The effect of arousal and eye gaze direction on trust evaluations of stranger's faces: A potential pathway to paranoid thinking

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ABSTRACT

Background and objectives: When asked to evaluate faces of strangers, people with paranoia show a tendency to rate others as less trustworthy. The present study investigated the impact of arousal on this interpersonal bias, and whether this bias was specific to evaluations of trust or additionally affected other trait judgements. The study also examined the impact of eye gaze direction, as direct eye gaze has been shown to heighten arousal.
Methods: In two experiments, non-clinical participants completed face rating tasks before and after either an arousal manipulation or control manipulation. Experiment one examined the effects of heightened arousal on judgements of trustworthiness. Experiment two examined the specificity of the bias, and the impact of gaze direction.
Results: Experiment one indicated that the arousal manipulation led to lower trustworthiness ratings. Experiment two showed that heightened arousal reduced trust evaluations of trustworthy faces, particularly trustworthy faces with averted gaze. The control group rated trustworthy faces with direct gaze as more trustworthy post-manipulation. There was some evidence that attractiveness ratings were affected similarly to the trust judgements, whereas judgements of intelligence were not affected by higher arousal.
Limitations: In both studies, participants reported low levels of arousal even after the manipulation and the use of a non-clinical sample limits the generalisability to clinical samples.
Conclusions: There is a complex interplay between arousal, evaluations of trustworthiness and gaze direction. Heightened arousal influences judgements of trustworthiness, but within the context of face type and gaze direction.

Paranoid thinking is characterised by suspicions about the intentions of others (Freeman, 2016). In psychosis, people report paranoid thoughts that are distressing, implausible, and relatively resistant to change (i.e., persecutory delusions; Freeman & Garety, 2000). However, paranoid ideation is not unusual, as around a third of people with no history of mental health problems report being suspicious of those around them (Freeman, 2007).

One bias associated with paranoia may be a tendency to perceive unfamiliar faces as being untrustworthy. Non-clinical participants prone to paranoid thinking evaluated unfamiliar faces as less trustworthy than control participants (Kirk, Gilmour, Dudley, & Riby, 2013). Clinical studies have reported more ambiguous results. People with psychosis rate unfamiliar faces as being less trustworthy (Pinkham, Hopfinger, Pelphrey, Piven, & Penn, 2008), or as no different (Haut & MacDonald, 2010; McIntosh & Park, 2014), or more trustworthy than controls (Baas, Van't Wout, Aleman, & Kahn, 2008). Usually these

studies did not specifically identify paranoid symptoms in their clinical groups. Where this has been done, paranoid individuals rate faces as less trustworthy (Pinkham et al., 2008).

Freeman, Garety, Kuipers, Fowler, and Bebbington (2002) describe how there are many routes to suspicion, mistrust and paranoia, but one contributory factor is how people make sense of unusual experiences and sensations. If a person experiences heightened arousal around other people, this experience drives a search for meaning or an explantion of what may account for this. People with psychosis may hold negative beliefs about others trustworthiness (Fowler et al., 2006), and may regard themselves as vulnerable to others' actions perhaps owing to past experience of assaults, bullying and interpersonal hostility (Freeman, 2016). These beliefs are usually stable, but the moment to moment appraisals of experiences that are shaped by these beliefs may fluctuate owing to dynamic factors such as levels of arousal (Freeman, 2007). Higher levels of negative arousal may predispose individuals towards

making negative interpretations of ambiguous events (Freeman et al., 2013). Hence, when experiencing normally occurring variations in arousal people with paranoia may be more prone to attribute the cause of their experience to the actions of others which thereby reinforces and maintains these negative beliefs about the intentions of other people to hurt or harm the individual.

Consistent with this claim, Hooker et al. (2011) reported that following a negative affect prime, individuals with schizophrenia rated neutral faces as less trustworthy than following neutral or positive primes. This provides preliminary evidence that heightened levels of arousal elicit (or exacerbate) a mistrust bias (Freeman et al., 2008). However, the induction paradigm employed by Hooker et al. (2011) primed participants to experience positive, neutral, or negative affect on a trial-by-trial basis, which can have different effects to more traditional mood induction paradigms (in which mood is induced and maintained for several minutes Lench, Flores, & Bench, 2011). Thus, it is important to replicate Hooker et al.'s (2011) findings using a different type of negative arousal induction. This is the first aim of two related experiments presented here.

In research on the trustworthiness of others it is important to consider the potential impact of eye gaze direction. Faces are powerful social cues, assisting rapid and automatic judgements about others (Ambady, 2010; Todorov, Pakrashi, & Oosterhof, 2009). Research suggests direct eye gaze elicits greater levels of arousal than averted gaze (Myllyneva, Ranta, & Hietanen, 2015) and that there are complex relationships between gaze direction and trustworthiness. For example, while speakers who communicate with a direct gaze appear more trustworthy than those who use an averted gaze (Kreysa, Kessler, & Schweinberger, 2016), this effect is moderated by the emotional expression of the to-be-rated face (Wyland & Forgas, 2010), and the mood of the rater (Willis, Palermo, & Burke, 2011).

Thus, in the first of two experiments, we investigated the impact of increased negative arousal on participants' evaluations of the trustworthiness of unfamiliar faces, hypothesising that a state of increased negative arousal and paranoia would result in participants rating faces as less trustworthy than controls. In the second experiment we investigated again whether increased arousal led to lower trustworthiness ratings with particular consideration of whether this bias was specific to the assessment of trust and if gaze direction further influenced these trust evaluations.

1. Experiment one

1.1. Method

1.1.1. Participants

Participants were 40 university students (33 females) aged 18–25 years (M = 21.13, SD = 2.13).

1.1.2. Design

A 2 (Time) x 2 (Group) x 3 (Face) mixed experimental design was utilised. Participants rated faces selected to be Untrustworthy, Neutral or Trustworthy before and after either an arousal or control induction. These two groups were compared on baseline levels of paranoia and completed Visual Analogue scales to assess levels of paranoia and arousal during the different stages in the experiment.

1.1.3. Measures
1.1.3.1. The Green et al. paranoid thoughts scale (GPTS; Green et al., 2008). Levels of paranoid thinking were assessed using the GPTS. This scale consists of 32 items that describe thoughts related to suspiciousness. Participants are asked to rate to what extent they have had these feelings over the past month on a 5-point Likert scale (1 = Not at all; 5 = Totally) with higher scores reflecting higher levels of paranoid thinking. In this sample, the GPTS had good internal reliability (Cronbach's α = .87).

1.1.3.2. Visual analogue scales (VAS). Levels of negative arousal and levels of paranoid ideation were assessed using two set of VAS. To assess levels of arousal, participants were asked to rate how nervous, jittery, tense, and scared they were on a scale of 0 (not at all) to 10 (very much so). To assess levels of paranoia, participants were asked to rate to what extent they felt that others were hostile, held bad intentions, would cause them harm, and wanted them to feel threatened on a scale of 0 (not at all) to 10 (very much so). Scores on both sets of VAS could range from 0 to 40, with higher scores reflecting higher levels of arousal or paranoia. In this sample, the scales had acceptable internal reliability (arousal Cronbach's α = .86; paranoia Cronbach's α = .91). Reliability of a scale of all the items combined was acceptable (Cronbach's α = .71).

1.1.4. Experimental inductions
1.1.4.1. Arousal induction. A negative arousal induction procedure used in a previous study (Dudley et al., 2014) to increase arousal and perceived threat from others was employed. It involved watching a 7-min film clip set at night amongst woods, and it implies interpersonal threat from unidentified others leading the characters to become increasingly distressed and afraid. The scene was originally chosen because it does not depict scenes of gore or physical violence but rather emphasises a state of nervousness, fear and concern about the presence of others.

1.1.4.2. Control induction. A neutral induction procedure that has been shown to maintain or lower levels of arousal (see Dudley et al., 2014) was also employed. This involved watching a 7-min film of interchanging flowers with a relaxing sound track.

1.1.5. Face evaluation task
Sixty computer generated faces were selected from the Todorov face data set (Oosterhof & Todorov, 2008), which provides computer manipulated variations of faces along a 7-point Likert scale of trustworthiness, from −3 (very untrustworthy) to +3 (very trustworthy). The faces were used to create two PowerPoint presentations (A and B) of 30 faces, consisting of 10 faces rated as untrustworthy, 10 rated as neutral, and 10 rated as trustworthy.

Participants were tested individually in a quiet room. Faces were presented using Microsoft PowerPoint, displayed on individual slides for 3 s, with a 1 s fixation cross presented between each face, in a fixed randomised order. Participants were asked to rate the trustworthiness of each face on a seven-point scale (1 = very untrustworthy; 7 = very trustworthy) that was presented on-screen throughout the task. The researcher recorded the participant's spoken ratings for each face. Participants received a small payment for their time.

1.1.6. Procedure
Both studies were approved by a departmental ethics committee. After providing informed consent, participants completed the GPTS, and the first set of VAS (Time 1). They then completed the first face evaluation task (either A or B), followed by a second set of VAS (Time 2). Participants completed their allocated (randomly) induction and a third set of VAS (Time 3), and then a second face evaluation task (B or A). Participants completed a fourth set of VAS (Time 4) and were then debriefed. The order in which participants completed the two versions of the face evaluation task was counterbalanced.

1.1.7. Sample size considerations
Although the full model is a 2 × 2 x 3 Time X Group X Face type ANOVA, for the key test of the within-between Time × Group interaction collapsed across Face Type, to detect a conventionally defined medium effect size (f = .25), alpha = 0.05; power = 0.80, the required sample size for the 1 df interaction is 34 (G*Power-3, Faul, Erdfelder, Lang, & Buchner, 2007). This is based on an assumed correlation between pre- and post-induction measures of .5, which seems reasonable