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BRIEF REPORT

Motivated empathy: The mechanics of the empathic gaze

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Successful human social interactions frequently rely on appropriate interpersonal empathy and eye contact. Here, we report a previously unseen relationship between trait empathy and eye-gaze patterns to affective facial features in video-based stimuli. Fifty-nine healthy adult participants had their eyes tracked while watching a three-minute long "sad" and "emotionally neutral" video. The video stimuli portrayed the head and shoulders of the same actor recounting a fictional personal event. Analyses revealed that the greater participants' trait emotional empathy, the more they fixated on the eye-region of the actor, regardless of the emotional valence of the video stimuli. Our findings provide the first empirical evidence of a relationship between empathic capacity and eye-gaze pattern to the most affective facial region (eyes).

Keywords: Emotion; Empathy; Eye-tracking; Social interaction; Eye-gaze patterns.

Human social interaction is highly complex and dynamic, and also, for some, a challenging everyday engagement. Our ability to traverse the ever-changing layers of social interaction often defines the quality and the depth of the lives we lead. Lying at the heart of successful social interaction is the development of empathic responses, which can so closely mirror the affective state of others that they automatically induce in us a state of physiological symmetry with another (Decety, 2004; Singer, 2006). When emotionally synchronised with others in such a way, a state of empathy exists where we are not only able to share, but fully understand the affective states of others, allowing us to successfully relate to them by responding in the most socially appropriate way (Eisenberg & Miller, 1987).

Although no unified model of empathy yet exists in the literature, Zaki and Ochsner's (2012) model of empathic responding is comprehensive and well supported. According to the model, empathy is comprised of three major components.

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The first, experience sharing, is defined as people's tendency to subsume, or simply share, the emotions of others and has been described as a form of affective empathy. A second component is mentalising, thought to be the cognitive facet of empathy, which enables the capacity for perspective-taking. The third component, prosocial concern, drives the capacity for emotional concern. As such, the motivation people have to act to help others depends upon the way they cognitively understand and/or share the emotions of others.

It is clear then that the mechanics of empathic responding, in particular our emotional concern, are critical to our overall understanding of the nature of successful social interaction. However, little is known about the role that positional eye-gaze and face-processing play in the development of our empathic responses. The aim of the present research was to investigate the connection between our trait empathy and the mechanics of face processing. Specifically, we propose that the eye-gaze pattern that arises as we process affective regions of faces may be subserved by our trait empathy.

This idea was stimulated by recent developments in the autism literature that have identified a possible connection between face processing and empathy. Individuals with autism have prominent social–emotional difficulties that include empathic-related deficits in perspective-taking, emotional contagion and mimicry (Baron-Cohen, Leslie, & Frith, 1985; McIntosh, Reichmann Decker, Winkielman, & Wilbarger, 2006). Atypical gaze patterns are also a feature of autism (fourth ed., text rev.; DSM–IV–TR; American Psychiatric Association, 2000), yet studies of social gaze in low-empathy individuals, using eye-tracking technology remain relatively rare. One of the few autism studies to include eye-tracking assessed facial gaze patterns in response to Hollywood actors performing emotionally laden dyadic scenes from a film (Klin, Jones, Schultz, Volkmar, & Cohen, 2002). Viewers with autism were found to attend to the mouth region of faces twice as long as non-clinical controls and to the eye-region for half as long. Also, unlike the control participants, those with autism did not follow the direction of eye-gaze between the actors. Moreover, a negative correlation between participant's social competence, as measured by the Autism Diagnostic Observation Schedule (ADOS), and fixations to the actors' body regions were found.

It is well known that people typically look for social cues such as eye-gaze direction to initiate interactions (Frischen, Bayliss, & Tipper, 2007; Pellicano & Macrae, 2009). It is eye-to-eye exchanges, in particular, that are considered vital in establishing or extinguishing social interactions (Mason, Tatkow, & Macrae, 2005). In addition to autism, abnormalities in socially directed eye-gaze patterns to facial features are seen in other clinical disorders that exhibit low-emotional empathy, such as schizophrenia and anorexia nervosa (Cornelissen, Hancock, Kiviniemi, George, & Tovée, 2009; Joshua & Rossell, 2009; Klin et al., 2002; Schwartz, Marvel, Drapalski, Rosse, & Deutsch, 2002). Underscoring a possible link between empathy and visual perception, each of these disorders also feature deficits in perception, attention and motor control (Gillberg, 1999).

In addition, individual differences in empathy are likely related to how people respond to emotional stimuli, particularly those having to do with the face. For example, people high in emotional empathy are more accurate in recognising emotional facial expressions than are people low in emotional empathy (Besel & Yuille, 2010). Moreover, trait empathy has been associated with a greater ability in reading emotional states from the eyes (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). Thus, one might hypothesise that differences in eye-gaze between people who are low and high in emotional empathy would be greatest when others are expressing emotion. It appears, however, that the only study to date to investigate this hypothesis failed to find support for it. In Hall, Hutton, and Morgan (2010), which was designed to examine gender differences in eye-gaze, the relationship between participants' trait empathy and eye fixations to static facial expressions was also examined. Although women tended to gaze more at the eyes than did men, no sex differences were found on the trait empathy measure. Moreover, no overall association between

eye fixation patterns and empathy was found. It is important to note, however, that the stimuli were presented for three seconds each across 96 trials and involved no context for the expression so that paradigm may have been insufficient to investigate trait differences in empathic responses. Therefore, we sought to address this problem by using a more naturalistic and engaging stimulus—a person speaking directly to the camera about a personal event.

THE PRESENT STUDY

Despite the well-documented variations in social gaze and face-processing ability in some clinical disorders characterised by low empathy, the connections between these aspects of social interaction have yet to be thoroughly investigated. Here, we aimed to fill this gap in the literature by examining a link between emotional empathy and eye fixations to faces within video stimuli using an unselected sample of adults in an eye-tracking paradigm. We hypothesised that participants would fixate longer to the eye-region of the actor in the emotionally laden condition compared to the neutral condition. We further hypothesised that those high in trait emotional empathy would spend more time fixating on the eye-region of the actor in both conditions in comparison to those low in trait emotional empathy.

METHOD

Participants

Fifty-nine participants (31 females) aged 18–33 years (M = 22) were recruited via a Facebook advertisement that targeted adults in the local area. Thirty-four participants were Caucasian, 25 were Asian, and all resided in a large metropolitan city.

Materials and stimuli

Participants answered the Interpersonal Reactivity Inventory (IRI; Davis, 1983) presented on an iPad. The IRI is a widely used 28-item instrument comprising four related but separate subscales each measuring a different dimension of empathy. Of interest in the present study were responses to the Empathic Concern subscale, a measure of emotional empathy, which taps into compassionate feelings and concern for others in need (seven items; α: males, .68; females, .73). Examples of items in this subscale include "I often have tender, concerned feelings for people less fortunate than me" and "I am often quite touched by things that I see happen". We were also interested in responses to the Perspective Taking subscale, a measure of cognitive empathy, that evaluates the ability to see things from another's point of view (seven items; α: males, .71; females, .75). Items in this subscale include "I believe that there are two sides to every question and try to look at them both" and "When I'm upset at someone, I usually try to 'put myself in his shoes' for a while". We did not use the Fantasy subscale, as there is ongoing debate over the extent to which this definitively taps pure empathy (Baron-Cohen & Wheelwright, 2004). We similarly did not use the Personal Distress subscale as it is not considered to be a reliable, stand-alone measure of empathy (Baron-Cohen & Wheelwright, 2004).

Rather than using scenes from major motion pictures as Klin et al. (2002) did, we chose to create our own stimuli, using an actor approximately the same age as the target sample and unknown to the participants. In addition, the actor was instructed to look directly in the camera as she spoke, as if she were having a conversation with the participant. We created two scripted videos, each of 180 seconds duration. One video was an emotionally laden "sad" scenario in which the female actor recalled the fictional onset and development of her grandmother's Alzheimer's disease. The second video was an "emotionally neutral" scenario in which the same actor recalled fictional events occurring while waiting for a flight at an airport. The actor was directed to be more expressive in the emotional condition. The videos were pilot tested on a sample of participants (N = 20) drawn from the same population. Due to the differing emotional qualities of each video, a separate rating scale was used for each one. The sad video was rated on how sad it was found to be, and the neutral video was rated on its level of emotional arousal. The average rating for the

emotional video was 3.6 on a 5-point scale, which indicated a rating between "Moderately sad" and "Very sad". The average rating for the neutral video was 4.8, which indicted a rating between "Slightly emotionally arousing" and "Not emotionally arousing at all". The stimuli were displayed full-screen on a 17-in LCD monitor at a resolution of 1024 × 768 pixels. The distance of the display screen from the participant's eyes was 590 mm and the bottom of the viewable display was 185 mm from the centre.

Procedure

All participants were blind to the hypotheses of the experiment and were tested in identical environmental conditions by the same researcher. Each participant was given verbal instructions on the tasks they were to perform. To allow for more naturalistic viewing, no further background information was provided about the videos. The researcher first asked the participant to complete the IRI and then left the room until it was completed. To record eye movements, participants were seated at an Eyelink SR1000 eye-tracking system sampling at 1000 Hz. Participants then had their eyes calibrated using a 9-point calibration and a drift-correction procedure to ensure that the positional eye data were consistent across all participants. After calibration, the first of the two videos was shown and eye-positions/pupil fixation durations were recorded. Participants remained in position and completed a simple distractor task requiring them to listen and repeat one set of five numbers back to the researcher and a different set in reverse order. Following this, the standard eye calibration process was repeated, and the second video was shown. Video order was counterbalanced across participants. At the end of the second video, the participant was fully debriefed.

RESULTS

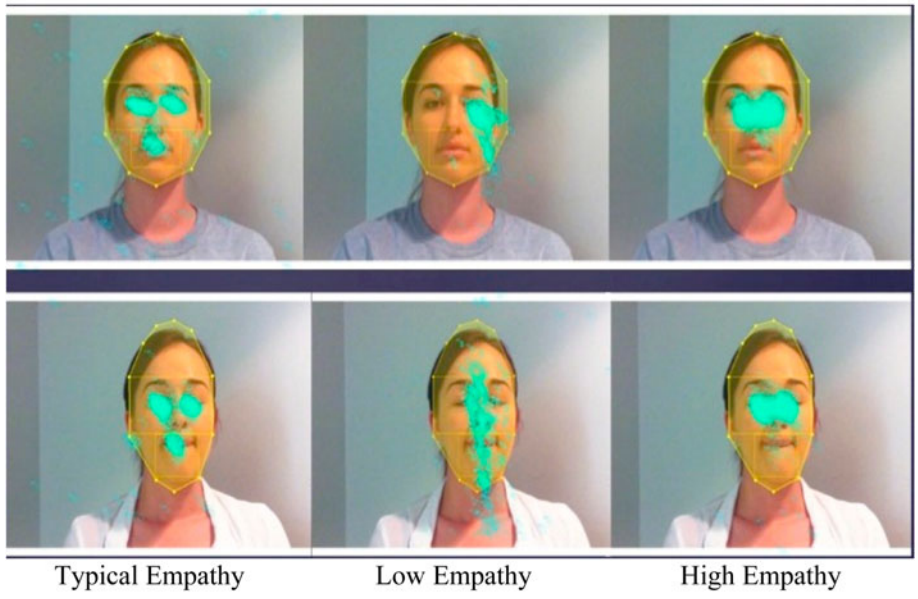
Areas of interest

SR Research Data Viewer v. 1.2.179 software was used to extract eye data. Using a still taken from each video as a trial background reference image, an area of interest (AOI) for the eye-region was generated. Following a previous method (van Reekum et al., 2007), the software was used to define and draw the rectangular eye-region AOI upon still images representing the video clips for both the emotional and the neutral conditions. Although there were minor differences in focal depth between the two video clips, the eye-region AOIs generated for each condition were notionally identical in facial location, pixel area and affective facial feature coverage. The AOIs allowed for minor lateral and vertical head movements across each three-minute video. Representations of the AOIs and the fixation heat maps can be seen in Figure 1. Preliminary analyses comparing male and female dwell-times to the eye-region in both the sad and neutral condition were conducted. No differences were found, and hence, sex was not considered further in the subsequent analyses.

Dwell-time percentage to the eyes AOI for the emotional video showed a significant correlation with the empathic-concern (emotional empathy) subscale of the IRI, $r(57) = .41$, $p = .001$. This relationship was not significant for the neutral video, $r(57) = .23$, $p = .080$. Dwell-time percentage to the eyes AOI for the emotional and the neutral video correlated with the perspective-taking (cognitive empathy) subscale of the IRI, $r(57) = .31$, $p = .018$ and $r(57) = .37$, $p = .004$, respectively. Scatterplots of each of these bivariate relationships are presented in Figure 2. Dwell-time percentage to the eye AOI was greater for the emotional video ($M = 76.32$, $SD = 19.48$) than for the neutral video ($M = 69.03$, $SD = 20.20$, $t(58) = 4.13$, $p < .001$, $d = 0.37$). Additional analyses of the video order revealed no difference between mean dwell-time percentage was found for either condition, regardless of whether the relevant video was shown as the first or second trial. Descriptive statistics for the IRI subscales can be found in Table 1.

To examine how much of the variance in dwell-time for the emotional video was related to empathic-concern (EC) and to perspective-taking

Panel 1.



Panel 2.

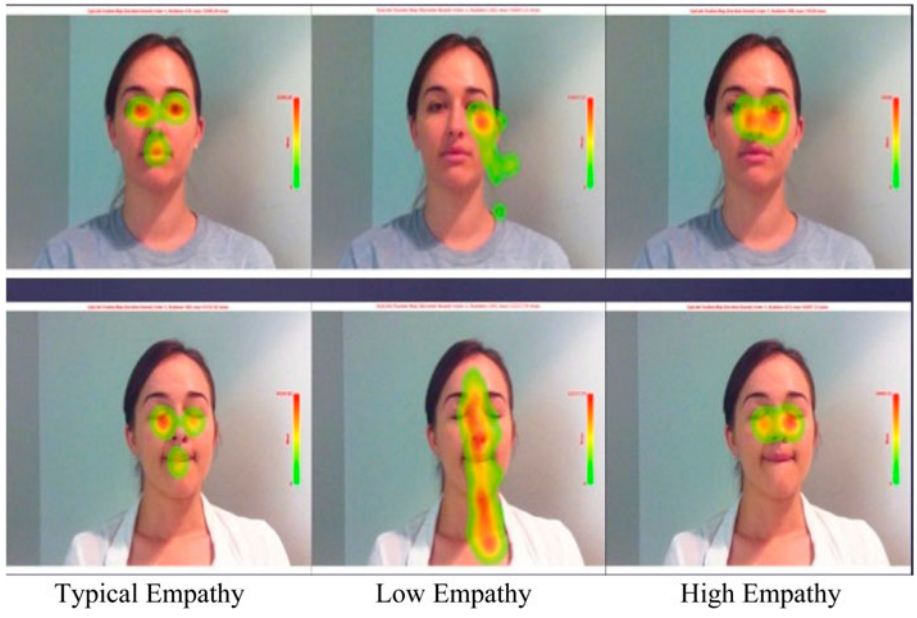


Figure 1. *The top row of each panel shows stills from the neutral video; the bottom row show stills from the emotionally intense video. The columns represent the same model across each condition. Panel 1 illustrates the AOIs and fixations made to each area in relation to empathic-concern. Panel 2 illustrates the intensity of observations made to the face shown as a heat map in relation to empathic-concern.*

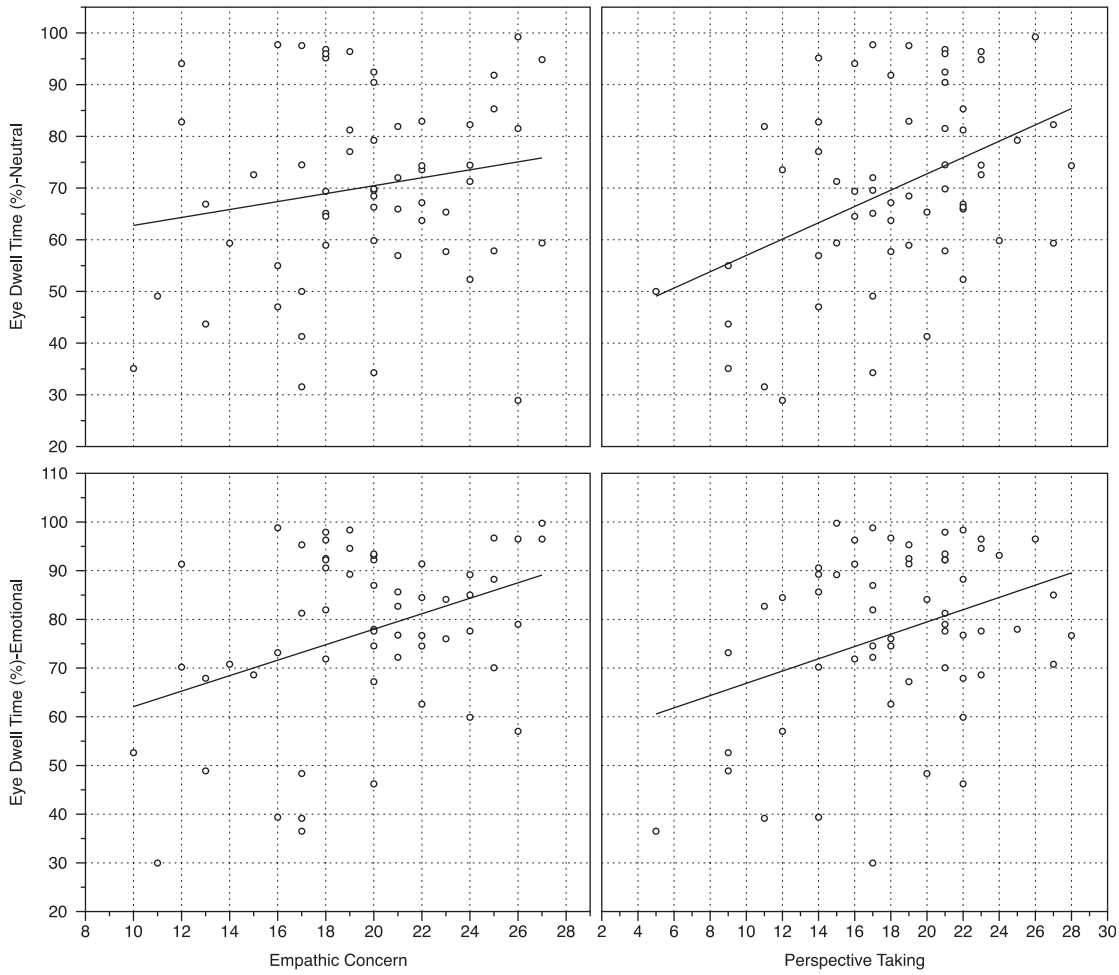


Figure 2. *Scatterplots and regression lines for the relationships between empathic-concern and perspective-taking with eye dwell-time for the emotional and neutral videos.*

(PT), a hierarchical multiple regression analysis was performed. At step 1, both EC and PT were entered. In the overall model, EC explained 16% of the variance in dwell-time, $R = .41$, $R^2 = .16$, $R^2_{adj} = .15$, $F(1,57) = 11.15$, $p = .001$, and PT accounted for 20% of the variance in dwell-time, $R = .45$, $R^2 = .20$, $R^2_{adj} = .17$, $F(1,56) = 7.10$, $p = .002$. However, in a stepwise regression, when controlling for EC and PT independently, the results suggested that EC was the most important predictor explaining 16% of the variance in dwell-time, $R^2_{adj} = .16$, F_{ch} (1, 57) = 11.15, $p = .001$. PT did not significantly add to the variance in dwell-time explaining only a further 4%, $R^2_{adj} = .04$, F_{ch} (1, 56) = 2.71, $p = .105$.

DISCUSSION

The suggestion of a relationship between face processing and empathy has its foundation in research with individuals with autism and other clinical disorders (Cornelissen et al., 2009; Joshua & Rossell, 2009; Klin et al., 2002; Schwartz et al., 2002). However, to date, no research has directly examined the link between eye-gaze to faces

Table 1. *Mean IRI subscale responses for emotional concern and perspective-taking*

	Emotional concern (EC)	*Perspective taking (PT)*
Male (n = 28)		
M	18.75	17.93
SD	4.43	5.37
Female (n = 31)		
M	20.26	18.77
SD	4.67	4.45
Overall (N = 59)		
M	19.54	18.37
SD	4.16	4.88

Note: Responses to the EC and PT subscales are not statistically different for males and females.

within live-action videos and emotional empathy within a typical population. Hall et al. (2010) failed to find evidence of a relationship between trait empathy and fixations to the eyes of emotional faces. As mentioned earlier, however, they relied on brief presentations of static pictures that may not be sufficient, in terms of length of exposure and salience of the emotions displayed, to elicit empathic responding.

It was hypothesised that when watching videos of faces embodying emotional and neutral affect, emotional empathy would be positively correlated with fixation times to the eye-region. This hypothesis was supported and is consistent with the notion that eye-to-eye encounters are critical to successful social engagement (Mason et al., 2005). In addition, participants spent more time looking at the facial eye-region in the emotionally laden video than in the neutral video. The results are also consistent with the findings of Klin et al. (2002) involving children with autism. Here, non-clinical individuals watching emotionally intense scenes pay more attention to the eye-region of a face than they did the rest of the face. The divergence between the results reported here and those of Hall et al. (2010), noted above, is likely due to the longer presentation duration and the dynamic video stimuli design of the current study offering the opportunity for greater emotional engagement. This is an important procedural point that future studies of empathy and eye-gaze will need to consider.

Our findings showed strong associations between both emotional and cognitive trait empathy and dwell-time to the eye-region of the actor. To determine which of these two components of empathy was the best predictor of dwell-time, we entered scores for these predictors into a hierarchical multiple regression analysis. The results of the regression confirmed our prediction that trait emotional empathy was underlying the dwell-time effect and is of primary interest here. Moreover, our findings indicate that the possession of a higher empathic response may motivate individuals to employ a gaze pattern that searches for affective social cues primarily from the eyes of other faces. We term this pattern of increased gaze to the eye-region of affective faces as the "empathic gaze". Moreover, we suggest it is this process that allows closer synchronisation of affective states in face-to-face encounters thus driving the quality of our social interactions.

The idea of an "empathic gaze" is supported by the variation in gaze patterns across the spectrum of empathic responding. As depicted in Figure 1, gaze patterns differ for those with high empathy, where gaze is fixated heavily on the eye-region, compared to those who are lower in empathy, where gaze falls away from the eyes, and generally in an irregular pattern. It may be that the capacity to readily fixate on the eyes, the strongest region of facial social information, is reduced for those with low empathic response. Without this social anchor, their gaze pattern may become irregular.

There may be other reasons for the variation in empathic gaze found in the present study.

Despite the fact that the IRI is a commonly used, valid and reliable instrument for measuring aspects of empathy, the possibility exists that some participants may seek to respond in more socially desirable ways. This could account for the larger number of participants at the higher end of the empathy scale. Future studies could address this by engaging sample populations known to be lower and higher in empathy and then perform a between groups analysis. Additionally, given the nature of the questions in the IRI, it is possible that despite not being informed of the purpose of

the study, some participants linked the nature of the video stimuli with the empathy scale.

Despite these limitations, it appears that a face-processing continuum exists such that some individuals possess more effective configural face-processing capabilities than others. It has been shown that individuals at the low end of empathic response, such as those with autism spectrum disorder, have a propensity to process faces on a more featural level (Falck-Ytter, 2008; Hobson, Ouston, & Lee, 1988; see also Jones & Klin, 2013). However, in the light of the present findings, emotional empathy levels should now be considered as one of the potential factors driving face processing. A recursive process may be evident such that higher emotional empathy motivates individuals to concentrate their gaze to the eye-region, which in turn facilitates more effective emotional synchrony with others to achieve empathy.

The empathic gaze as revealed in the present study is an important new finding that may yet prove to be a fundamental piece of the empathy puzzle. In order to be as one with another, we look into the eyes. It is possible that this addition to our understanding of the connection between empathy and face processing may open new areas of research to benefit all those who struggle with social interaction. Empathy may be largely determined simply by the way we look at faces.

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