Perceived Animacy in People Proneness to Delusions

Santiago Castiello[1,2], Joan D. Ongchoco[2,3], Brian Scholl[3] & Philip R. Corlett[2]

[1]Department of Experimental Psychology, University of Oxford; [2] Department of Psychiatry, Yale University;
[3]Department of Psychology, Yale University

Highlights

- General population with elevated paranoia scores exhibited higher false alarm rates in a perceived animacy task.
- We developed a perceived animacy detection model (DWIM) and fitted to individual participants.
- Sheep path entropy may be a low level visual feature promoting a chase detection impairment in people with elevated scores of paranoia.

Introduction

We studied to what extent an already validated task (van Buren et al., 2016) of Perceived animacy (PA) is associated with paranoia in general population. PA is a visual and cognitive phenomenon where people attribute intentions to inanimate dynamic shapes (Gao et al., 2009; Heider & Simmel, 1944). PA studies conducted in people diagnosed with schizophrenia, have found a lower discriminability (Roux et al., 2015) and interaction between hit rates and SZ when manipulating the 'wolf' chasing efficacy (Langdon et al., 2014). We hypothesized that elevated paranoia would exhibit higher false alarm rates.

Methods

One hundred and fifthly participants were recruited. We excluded thirty participants given a lack of task sensitivity and evidence of responding randomly or extremely fast (in both task and questionnaire). After exclusion criteria we finished with a N = 120. Participants were recruited via MTurk® and CloudResearch®, and were exposed to a PA chase detection task. In half of the trials one disc (Figure 1: Chase trials) followed another, in the second half not (No Chase trials). Participants were asked to detect whether a chase was occurring or not. –Entropy: $H = ln(\sigma_x \sigma_y)$ (see Treviño, et al., 2018)–.

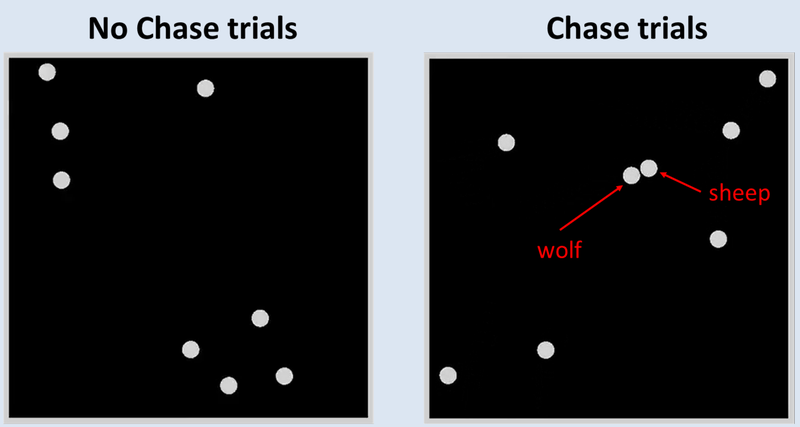

Figure 1. Task schematic description. Participants were exposed to 200 trials, 100 of each of two trial types: No Chase (left) and Chase (right). Each trial was a 4 sec. display (van Buren, et al., 2016). Displays stopped when participants made one of two responses: chase or no chase.

Elevated vs Average Paranoia

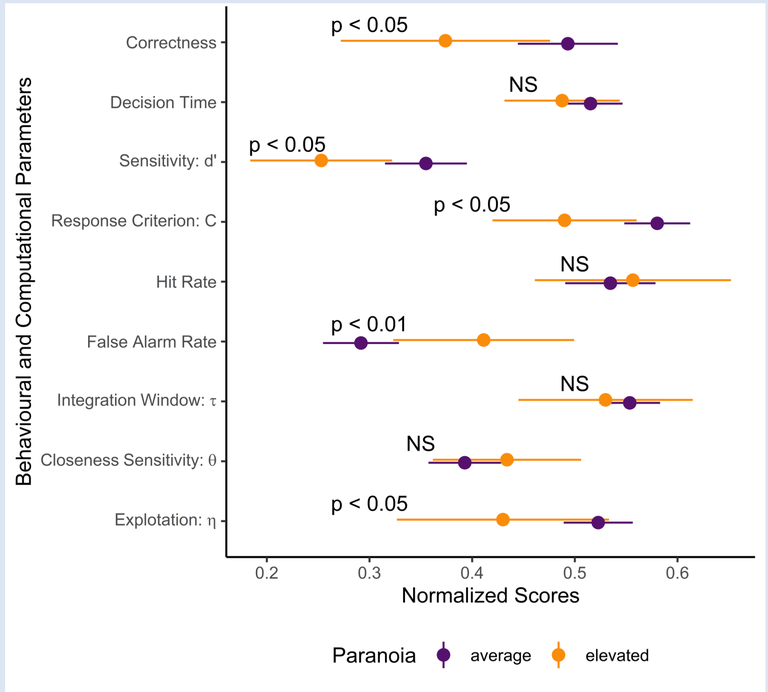

Figure 2. Elevated and Average paranoia comparison across all dependent variables normalized between 0 and 1. Correctness is the % of correct trials. Decision time between the display onset and detection response. Sensitivity, response criterion, hit and false alarm rates are calculated with classic Signal Detection Theory equations. Integration window, closeness sensitivity, and exploitation estimated with DWIM (see bellow).

Distance Window Integration Model (DWIM)

The DWIM is grounded in basic visual features of the displays, *e.g.*, the distance between two discs. This model assume that people are detecting chases based on the how close are two discs for a τ window of time (number of frames). Hence, if two discs are closer than a threshold θ pixels for a τ window, then the probability of detecting a chase will be η. Thus, the probability of detecting a chase at every trial is:

$$p(chase) = \begin{cases} \eta & ; if \sum_{28}^{d} \left\{ \left[\left(\sum_{f+\tau}^{f} \left(\boldsymbol{D}_{f,d} < \theta \right) \right) == \tau \right] > 0 \right\} \\ 1-\eta; & otherwise \end{cases}$$

where f represent a frame, and $\boldsymbol{D}$ is a matrix representing each trial with the distances between all the discs (columns) and the total number of frames (rows), *i.e.*, is a 120 (frames) x 28 (distances) sized matrix per trial.

Entropy of Visual Chasing

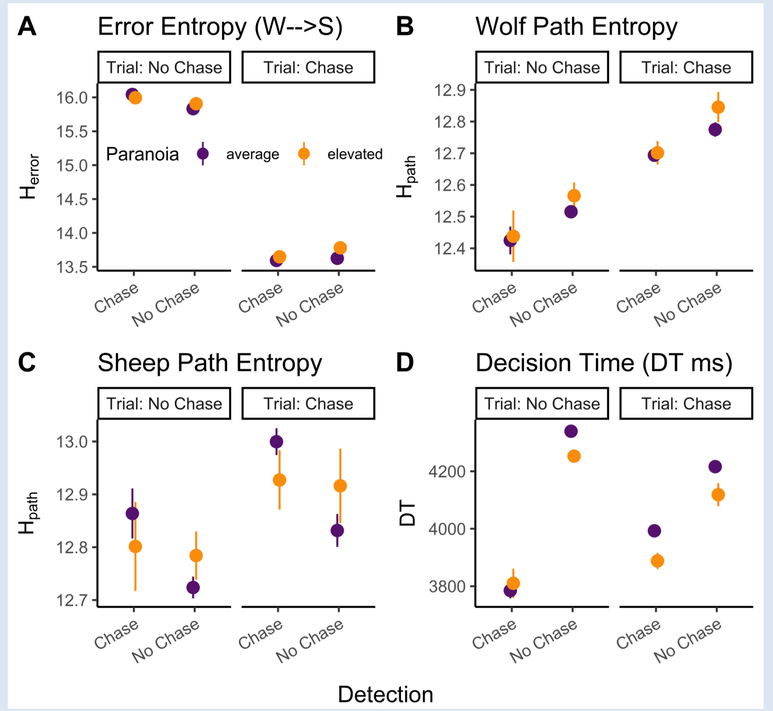

Figure 3. X-axis is the participant's detection response, left and right subpanels are the trial types (ground truth). **A.** Entropy from the wolf (W) with respect the sheep (S). **B.** Entropy of the W with respect its own trajectory. **C.** Entropy of the S with respect its own trajectory. **D.** Decision times in milliseconds.

Results and Discussion

We found that people with elevated scores of paranoia exhibited higher false alarm rates. However, a second hypothesis whether people with elevated paranoia would exhibit a shorter integration window (τ) was not corroborated. In addition, we found that that people with elevated paranoia's detection resposes were not as sensitive to the entropy trajectory of the sheep as the average paranoia group. A limitation of this study is that the excluded participants were overall higher in paranoia (data not presented).

Acknowledges and References

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-van Buren, B., (2016). *Psychonomic Bulletin and Review,*. -Gao, T., et al., (2009). *Cognitive Psychology.* -Heider, F., & Simmel, M. (1944). *The American Journal of Psychology.* -Roux, P., et al. (2015). *Journal of Psychiatry & Neuroscience.* -Langdon, R., et al. (2014). *Psychiatry Research.*. –Freeman, et al., (2021). *Psychological Medicine.* -Treviño, et al. (2018) *Frontiers in Behavioral Neuroscience.*