

Dilated and constricted pupils capture attention during different time intervals.

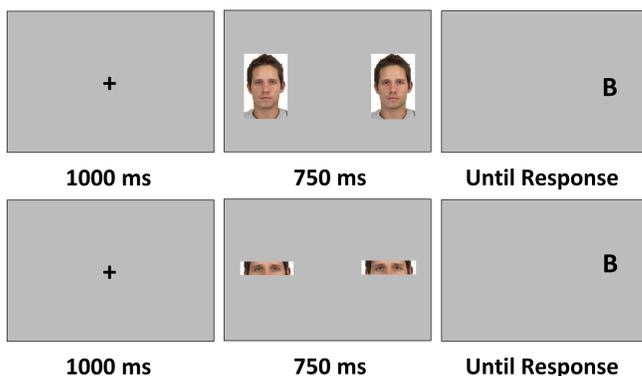
Introduction

- Pupil size, although subtle, provides an outward signal of internal changes in autonomic arousal¹.
- Pupil size change in others as a social cue appears to be largely processed incidentally, but has been shown to influence first impressions of traits such as attractiveness², trustworthiness³ and friendliness⁴, as well as approach avoid and other behaviours⁵.
- First impressions of trustworthiness have been shown to modulate the influence of pupil size on perceptions of friendliness, with more trustworthy faces appearing more friendly with dilated as opposed to constricted pupils, and the opposite true for less trustworthy faces where dilated pupils may be taken as a sign of potential threat⁴.
- Emotional facial expressions have been shown to preferentially capture visual attention, if not necessarily in a fully automatic manner⁵.
- Could pupil size do likewise, and if so, would facial trustworthiness influence whether larger or smaller pupils preferentially captured attention?
- We set out to address this question with a two simple dot-probe experiments.

Pilot Experiment: Lab Based

Design

Dot Probe Task



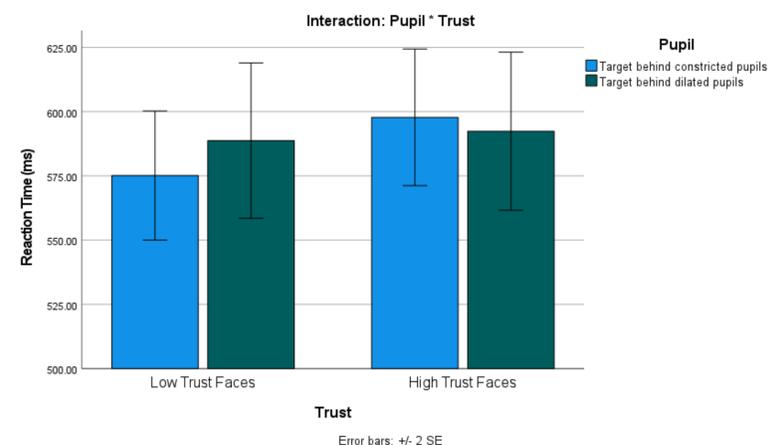
Participants: 26 (mean age 21.0, SD = 2.4 years), 17 female, 9 male.

Dot Probe Task: Participants completed a dot probe task where rival face pairs (8 high trust identities, 8 low trust identities), differing only in pupil size (dilated v constricted) appeared to the left and right of centre, followed by a letter target behind one or other face. Participants responded with a key press denoting the letter (B or H).

Blocks: In one block participants saw whole faces in the other only eye-regions. Blocks consisted of 64 trials counterbalanced for pupil location, target location, and target letter. All high and low trust faces appeared in each block.

Results

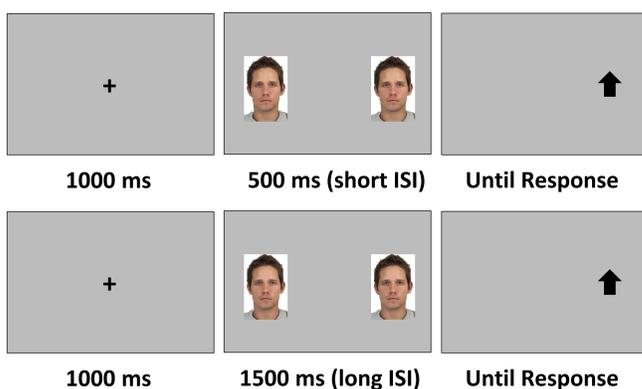
A Pupil (target behind dilated / behind constricted) * Trust (high / low) * Face Type (whole / eye-region) ANOVA, revealed an interaction between Pupil and Trust ($F = 5.2, p < .05$). This reflected faster reaction times to targets behind low trust faces with constricted, as opposed to dilated pupils ($p < .05$), and no significant effect in high trust faces ($p > 0.5$).



Main Experiment: Online (Eprime Go)

Design

Dot Probe Task



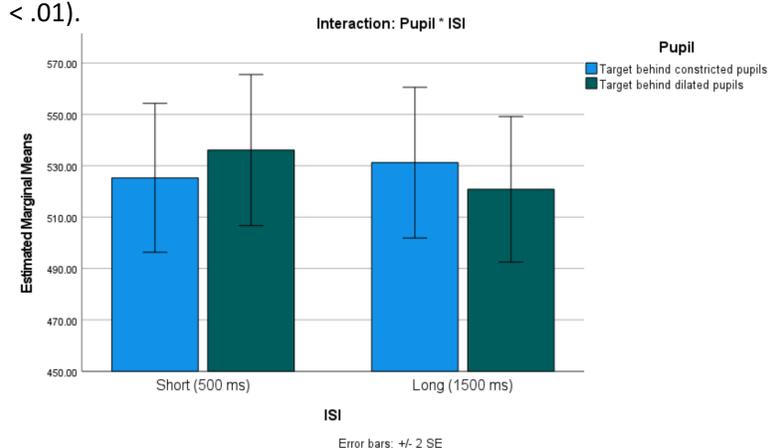
Participants: 26 (mean age 32.8, SD = 13.2 years), 39 female, 11 male.

Dot Probe Task: Participants completed a dot probe task where rival face pairs (8 high trust identities, 8 low trust identities), differing only in pupil size (dilated v constricted) appeared to the left and right of centre, followed by an arrow target behind one or other face. Participants responded with a key press denoting the arrow's direction.

Blocks: The task consisted of two blocks of 96 trials, counterbalanced for pupil location, target location, and target direction. All high and low trust faces appeared in each block. Each block contained 500 ms and 1500 ms ISIs to probe the temporal nature of attentional capture effects.

Results

A Pupil (target behind dilated / behind constricted) * Trust (high / low) * ISI (500 ms / 1500 ms) ANOVA, revealed an interaction between Pupil and ISI ($F = 29.6, p < .001$). This reflected faster reaction times to targets behind constricted compared to dilated pupils during short ISIs ($p < .01$) and the opposite pattern during long ISIs ($p < .01$).



Conclusions

- Two dot probe tasks provided evidence of attention capture effects caused by differences in pupil size. Attention was not randomly allocated between otherwise identical faces, but drawn toward constricted or dilated pupils.
- Initial attention capture and attention capture in low trust faces, by constricted pupils, surprised us as we predicted the opposite effect. We speculate our constricted pupils were more extreme in size than our dilated pupils, which may have caused this pattern of results.
- We were likely underpowered in the main experiment for the 3-way interaction of Pupil, Trust and ISI ($p = 1.8$). Descriptively, constricted pupils drew attention at short ISIs in both high and low trust faces, but with longer viewing times, larger pupils drew attention more powerfully in high trust faces.

References

1. Bradley *et al* (2008) *Psychophysiology* **45**, 602-607.
2. Tombs & Silverman (2004) *Evolution and Human Behaviour* **25**, 221-228.
3. Kret & De Dreu (2019) *Journal of Experimental Psychology: General* **148**, 1299-1311.
4. Pawling *et al* (2017) *British Journal of Psychology* **108**, 169-190
5. Puls & Rothermund (2018) *Cognition and Emotion* **32**, 450-463.