplab) toolboxes in MATLAB were used to process the data. An average-reference was computed offline and trials were epoched from -100ms pre- to 800ms post-face presentation using the 100ms pre-stimulus as baseline. Data were band-pass filtered between 0.01Hz and 30Hz.

Any channels excluding frontal and ocular electrodes (Fp1, Fpz, Fp2, AF3, AFz, AF4, AF8, AF7, IO1, IO2, LO1, and LO2) that were consistently noisy were first removed (to be interpolated later on). Trials with artifacts exceeding ±70µV on all remaining (non-frontal and non-ocular) channels were then excluded. Independent Component Analysis (ICA) decomposition was then run on all channels using the ICA “runica” function in EEGLab (Delorme & Makeig, 2004). Components reflecting eye-blinks and lateral eye movements were removed for each participant. Any channels that had previously been removed were then added back in and interpolated using EEGlab’s spherical splines interpolation tool, which replaces the electrode’s signal with an averaged signal from neighbouring electrodes. Finally, ERPs were created for each participant and condition and were visually inspected. A second manual cleaning stage was performed if the waveforms were deemed too noisy. At the end of the preprocessing stage, participants’ ERP waveforms included an average of 52.38 (*SD* =15.85) trials per condition. A repeated measures Analyses of Variance (ANOVA) run on the final number of trials per condition ensured that no conditions had a disproportionate number of trials compared to the others, $F(5.00,275.10) = .914$, $MSE = 32.027$, $p = .496$, $\eta_p^2 = .016$.

2.2.5 Data Analysis

For each participant, self-reported valence and arousal ratings were averaged to create a mean valence and arousal rating per condition, after excluding trials where participants did not read the sentences. The right and left electrodes where the N170 peak was maximal (Table 2) were selected for each participant and the peak amplitude and latency were extracted at these electrodes between 115 and 225ms (see also Neath & Itier, 2015; Neath-Tavares & Itier, 2016; Itier & Neath-Tavares, 2017; Rousselet & Pernet, 2011).

A series of mean amplitude analyses were also performed across the following seven 100ms time windows: 50-150ms, 150-250ms, 250-350ms, 350-450ms, 450-550ms, 550-650ms, and 650-750ms. Based on visual inspection, the signal was averaged across several electrodes to create left (P9, TP9, PO9) and right (P10, TP10, PO10) occipitotemporal clusters, and left (C1, C3, CP1 and FC1), midline (CPz, Cz and FCz) and right (C2, C4, CP2 and FC2) frontocentral and centroparietal clusters. SPSS Statistics 22 was used for all statistical analyses. Behavioural responses, N170 peak latency, N170 peak amplitude and the mean amplitude data were separately analyzed using repeated measures Analyses of Variance (ANOVAs). Significant hemisphere and electrode cluster interactions were broken down with separate ANOVAs over each hemisphere or cluster. When Mauchly's Test of sphericity was significant, the Greenhouse-Geisser corrections to the degrees of freedom were reported.

3. RESULTS

3.1 Behavioural Valence Ratings

A repeated measures ANOVA with factors of valence (2; positive, negative), self-relevance (2; self, other), and gaze direction (2; direct, averted) was performed on participants' average valence ratings (how positive or negative the faces made them feel).

As seen in Figure 4, faces viewed within positive contexts made participants feel more positive than those in negative contexts (main effect of valence), $F(1,55) = 91.377$, $MSE=6.339$, $p<.001$, $\eta_p^2=.624$. There was also a main effect of self-relevance, $F(1,55) = 5.037$, $MSE=.105$, $p=.029$, $\eta_p^2=.084$, which was strongly modulated by an interaction with valence (self-relevance x valence, $F(1,55) = 44.830$, MSE=.309, $p<.001$, $\eta_p^2=.449$). As seen in the sentence validation study, within positive contexts (Figure 4a), self-relevant faces elicited slightly more positive responses than other-relevant faces, $F(1,55) =21.795$, $MSE=.206$, $p<.001$, $\eta_p^2=.284$. Similarly, within negative contexts (Figure 4b), self-relevant faces elicited more negative responses than other-relevant faces, $F(1,55) =47.561$, $MSE=.208$, $p<.001$, $\eta_p^2=.464$.

A main effect of gaze direction was also found, $F(1,55) = 18.079$, $MSE=.068$, $p <.001$, $\eta_p^2=.247$, qualified by two-way self-relevance by gaze, $F(1,55) = 6.295$, $MSE=.045$, $p =.015$, $\eta_p^2=.103$, and valence by gaze, $F(1,55) = 20.833$, $MSE=.050$, $p <.001$, $\eta_p^2=.275$ interactions, and a three-way valence by self-relevance by gaze direction interaction, $F(1,55) = 10.936$, $MSE=.062$, $p =.002$, $\eta_p^2=.166$. The three-way interaction was driven by an effect of gaze seen only in the self-relevant positive trials (Figure 4a) as indicated by a self-relevance by gaze interaction seen for positive, F (1,55) = 11.905, $MSE=.077$, $p =.001$, $\eta_p^2=.178$, but not negative, F (1,55) = 1.429, $MSE=.030$, $p =.237$, $\eta_p^2=.025$, trials. Bonferroni-corrected paired comparisons for positive self-relevant trials confirmed that faces with direct gaze elicited more positive ratings than faces with averted gaze, $t(55) = 5.609$, $p < .001$, $SE = .059$, while no gaze effect was seen for positive other-relevant trials, $t(55) = 1.749$, $p = .086$, $SE = .042$.

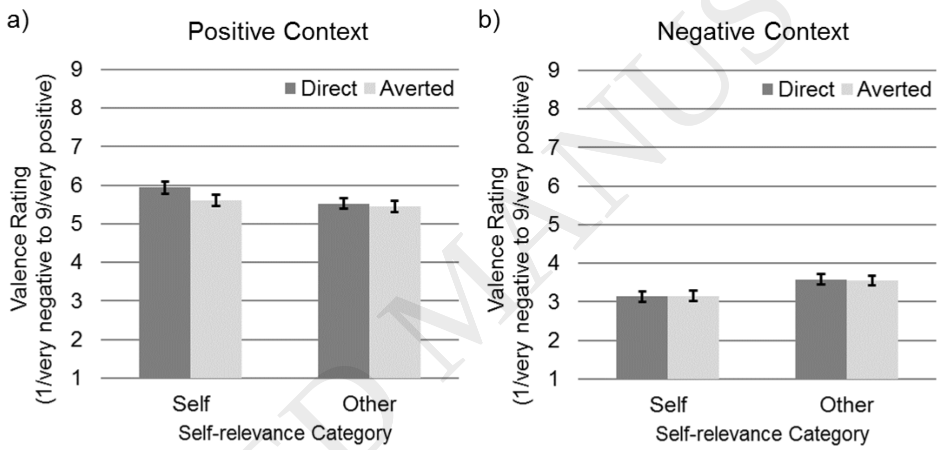


Figure 4. Valence ratings (with standard errors to the means) for **a)** positive and **b)** negative context trials. More positive ratings were obtained in the positive than in the negative trials. More positive ratings were also obtained for Direct than Averted gaze but only in self-relevant positive trials.

3.2 Behavioural Arousal Ratings

An ANOVA with the factors of valence (2: positive, negative), self-relevance (2; self, other), and gaze direction (2; direct, averted) was performed on participants' ratings of how affectively aroused the faces made them feel.

As predicted and seen in the validation study, there was a main effect of self-relevance, $F(1,55) = 50.320$, $MSE=1.059$, $p <.001$, $\eta_p^2=.478$, with larger self-reported arousal in response to faces viewed under self-relevant contexts than under other-relevant contexts (Figure 5a). Participants also reported feeling more affectively aroused during direct gaze than during averted gaze trials (main effect of gaze direction), $F(1,55) = 22.971$, $MSE=.159$, $p <.001$, $\eta_p^2=.295$. While the effect of gaze direction was significant for both self-relevant, $F(1,55) = 20.919$, $MSE=.156$, $p <.001$, $\eta_p^2=.276$, and other-relevant, $F(1,55) = 11.620$, $MSE=.069$, $p =.001$, $\eta_p^2=.174$, trials, a self-relevance by gaze direction interaction, $F(1,55) = 6.319$, $MSE=.066$, $p =.015$, $\eta_p^2=.103$, indicated that the gaze direction effect was stronger for self-relevant trials than for other-relevant trials (Figure 5a). Similarly, while the gaze effect was present for both positive, $F(1,55) = 27.763$, $MSE=.107$, $p <.001$, $\eta_p^2=.335$, and negative, $F(1,55) = 8.737$, $MSE=.110$, $p =.005$, $\eta_p^2=.137$, trials, a valence by gaze direction interaction, $F(1,55) = 4.754$, $MSE=.058$, $p =.034$, $\eta_p^2=.080$, indicated that the gaze effect was slightly larger for positive trials (Figure 5b). No main effect of valence was seen.

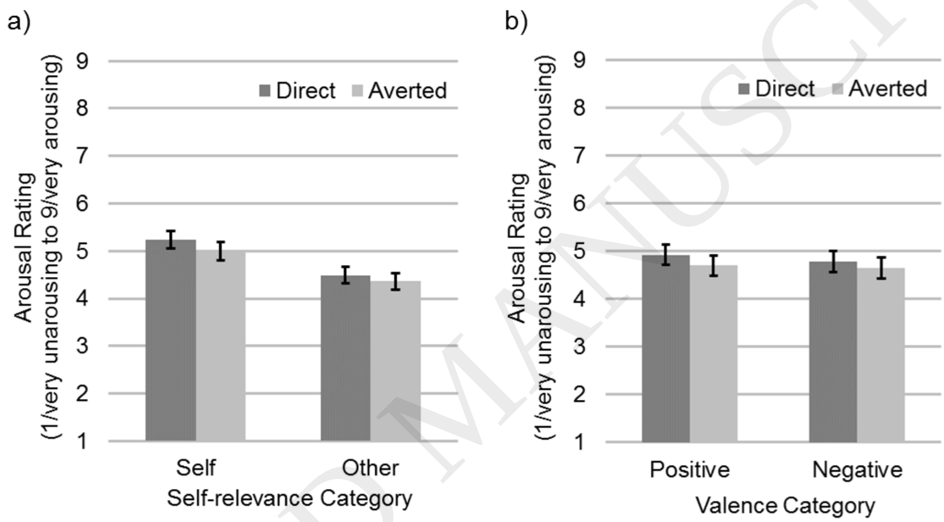


Figure 5. Arousal ratings (with standard errors to the mean). **a)** Self-relevance by gaze direction interaction; participants felt more aroused by faces presented in the self-relevance context compared to the other-relevant context, and the effect of gaze was largest in the self-relevant context. **b)** Valence by gaze direction interaction; note how direct gaze made participants feel slightly more aroused than averted gaze, especially in the positive context.

3.3 N170 Peak Amplitude Analysis

As there were no significant effects on N170 latency, we report only the N170 amplitude analyses. A hemisphere (2; left, right) by valence (2; positive, negative) by self-relevance (2; self, other) by gaze direction (2; direct, averted) repeated measures ANOVA was performed on the N170 amplitude data.

Overall, amplitudes were more negative over the right than the left hemisphere (Figure 6; main effect of hemisphere), $F(1, 55) = 4.290$, $MSE = 44.238$, $p =.043$, $\eta_p^2 =.072$. The main effect of self-relevance was only trending, $F(1, 55)$ =3.510, MSE=2.233, p = .066, η_p^2=.060, as was the self-relevance by hemisphere interaction, $F(1, 55)$ =3.914, MSE=.966, p = .053, η_p^2=.066.

There was a significant three-way hemisphere by valence by gaze direction interaction in the omnibus ANOVA, $F(1, 55)$ =7.585, MSE=1.238, p = .008, η_p^2=.121. Separate ANOVAs over the right (Figure 6, top) and left (Figure 6, bottom) hemispheres indicated that the valence by gaze direction interaction was significant in the right hemisphere, $F(1, 55)$ =7.350, MSE=1.335, p = .009, η_p^2=.118), but not in the left, $F(1, 55)$ =.776, MSE=1.860, p = .382, η_p^2=.014. As seen in Figure 6 (top), in the right hemisphere, the N170 was slightly larger for averted than direct gaze faces for the positive trials (effect of gaze for positive trials), $F(1, 55)$ =5.772, MSE=1.144, p =.020, η_p^2=.095, while no significant gaze effect was seen for negative trials, $F(1, 55)$ =1.498, MSE=2.309, p = .226, η_p^2=.027.

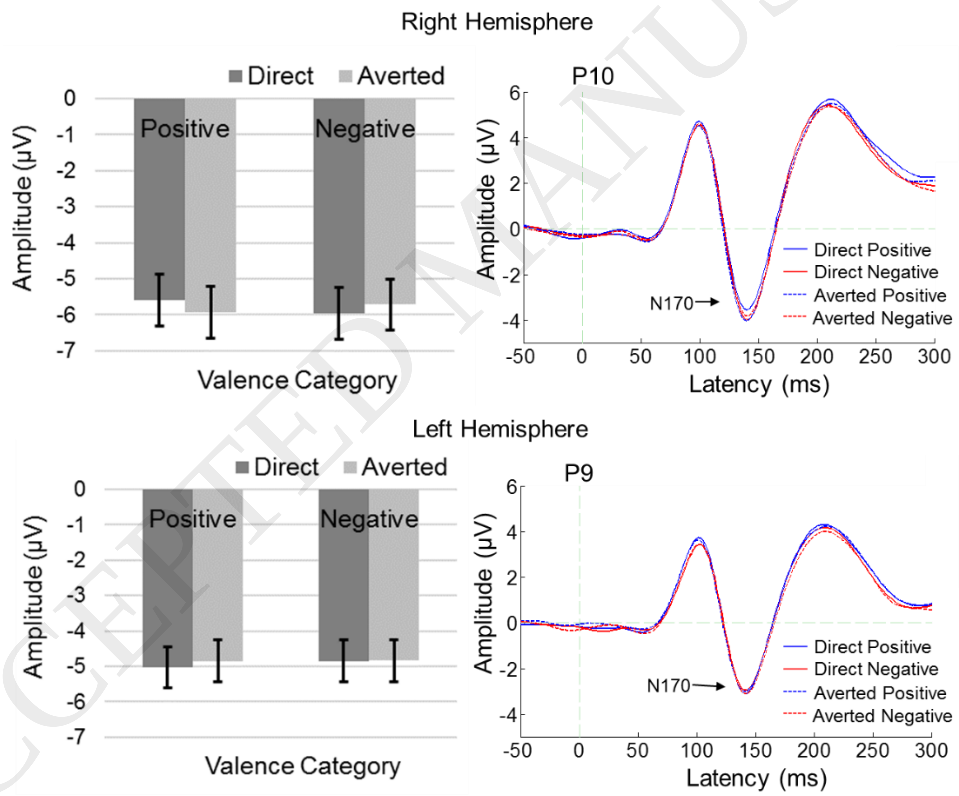


Figure 6. N170 amplitudes over the right (top panels) and left (bottom panels) hemispheres, averaged across each participant's peak electrode. Left panels display the mean N170 amplitude for direct and averted gaze faces as a function of contextual valence. Right panels display the N170 over a representative electrode (P9 and P10) for these conditions.

Finally, there was a significant three-way valence by self-relevance by gaze direction interaction in the omnibus ANOVA, $F(1, 55) = 16.766$, $MSE = 1.512$, $p < .001$, $\eta_p^2 = .234$. Separate ANOVAs for positive (Figure 7, top) and negative (Figure 7, bottom) context trials indicated a significant interaction between self-relevance and gaze direction for positive trials, $F(1, 55) = 12.189$, $MSE = 1.592$, $p < .001$, $\eta_p^2 = .181$, but not negative trials, $F(1, 55) = 3.575$, $MSE = 2.062$, $p = .064$, $\eta_p^2 = .061$. As shown in Figure 7 (top), there was a main effect of gaze direction for positive self-relevant trials, $F(1, 55) = 8.476$, $MSE = 1.483$, $p < .005$, $\eta_p^2 = .134$, with a larger N170 amplitude elicited by faces with averted than with direct gaze. In contrast, there was no significant effect of gaze direction for positive other-relevant trials, $F(1, 55) = 3.322$, $MSE = 2.170$, $p = .074$, $\eta_p^2 = .057$, despite a trend in the opposite direction.

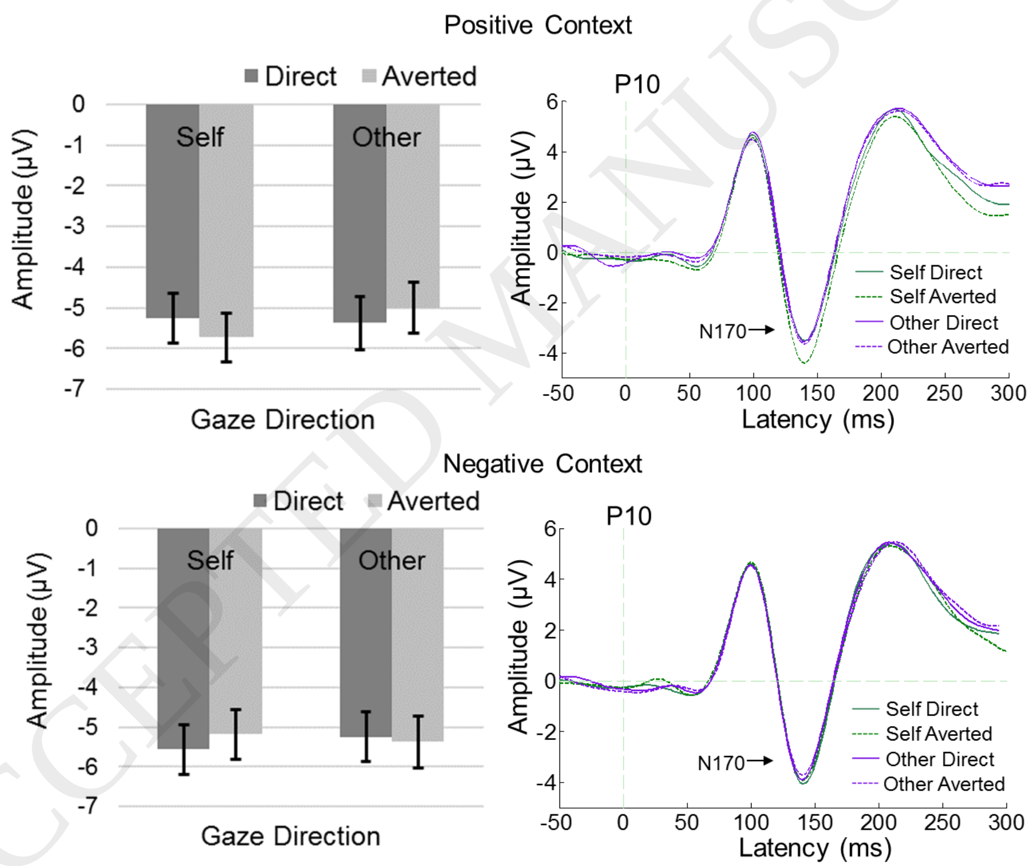


Figure 7. N170 amplitudes elicited by faces primed with positive (top panels) and negative (bottom panels) contexts. Left panels display the mean N170 amplitude for direct and averted gaze faces as a function of contextual self-relevance (self versus other), averaged from the peak electrode of each participant. Right panels display the N170 for these conditions over a representative electrode (P10).

3.4 Mean Amplitude Analyses over Occipitotemporal Electrodes (P9/10, PO9/10, TP9/10)

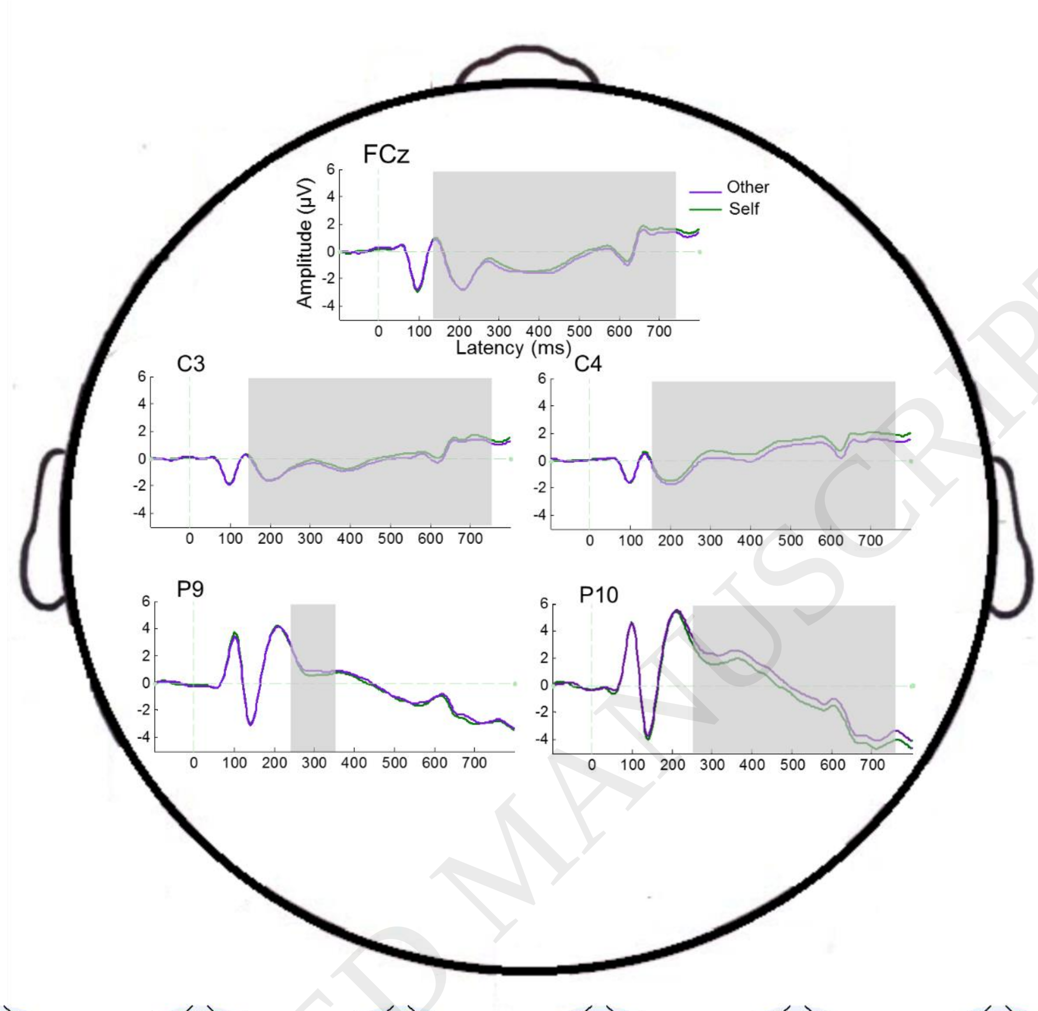
A repeated measures ANOVA with factors of hemisphere (2; left, right), valence (2; positive, negative), self-relevance (2; self, other) and gaze direction (2; direct, averted) was run on the mean amplitude for each 100ms time window between 50ms and 750ms.

No effects were found between 50-150ms. There was a main effect of hemisphere in three subsequent time windows (Table 3a), with more negative amplitude in the left than in the right cluster from 250-450ms, and the opposite pattern from 650-750ms.

There was a trending main effect of valence between 250-350ms (Table 3b), with a trend for faces put into negative contexts to elicit more negative amplitude than those put into positive contexts. A consistent main effect of self-relevance (Table 3c) was seen from 250-750ms, with a more negative amplitude for the self-relevant than the other-relevant trials. Self-relevance interacted with hemisphere (Table 3d) such that the effect of self-relevance was more pronounced in the right than in the left hemisphere between 250-350ms and then was uniquely right-lateralized from 350-750ms (Figure 8a, bottom left and right panels show sample occipitotemporal sites).

There was a valence by self-relevance interaction (Table 3e) from 150-250ms, and 350-550ms. Separate ANOVAs for positive and negative trials (Figure 9, top four panels) indicated that from 150-250ms, and then 350-550ms, the effect of self-relevance was only seen for positive trials, with faces placed into self-relevant contexts eliciting more negative amplitudes than those in other-relevant contexts.

a)



b)

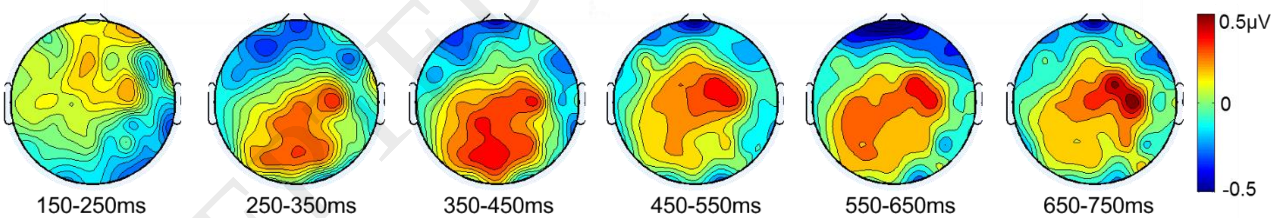


Figure 8. Main effect of self-relevance. **a)** Self-relevance effect shown over sample electrodes from left (P9) and right (P10) occipitotemporal clusters, as well as from the left (C3), right (C4) and midline (FCz) clusters of centroparietal and frontocentral sites. Time windows during which the main effect of self relevance was significant are outlined in grey. **b)** Topographic maps showing the mean voltage distribution of the grand average difference waveforms (self-relevant minus other-relevant) across 100ms time intervals.

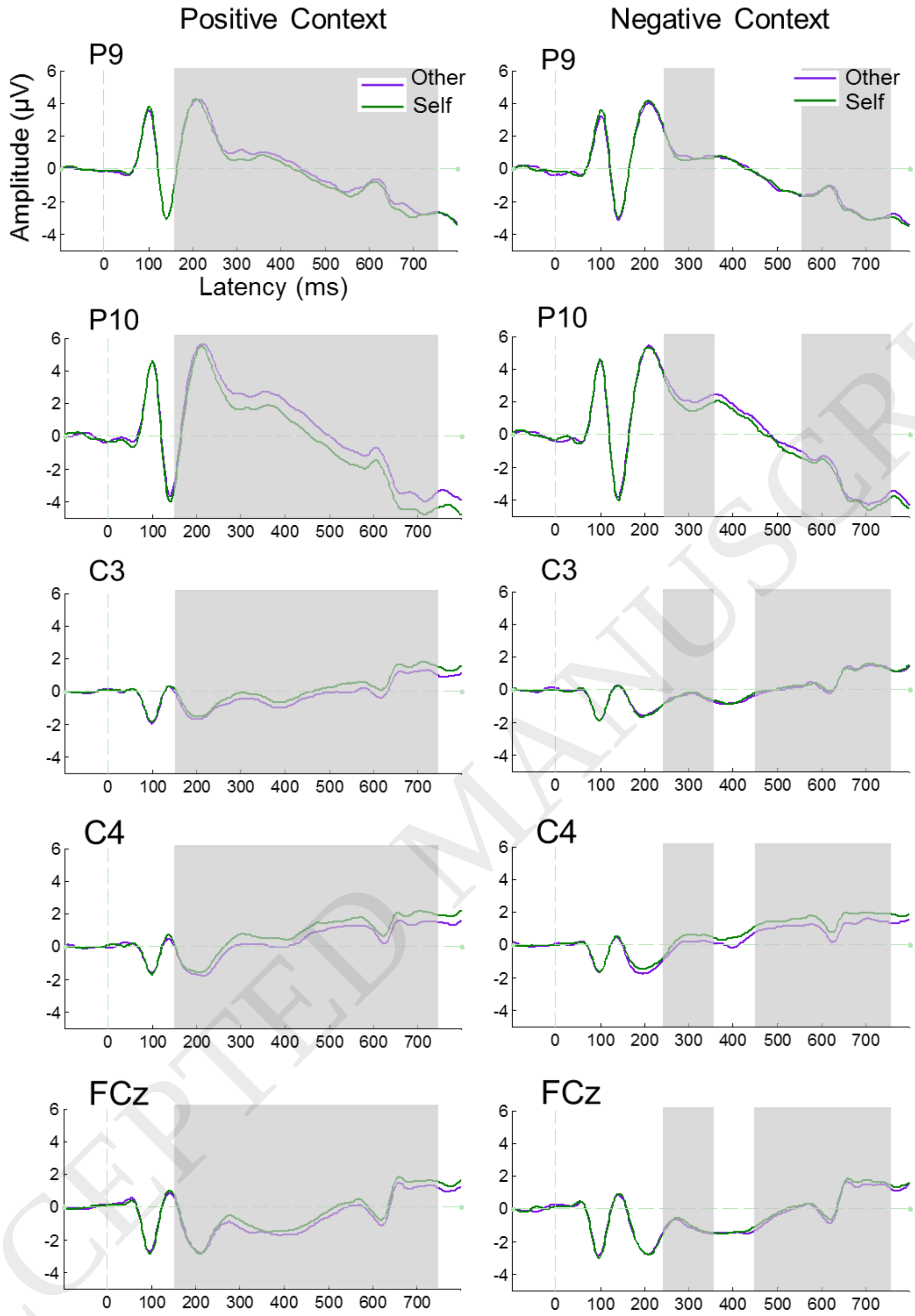


Figure 9. Valence and self-relevance interaction. ERP waveforms for self and other-relevant conditions during positive (left panels) and negative (right panels) contexts are shown for sample electrodes from left (P9) and right (P10) occipitotemporal clusters, and left (C3), right (C4) and midline (FCz) centroparietal and frontocentral clusters. Grey areas represent the time windows during which the self-relevance effect was significant for positive or negative contexts.

3.5 Mean Amplitude Analyses over Frontocentral and Centroparietal Electrodes

An electrode cluster (3; left (C1, C3, CP1, FC1), midline (CPz, Cz, FCz), and right (C2, C4, CP2, FC2)) by valence (2; positive, negative) by self-relevance (2; self, other) by gaze direction (2; direct, averted) repeated measures ANOVA was also run on the mean amplitudes for each time window (100ms increments from 50ms to 750ms).

No effects were found for the 50-150ms time window, aside from a main effect of electrode cluser, with significantly more positive amplitudes seen over the right cluster than the left. There was also a main effect of electrode cluster from 250-750ms, with most positive amplitudes seen over the right cluster, followed by the midline and left clusters (Table 4a – the paired comparisons differed depending on the time window). Most importantly, there was a main effect of self-relevance from 150ms-750ms (Table 4b), independent of electrode cluster. As seen in Figure 8-9, faces put into self-relevant contexts elicited more positive amplitudes than those in other-relevant contexts. This effect was qualified by an interaction between self-relevance and valence from 150-350ms (Table 4c), where the effect was mainly seen for positive trials (Figure 9, bottom three left panels), only ever reaching significance for negative trials between 250-350ms (Figure 9, bottom three right panels).

4. DISCUSSION

While the majority of face processing research has studied how facial information is extracted from faces devoid of context, recent evidence suggests that the context under which we view faces modulates this information extraction, not just for emotional faces but also for neutral faces. In particular, situational self-relevance (Weiser et al., 2014; Schwarz et al., 2013; Klein et al., 2015) and valence (Weiser et al., 2014; Schwarz et al., 2013; Weiser & Moscovitch, 2015; Klein et al., 2015) have been shown to strongly impact affective and cognitive response to neutral faces, though the time-course of these effects is still unclear. Furthermore, how these context cues might interact with the direction of gaze, itself a sign of self-relevance (Conty et al., 2016; Hamilton, 2016) and positive valence (e.g., Strick et al., 2008; Kampe et al., 2001), is currently unknown. To address these gaps, the present study manipulated the contextual valence and self-relevance under which direct and averted gaze faces were viewed. We used ERPs time-locked to the presentation of neutral faces to track the time-course of context and gaze effects on face processing. Our results demonstrate that context alters behavioural and neural responding to faces quite early, and interacts with gaze in a complex manner.

Information processing is thought to be biased towards self-relevant stimuli (Schmitz & Johnson, 2007), and this self-referential processing has been linked to adaptive social functioning (Mitchell, Banaki & Macrae, 2005). In the present study, we replicated the finding that self-relevance impacts behavioural responses to neutral faces (Weiser et al., 2014; Schwarz et al., 2013), such that faces presented in a self-relevant context were rated as more arousing than those presented in an other-relevant context. At the neural level, however, self-relevance impacted ERPs to faces earlier than previously reported. Weiser et al. (2014) and Klein et al. (2015) found an increased negativity elicited by self-relevant faces compared to other-relevant faces over occipitotemporal electrodes between 220-300/350ms (EPN), and a corresponding larger positivity for self-relevant faces at frontocentral sites between 400-600ms ((early LPP, Weiser et al., 2014) and between 700-1000ms (late LPP, Klein et al., 2015). We found similar effects of self-relevance, except self-relevance also interacted with valence as early as 150ms, and until 450ms, as detailed below (also note the trending effect of self-relevance on the N170 i.e. around the 150ms mark). In addition, this effect of self-relevance was seen until 750ms. Our approach of analysing mean amplitudes in 100ms increments across the entire waveform instead of analyzing only restricted time windows around known components allowed to show that the impact of self-relevance can be fast, but also long lasting, and that it exerts its influence over both frontal and right-lateralized posterior sites.

The effect of self-relevance was modulated by situational valence at both the behavioural and ERP level. Self-relevant (neutral) faces made participants feel more positive than other-relevant faces when the situation was positive, and more negative than other-relevant faces when the situation was negative. In contrast to previous assumptions that contextual valence and self-relevance might be processed independently in the earliest stages of processing (Weiser et al., 2014) we found initial evidence that they actually interact quite early during the course of cognitive processing. Self-relevance impacted the processing of faces only within positive contexts during 150-250ms and 350-450ms over fronto-central/centro-parietal sites, and between 150-250ms (i.e. during the early part of the EPN) and 350-550ms over occipitotemporal sites. As Weiser et al. (2014) and Klein et al. (2015) did not report any analyses over frontal sites before 400ms (lower limit of their LPP), and restricted their EPN window to 220-300/350ms, they may have missed this interaction (note that between 250-350ms, the time window closest to their EPN time window, we also did not find an interaction with valence, just a main effect of self-relevance at occipitotemporal sites). It is also possible that we were able to track this interaction because we included more contextual sentences and trials per condition, because our sentences were selected to maximize the interaction behaviourally (see section 2.1.2) and because our sample was much larger.

At early stages of processing, the self-relevance effect was seen only during positive trials at the ERP level. This finding may be related to the previously reported self-referential positivity bias, which proposes that individuals interpret positive information as self-relevant and negative information as other-relevant (Heine, Lehman, Markus, & Kitayama, 1999). Several studies have found that this positivity bias is greater for positive descriptors than for negative ones, meaning that people endorse positive descriptors as self-relevant to a greater extent than they deny negative descriptors as being self-relevant (e.g., Alicke et al. 1995; Eiser, Pahl and Prins, 2001; but see Paul & Eiser, 2005 for conflicting evidence). Our ERP findings may reflect this increased sensitivity to self-relevance during positive trials in the first stages of processing. This possible positivity bias seems different from the motivational salience that results from reward association, or from other types of association, which have been shown to impact early sensory responses to neutral faces (P1 component) or even earlier activity (30-60ms, Morel et al., 2012), but not the EPN (Hammerschmidt, Sennhenn-Reulen & Schacht, 2017; Aguado et al., 2012). Indeed, our effects were not seen before 150ms but impacted the EPN and LPP.

Given its early timing, however, we propose that this valence and self-relevance interaction still reflects top-down processes, possibly coming from prefrontal areas, onto ventral visual areas (Adolphs, 2002; Bar et al., 2006). The prefrontal cortex seems to play an important role in the rapid differentiation of neutral stimuli (including faces) which have been paired with aversive and appetitive stimuli (Steinberg, Bröckelmann, Rehbein, Christian Dobel & Junghöfer, 2013). Moreover, neuroimaging research using a very similar paradigm to ours (Schwarz et al., 2013) found that self-relevance resulted in increased activation in the medial prefrontal cortex (mPFC), an area known to be involved in many different tasks implicating self-referential processing (e.g. Macrae et al., 2004; Schmitz et al., 2004; Mitchell et al., 2005), and in the right inferior-temporal lobe/fusiform gyrus (IT/FG), one of the main nodes of the face perception network (Haxby et al., 2000). Although caution is required given the poor spatial resolution of the EEG technique, it is possible that the activity recorded over fronto-central and centro-parietal sites was related to mPFC activity while activity over occipitotemporal sites was related to activity in the IT/FG area, and that the mPFC was involved in quickly identifying the neutral faces paired with a positive self-referential context and modulated the face perception network through top-down connections. Although we did not find frontal activations to precede occipitotemporal activation, the overall pattern and effect sizes suggest the self-relevance and valence interaction was stronger and more sustained at fronto-central sites.

In contrast to the early self-relevance and valence interaction, in the later stages of processing, a main effect of self-relevance was seen, regardless of valence context (after 450ms at anterior sites and after 550ms at posterior sites), despite a strong valence by self-relevance interaction at the behavioural level. Thus, there does not seem to be a direct link between the interaction seen at the ERP level and that seen at the behavioural level. Alternatively, it is possible that our epoch was too short and that at even later cognitive stages, negative contexts might elicit unique and opposite effects of self-relevance as seen earlier for positive contexts, an idea that future studies could test.

Interestingly, we did not find any general effect of valence on the N170 component peak, although valence interacted with self-relevance and gaze on that component, as discussed later. The N170 is most often modulated by facial expressions (Hinojosa et al., 2015; Calvo & Nummenmaa, 2016, for reviews) and there is evidence that this emotional processing is also influenced by the valence and/or congruency of the context in which those faces are presented (e.g. Righart & de Gelder, 2006; Dieguez-Risco et al., 2013; also see Bartlett et al., 2011 and Wieser & Brosch 2012). However, in all these studies, explicit emotional cues were present through physical changes of the face configuration driven by the emotional expression. In contrast, when neutral faces are used, as in the present study, valence of the contextual information does not seem to modulate the N170, as also reported previously (Aguado et al., 2012; Wieser et al., 2014; Klein et al., 2015; Weiser & Moscovitch, 2015).

We only found a trend for a main effect of valence between 250-350ms, encompassing the EPN time window, with a tendency for faces put in negative contexts to elicit more negative amplitudes compared to faces put in positive contexts. The direction of this effect is similar to the increased EPN elicited by negative faces (fearful, angry) compared to positive (joyful) faces reported by some studies (Rellecke, Palazova, Sommer, & Schacht, 2011; Rellecke, Sommer, & Schacht, 2013; Schupp, Junghöfer, Weike, & Hamm, 2004). These findings have previously been interpreted as reflecting facilitated perceptual processing of threat, which could aid in responding to evolutionarily significant stimuli (Schupp et al., 2004). Again, we always recorded neural responses to neutral faces containing no explicit affective information. Thus, it may be that emotional modulation of the EPN can be elicited solely by the affective context in which neutral faces are perceived. Weiser et al. (2014) indeed reported a larger EPN for neutral faces presented in a negative context compared to a positive context (but see Klein et al., 2015 for null results), although the positive-neutral and negative-positive differences (as here) were not significant (but see Wieser & Moscovitch, 2015, who found significant positive-neutral and negative-neutral differences). A mechanism that does not require direct visual perception of threat to enhance processing of threat-related stimuli would enable adaptive responding to threat in a wider range of scenarios. Let's note that the EPN is more broadly related to the processing enhancement of visual stimuli that carry affective but also motivational and arousing significance (Junghöfer et al., 2001; Schupp et al., 2007; Kissler et al., 2009). For instance, the EPN is also enhanced for own-face compared to other-face photographs (Gunji et al., 2009) and for real faces compared to a mannequin face seen in real life (Pönkänen et al., 2008). Perhaps it is the arousal elicited by the self-relevant importance of the affective stimuli, rather than their explicit affective value, that impacts the EPN, an idea in line with the present self-relevance effects seen around this component timing.

One of the main goals of the present study was to investigate the possible interactions of contextual self-relevance and valence with gaze direction. Early processing of faces with varying gaze direction has been studied (see George & Conty, 2008 and Itier & Batty, 2009, for reviews), but there is a need for systematic investigation into how situational context interacts with gaze cues to alter behavioural and neural responding to faces. We reasoned that if seeing direct gaze puts one into a self-referential processing mode, given direct gaze is itself implicated in self-referential processing (see Conty et al. 2016 and Hamilton 2016), direct gaze may work additively with contextual self-relevance, resulting in larger self-relevance effects for direct gaze compared to averted gaze conditions. In the present study, participants reported that direct gaze faces made them feel more aroused and positive than averted gaze faces, a result in line with findings that direct gaze is more affectively arousing (Nichols & Champness 1971; Conty et al. 2010), rewarding (Kampe et al. 2001) and preferred (Dubey et al. 2015) than averted gaze. However, these effects were context specific; direct gaze only made participants feel more positive when viewed within positive, self-referential contexts. Similarly, the difference in arousal ratings between direct and averted gaze faces was largest when these faces were put into either positive or self-referential contexts. Importantly, similar effects were seen at the neural level. Gaze direction affected early neural responses to faces only when these faces were presented within a positive and self-referential context. We found this interaction on the N170 ERP component, thought to reflect configural face processing (Eimer, 2000; Sagiv & Bentin 2001). While it must be noted that the interaction was relatively weak, this finding suggests that certain situational contexts may interact with gaze direction to modulate the early face processing stages.

Interestingly, the pattern of behavioural and ERP results suggests that positive and self-referential contexts prime sensitivity to averted gaze. Indeed, despite *direct* gaze being both attention grabbing (Senju & Hasegawa 2005) and arousing (Nichols & Champness 1971; Conty et al. 2010), we found *averted* gaze under positive, self-referential contexts to be associated with enhanced N170s. One possibility is that, because direct gaze is a positive (e.g., Strick et al. 2008; Kampe et al. 2001) and self-referential cue (e.g., Conty et al. 2016; Hamilton 2016; Kampe et al., 2003), it is incongruous and salient to see averted gaze under positive, self-referential contexts. On a social level, it may be somewhat surprising to see someone who has just complemented you avert their gaze. Gaze aversion could mean that a positive conversation partner is starting to lose interest, or alternatively be a signal of modesty or shyness. This idea of potential expectation violation leading to early incongruence effects echoes some findings from the emotion processing ERP literature. For instance, Mereen, van Heijnsbergen, and de Gelder (2005) reported enhanced early visual processing between 140 and 230ms, when individuals viewed emotional faces placed onto bodies displaying incongruent body language relative to congruent body language.

Modulations of the N170 (and M170, the N170 equivalent in MEG) by gaze direction have been reported, although results are not always consistent. Some found that static averted gaze faces or dynamic averted gaze shifts elicited a larger N170 amplitude than direct gaze faces or gaze shifts (Watanabe et al., 2002; Itier et al., 2007; Puce et al.,2000; Latinus et al., 2015; Rossi et al., 2015; see also Caruana et al., 2014 with intracranial recordings). Others, in contrast, found larger N170s for direct than averted gaze static faces or gaze shifts (Conty et al., 2007; Pönkänen et al., 2010; Watanabe et al. 2006; Burra et al., 2017). Yet others found no gaze modulations of the N170 (Taylor, Itier et al., 2001; Schweinberger et al., 2007; Brefczynski-Lewis et al., 2011). Shorter N170 latency to averted gaze faces (Puce et al. 2000) and shorter M170 latency for averted eyes (Taylor, George, et al. 2001) have also been reported, suggesting that averted gaze might be processed faster than direct gaze in static pictures. Those inconsistencies might be due to differences in tasks and other parameters specific to each design (e.g. head orientation, face photographs versus real faces, etc.). The present study adds to this literature and further suggests that gaze direction can interact with situational context in the early stages of face processing. Importantly, we did not find any effect of gaze or interaction of gaze direction with context factors after the N170 component. Thus, it does not seem like direct gaze works additively with self-referential contextual cues to put participants in a larger self-referential mode, as we initially thought. Rather, the interaction between context and gaze direction seems transient, occurring only at the N170 level, and might simply be linked to the incongruity or expectation violation of the gaze signal within a given social situation.

In conclusion, our everyday social environment is rich with contextual cues, and the present study emphasizes the importance of studying face processing in increasingly ecological scenarios. Our results suggest that self-referential contexts may put an observer into a self-referential processing mode which has early, long-lasting and widespread effects on face processing. Furthermore, our findings suggest that this mode of processing can impact our corresponding emotional reaction to the facial cues that we encounter, even when the faces do not contain any explicit emotional cues themselves. As alterations in both self-referential processing and face processing have been linked to social impairment in autism (Henderson, et al., 2009; Mundy, Gwaltney & Henderson, 2010; Burrows, Usher, Mundy & Henderson, 2017; Gentili et al., 2016), high social anxiety (Blair et al. 2008; Moscovitch, Orr, Rowa, Reimer & Antony, 2009; Morin et al., 2015), and depression (Auerbach, Stanton, Proudfit, & Pizzagalli, 2015; Stuhrmann, Suslow, & Dannlowski, 2011), it is possible that the way in which self-reference impacts face processing is altered in individuals with these disorders. Indeed, preliminary results suggest that individuals with high social anxiety have reduced N170 amplitudes to faces, and enhanced LPPs to faces when the faces were put into negative contexts, while those with low social anxiety have larger N170 responses and enhanced LPPs to faces put into positive contexts (Wieser & Moscovitch, 2015). Understanding more about how self-referential processing modulates face processing in neurotypical individuals is the first step towards understanding how alterations in this process may lead to social impairment in these disorders.

DISCLOSURE STATEMENT

We report no potential conflicts of interest.

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Table 1. Sentence validation results, with mean valence and arousal ratings (*SE* in parentheses) obtained across all 68 participants as a function of descriptor valence and self-relevance. Bolded sentences were later used in the EEG-Eye tracking experiment.

	SOCIAL COMPETENCE								
Descriptors	Self Positive Valence	Self Negative Valence	Other Positive Valence	Other Negative Valence	Self Positive Arousal	Self Negative Arousal	Other Positive Arousal	Other Negative Arousal	Valence X Self-relevance Score
socially awkward /socially adept	6.36(1.67)	2.66(1.47)	5.66(1.80)	3.30(1.61)	5.50(1.93)	4.64(2.66)	4.67(2.03)	3.84(2.26)	**1.34**
no personality/great personality	7.84(1.38)	1.98(1.42)	6.83(1.95)	2.88(2.01)	6.57(2.01)	4.99(2.92)	5.79(2.32)	4.17(2.53)	**1.91**
jokes are humorless /hilarious	7.53(1.45)	2.79(1.70)	6.88(1.89)	3.25(1.53)	6.57(1.93)	4.35(2.65)	6.88(2.38)	4.13(2.18)	1.12
very shy/confident	7.44(1.52)	3.98(2.16)	7.03(1.53)	4.52(1.60)	6.39(2.04)	4.68(2.16)	5.81(2.34)	4.36(2.18)	0.95
very friendly /unfriendly	7.71(1.23)	1.97(1.40)	7.78(1.68)	2.88(1.98)	7.71(1.68)	5.14(2.94)	5.34(2.12)	4.24(2.59)	0.85
really intelligent /unintelligent	7.95(1.41)	2.13(1.69)	7.22(1.93)	3.03(2.10)	6.62(2.01)	5.17(3.07)	5.82(2.37)	4.32(2.63)	**1.62**
really want/never want to date	7.21(1.82)	2.80(1.88)	6.93(2.05)	3.04(2.02)	6.58(2.07)	4.52(2.88)	6.15(2.47)	4.27(2.67)	0.53
really boring/ interesting	7.84(1.36)	1.97(1.40)	6.90(1.95)	2.88(1.98)	6.58(1.98)	5.14(2.94)	5.80(2.32)	4.24(2.59)	**1.27**
always enjoys/dreads meeting with	7.73(1.19)	2.34(1.79)	6.82(2.04)	2.87(1.90)	6.50(2.02)	5.00(3.04)	5.70(2.22)	4.23(2.66)	**1.45**
lack/have charisma	7.09(1.58)	2.86(1.61)	6.52(1.85)	3.51(1.56)	6.08(2.00)	4.91(2.34)	5.47(2.28)	4.07(1.96)	**1.22**
very sociable/ antisocial	7.28(1.41)	2.68(1.60)	6.74(1.49)	3.37(1.82)	6.00(2.07)	4.92(2.54)	5.22(2.33)	4.17(2.50)	**1.22**
emotionally stunted/mature	7.03(1.39)	2.85(1.45)	6.72(1.81)	3.57(1.65)	5.57(2.17)	4.68(2.37)	5.00(2.13)	4.40(2.17)	1.04
express yourself well/poorly	7.19(1.39)	2.92(1.68)	6.68(1.49)	3.54(1.69)	5.65(2.03)	4.85(2.69)	5.06(2.04)	3.90(2.10)	**1.13**

	PHYSICAL ATTRACTIVENESS								
Descriptors	Self Positive Valence	Self Negative Valence	Other Positive Valence	Other Negative Valence	Self Positive Arousal	Self Negative Arousal	Other Positive Arousal	Other Negative Arousal	Valence X Self-relevance Score
face is lovely/ugly	7.67(1.50)	1.88(1.39)	6.88(1.83)	2.77(2.05)	6.39(2.14)	5.39(3.01)	5.45(2.25)	4.89(2.78)	**1.68**
attractive/unattractive	7.52(1.55)	2.56(1.69)	6.80(2.00)	3.18(1.69)	6.46(2.11)	4.76(2.62)	5.78(2.50)	4.31(2.50)	**1.34**
an unhealthy/healthy weight	6.74(1.65)	2.77(1.67)	6.51(1.65)	3.27(1.84)	5.33(2.11)	4.74(2.52)	4.77(2.27)	4.14(2.40)	0.73
hair is healthy/greasy	7.03(1.64)	2.67(1.56)	6.55(1.67)	3.97(2.37)	5.36(2.26)	4.85(2.68)	4.66(2.40)	3.97(2.37)	**1.78**
smell really good/bad	7.23(1.64)	1.84(1.23)	6.91(1.76)	2.68(2.03)	6.18(2.08)	5.24(3.12)	6.01(2.41)	4.59(2.81)	**1.16**
look really exhausted/well-rested	6.31(1.45)	3.84(1.41)	6.27(1.52)	4.20(1.57)	4.84(2.15)	4.14(2.08)	4.32(2.34)	4.01(2.10)	0.40
skin is blemished/flawless	7.49(1.55)	3.17(1.48)	7.28(1.73)	3.66(1.42)	6.23(2.13)	5.06(2.38)	5.71(2.43)	4.17(2.26)	0.70
look really weird/cool	7.40(1.36)	2.55(1.63)	6.86(1.79)	3.11(1.76)	6.15(2.17)	5.12(2.71)	5.77(2.27)	4.37(2.20)	**1.10**
look quite fit/fat	7.65(1.25)	2.44(1.63)	7.00(1.69)	2.70(1.72)	6.36(2.22)	5.02(2.96)	5.74(2.41)	4.32(2.56)	0.91
have great/gross hair	7.51(1.11)	2.32(1.53)	6.79(1.75)	2.60(1.62)	5.99(1.95)	4.75(2.69)	5.44(2.26)	4.23(2.47)	1.00
eyes are dull/pretty	7.58(1.49)	3.03(1.43)	6.98(2.01)	3.70(1.64)	6.06(2.13)	4.18(2.36)	5.45(2.33)	3.90(2.11)	**1.28**
look very neat/ sloppy	6.95(1.33)	2.48(1.43)	6.23(1.80)	3.14(1.80)	5.42(2.03)	4.70(2.64)	5.03(2.31)	3.96(2.20)	**1.38**
poorly dressed/well dressed	7.51(1.10)	2.76(1.65)	6.82(1.55)	3.17(1.72)	6.09(1.80)	4.77(2.52)	5.49(2.33)	4.15(2.39)	**1.10**

	SIGNS OF ANXIETY								
Descriptors	Self Positive Valence	Self Negative Valence	Other Positive Valence	Other Negative Valence	Self Positive Arousal	Self Negative Arousal	Other Positive Arousal	Other Negative Arousal	Valence X Self-relevance Score
speak very effortlessly/hesitantly	6.91(1.63)	3.80(1.71)	6.50(1.80)	4.04(1.42)	5.47(2.27)	4.23(2.13)	5.02(2.46)	4.01(2.16)	**0.65**
always/never fidget	5.46(1.34)	3.60(1.30)	5.50(1.28)	4.15(1.47)	3.80(2.23)	4.27(1.99)	4.08(1.98)	3.32(1.79)	0.50
sound very terrified/confident	7.42(1.55)	3.22(1.66)	7.01(1.65)	3.30(1.63)	6.30(2.18)	4.84(2.50)	5.63(2.41)	4.55(2.54)	0.50
voice is shaky/steady	6.65(1.30)	3.48(1.38)	6.10(1.59)	3.79(1.23)	4.89(1.99)	4.46(2.42)	4.89(1.99)	3.98(1.99)	**0.86**
words are mumbled/clear	6.69(1.26)	3.16(1.44)	5.97(1.75)	3.52(1.62)	4.98(1.89)	4.67(2.28)	4.25(2.00)	3.88(2.19)	**1.08**
always/never thinks you are blushing	5.02(1.41)	4.98(1.33)	4.98(1.33)	5.36(1.59)	4.23(2.27)	5.37(2.04)	4.04(2.17)	4.75(2.12)	0.41
look really refreshed/sweaty	6.78(1.28)	3.07(1.65)	6.23(1.77)	3.56(1.76)	5.32(2.03)	4.61(2.49)	4.85(2.30)	4.34(2.58)	**1.04**
quite anxious/relaxed	6.32(1.44)	3.67(1.63)	6.12(1.59)	3.82(1.41)	4.95(2.07)	4.50(2.26)	4.38(1.97)	4.49(2.19)	0.35
very tense/calm	6.95(1.33)	3.85(1.50)	6.14(1.48)	4.20(1.69)	5.05(2.31)	4.88(2.08)	4.26(2.15)	4.13(2.18)	**1.17**
avoiding/meeting gaze	5.80(1.55)	4.01(1.62)	5.65(1.51)	4.16(1.21)	4.96(2.11)	4.66(2.10)	5.08(2.20)	4.01(2.02)	0.31

look really emotional/composed	7.01(1.28)	4.02(1.64)	6.42(1.37)	4.38(1.69)	5.67(1.90)	4.91(2.00)	4.89(2.20)	4.62(2.10)	**0.95**
eloquent/stuttering	6.83(1.76)	3.55(1.49)	6.44(2.02)	3.92(1.75)	5.59(2.05)	4.64(2.35)	4.97(2.30)	4.02(2.21)	**0.75**
panicking/unafraid	6.82(1.34)	3.17(1.48)	5.76(1.69)	3.74(1.59)	5.45(2.02)	4.97(2.42)	4.59(2.33)	4.41(2.22)	**1.63**

Table 2. Number of participants who showed a maximal N170 peak at left and right hemisphere electrode locations (total *N* =56).

Left Hemisphere		Right Hemisphere	
PO7	4	PO8	5
P9	38	P10	37
PO9	8	PO10	8
TP9	2	TP10	1
O1	4	O2	4
		P8	1

Table 3. Statistical effects from the mean amplitude analyses at occipitotemporal sites, organized by time window. The first *F* value in each box is the result from the omnibus ANOVA. Subsequent lines are for follow up ANOVAs split over the indicated factors, with significant follow-up tests bolded. The direction of significant Bonferroni-corrected paired comparisons or main effects are indicated with ">".

Statistical Effects	**150-250ms**	**250-350ms**	**350-450ms**	**450-550ms**	**550-650ms**	**650-750ms**
3. a) Hemisphere	---	$F(1,55) = 7.87$, $MSE=15.45$, $p = .007$, $\eta_p^2=.125$ (LEFT < RIGHT)	$F(1,55) = 6.75$, $MSE=15.63$, $p = .012$, $\eta_p^2=.109$ (LEFT < RIGHT)	---	---	$F(1,55) = 18.73$, $MSE=12.60$, $p < .001$, $\eta_p^2=.254$ (LEFT > RIGHT)
3. b) Valence	---	$F(1,55) = 3.74$, $MSE=1.88$, $p = .058$, $\eta_p^2=.064$ (NEGATIVE < POSITIVE)	---	---	---	---
3. c) Self-relevance	---	$F(1,55) = 16.76$, $MSE=1.96$, $p < .001$, $\eta_p^2=.234$ (SELF < OTHER)	$F(1,55) = 7.71$, $MSE=3.10$, $p = .007$, $\eta_p^2=.123$ (SELF < OTHER)	$F(1,55) = 5.70$, $MSE=3.27$, $p = .020$, $\eta_p^2=.094$ (SELF < OTHER)	$F(1,55) = 7.07$, $MSE=3.91$, $p = .010$, $\eta_p^2=.114$ (SELF < OTHER)	$F(1.55) = 6.53$, $MSE=4.73$, $p = .013$, $\eta_p^2=.106$ (SELF < OTHER)
3. d) Self-relevance by Hemisphere	---	$F(1,55) = 5.68$ $MSE=.54$, $p = .021$, $\eta_p^2=.094$ **RIGHT self-relevance effect:** $F(1,55) = 22.15$, $MSE=1.27$, $p < .001$, $\eta_p^2=.287$ (SELF < OTHER) **LEFT self-relevance effect:** $F(1,55) = 6.42$, $MSE=1.24$, $p = .014$, $\eta_p^2=.105$ (SELF < OTHER)	$F(1,55) = 4.96$, $MSE=.60$, $p = .030$, $\eta_p^2=.030$ **RIGHT self-relevance effect:** $F(1,55) = 11.69$, $MSE=1.87$, $p < .001$, $\eta_p^2=.175$ (SELF < OTHER) LEFT self-relevance effect: $F(1,55) = 2.74$, $MSE=1.83$, $p = .103$, $\eta_p^2=.047$	$F(1,55) = 7.57$, $MSE=.78$, $p = .008$, $\eta_p^2=.121$ **RIGHT self-relevance effect:** $F(1,55) = 10.83$, $MSE=2.14$, $p = .002$, $\eta_p^2=.165$ (SELF < OTHER) LEFT self-relevance effect: $F(1,55) = .94$, $MSE=2.01$, $p = .336$, $\eta_p^2=.017$	$F(1,55) = 4.30$, $MSE=.87$, $p = .043$, $\eta_p^2=.072$ **RIGHT self-relevance effect:** $F(1,55) = 10.55$, $MSE=2.45$, $p = .002$, $\eta_p^2=.161$ (SELF < OTHER) LEFT self-relevance effect: $F(1,55) = 2.37$, $MSE=2.33$, $p = .129$, $\eta_p^2=.041$	$F(1,55) = 4.63$, $MSE=.96$, $p = .036$, $\eta_p^2=.078$ **RIGHT self-relevance effect:** $F(1,55) = 10.62$, $MSE=2.76$, $p = .002$, $\eta_p^2=.162$ (SELF < OTHER) LEFT self-relevance effect: $F(1,55) = 2.03$, $MSE=2.92$, $p = .160$, $\eta_p^2=.036$

3. e) Self-relevance by Valence	F (1,55) = 4.451, MSE=.940, p = .039, η_p^2=.075 **POSITIVE** **self-relevance effect:** F(1,55) = 5.82,MSE=1.18, p =.019, η_p^2=.096 (SELF < OTHER) ______________ NEGATIVE self-relevance effect: F (1,55) = .06, MSE=1.17, p =.802, η_p^2=.001	---	F (1,55) = 5.203, MSE=1.690, p = .026, ηp^2=.086 **POSITIVE** **self-relevance effect:** F (1,55) = 14.42, MSE=2.14, p <.001, ηp²=.208 (SELF < OTHER) ______________ NEGATIVE self-relevance effect: F (1,55) = .70, MSE=2.65, p =.407, η_p^2=.013	F (1,55) = 5.408, MSE=1.958, p = .024, η_p^2=.090 **POSITIVE** **self-relevance effect:** F (1,55) = 10.09, MSE=2.89, p =.002, ηp²=.155 (SELF < OTHER) ______________ NEGATIVE self-relevance effect: F (1,55) = .26, MSE=2.44, p =.612, η_p^2=.005	---	---

Table 4. Statistical effects from the mean amplitude analyses on frontocentral and centroparietal electrodes, organized by time window. The first *F* value in each box is the result from the omnibus ANOVA. Subsequent lines are for follow up ANOVAs split over the indicated factors, with significant follow-up tests bolded. The direction of significant paired comparisons or main effects are indicated with "<".

Statistical Effects	150-250ms	250-350ms	350-450ms	450-550ms	550-650ms	650-750ms
4. a) Electrode Cluster	---	*F*(1.63,89.56) = 10.47, *MSE*=3.14, *p* <.001, η_p^2=.160 (LEFT & MID) < RIGHT	*F*(1.60,88.10) = 17.56, *MSE*=4.43, *p* <.001, η_p^2=.242 (LEFT & MID) < RIGHT	*F*(1.58,86.63) = 17.65, *MSE*=5.85, *p* <.001, η_p^2=.243 LEFT < (MID & RIGHT)	*F*(1.47,80.99) = 8.44, *MSE*=7.21, *p* <.002, η_p^2=.133 LEFT < (MID & RIGHT)	*F*(146,80.18) = 2.80, *MSE*=8.37, *p* <.083, η_p^2=.048 LEFT < (MID & RIGHT)
4. b) Self-relevance	*F*(1,55) = 5.30, *MSE*=.82, *p* =.025, η_p^2=.088 SELF > OTHER	*F*(1,55) = 30.68, *MSE*=.98, *p* <.001, η_p^2=.358 SELF > OTHER	*F*(1,55) = 16.62, *MSE*=1.24, *p* <.001, η_p^2=.232 SELF > OTHER	*F*(1,55) = 15.92, *MSE*=1.48, *p* <.001, η_p^2=.224 SELF > OTHER	*F*(1,55) = 17.48, *MSE*=1.79, *p* <.001, η_p^2=.241 SELF > OTHER	*F*(1,55) = 30.91, *MSE*=1.94, *p* <.001, η_p^2=.225 SELF > OTHER
4. c) Valence by self-relevance	*F*(1,55) = 5.74, *MSE*=.56, *p* =.020, η_p^2=.094 **POSITIVE self-relevance effect:** *F* (1,55) = 8.40, *MSE*=.89, *p* =.005, η_p^2=.132 SELF > OTHER NEGATIVE self-relevance effect: *F* (1,55) = .091, *MSE*=.48, *p* =.764, η_p^2=.002	*F*(1,55) = 5.35, *MSE*=1.18, *p* =.024, η_p^2=.089 **POSITIVE self-relevance effect:** *F* (1,55) = 28.18, *MSE*=1.14, *p* <.001, η_p^2=.339 SELF > OTHER **NEGATIVE self-relevance effect:** *F*(1,55) = 4.32, *MSE*=1.03, *p* =.042, η_p^2=.073 SELF > OTHER	*F*(1,55) = 2.98, *MSE*=1.12, *p* =.090, η_p^2=.051 **POSITIVE self-relevance effect:** *F* (1,55) = 21.43, *MSE*=.95, *p* <.001, η_p^2=.280 SELF > OTHER NEGATIVE self-relevance effect: *F* (1,55) = 2.56, *MSE*=1.49, *p* =.113, η_p^2=.045	---	---	---