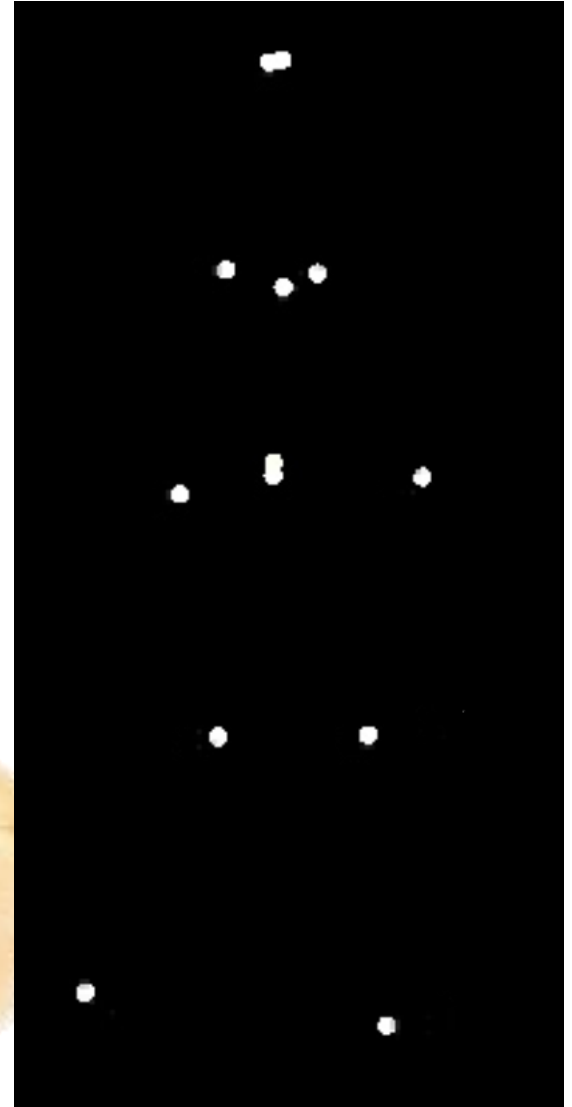


I see moving people:
Expectations drive detection of biological motion
in noisy point-light displays

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Biological motion processing

- Humans easily recognize biological motion from point-light displays of a human walker and infer a broad range of the walker's social characteristics (Johansson, 1973; Blake & Shiffrar, 2007; Thompson, 2015)
- Biological motion processing is found in unexperienced chicks and newborn children (Vallortigara et al., 2005; Simion et al., 2008)



Motivation

- Research so far has focused on identified the bottom-up constraints of recognition of human walkers
 - Salience of short temporal intervals and extreme dots (Mather et al., 1992)
 - Processing complex stimuli composing the walker inhibits tracking of the movement (Hunt & Halper, 2008)
 - Sensitivity to inversion (Sumi, 1984; but see Troje & Westhoff, 2006) – a life detector?
- Little is known about cognitive penetrability of biological motion processing
 - role of attention (Thornton et al., 2002; Nizamoglu & Urgen, 2024)
 - **effect of expectations** (Uçkan and Urgen, 2025) – auditory cues help recognize biological motion
- Do expectations induced with explicit verbal instructions bias detection of biological motion (when sensory input is unreliable)?

Theoretical background

- Agency detection and supernatural beliefs (Barrett & Lanman, 2008)
- HADD vs predictive processing account (Andersen, 2019)
 - Bias to over-detect agents vs interaction of priors and reliability of perceptual data
 - Studies in virtual reality (Andersen et al., 2019) and on voice hearing (Szymanek et al., 2024b)



The study

$N = 74$

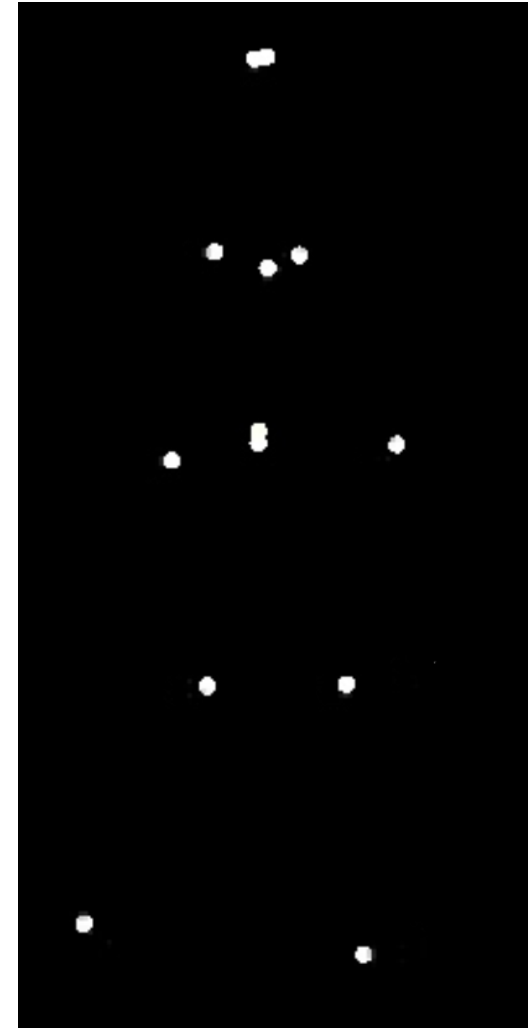
Age: 18–40

52 females, 4 other

B-S (expectations) x W-S (noise)

- Hypotheses: (1) expected frequency of biological motion in stimuli will drive participants' response bias and (2) this effect will be stronger at higher levels of noise.
- Task: detect a walker in point-light displays (Yes / No response; 2000ms)
- Stimuli (van Elk, 2013):
 - 2000ms
 - 50% intact walker, 50% scrambled walker
 - 4 levels of noise: 24, 48, 96, or 192 scrambled dots
- Manipulation of expectations – verbally induced expectations
 - “High expectations” group – 75%
 - “Low expectations” group – 25%

+ measure of supernatural beliefs (PSBS; Dean et al., 2021)

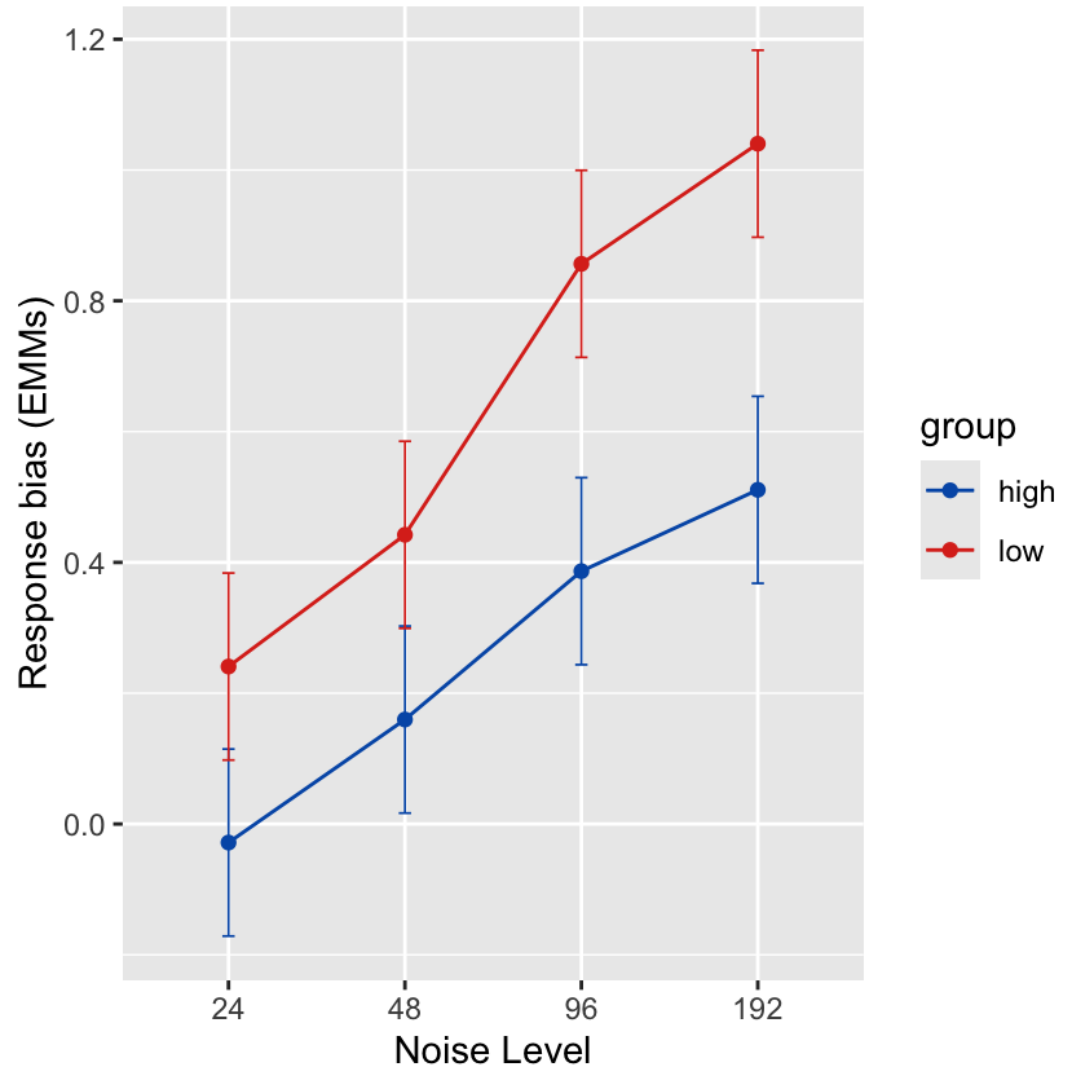


Analysis

- **Manipulation check:** sensitivity as a function of noise
 - Linear mixed-effects model ($R^2 = 0.75$)
 - Sensitivity decreased with each level of noise (all $ps < .001$)
- **Main analysis:** response bias as a function of group*noise
 - Linear mixed-effects model ($R^2 = 0.62$)
- **Exploratory analysis:** response bias as a function of PSBS score*group*noise
 - No consistent, significant main effects or interaction
- Data, analyses, materials: <https://osf.io/v9nm4>

Results

- Main effect of expectations ($\beta = 0.27, p = .009$)
- Main effects of noise:
 - 24-48 ($\beta = 0.19, p = .019$)
 - 48-96 ($\beta = 0.42, p < .001$)
 - 96-192 ($\beta = 0.54, p < .001$)
- Interaction at noise levels:
 - 24-48 ($\beta = 0.01, p = .906$)
 - 48-96 ($\beta = 0.20, p = .075$)
 - 96-192 ($\beta = 0.26, p = .021$)
- EMMs: simple effects of expectations at noise level 192 ($\beta = 0.53, p < .001$)



Higher response bias = stronger bias to say “no” / more conservative response strategy

Main findings

- Perception of biological motion can be shaped by verbally induced expectations
 - But which visual algorithms respond to expectations?
 - Troje and Chang (2023): two systems for recognition of biological motion: “life detector” and global pattern processing system salient in social cognition
- Results are in line with the predictive processing view of agency detection
 - Priors interacting with sensory unreliability might underlie experiences of illusory detections of agents
 - No evidence for HADD-like effects (supernatural beliefs, noise)



Take-home message

- Detection of biological motion is driven by expectations
- The role of expectations increases when sensory data is unreliable
- This effect might help us understand experiences of encounters with supernatural agents

Thank you for your attention

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We report all data exclusions, all manipulations, and all measures in the study. The dataset, analysis scripts, and materials are available on the Open Science Framework (<https://osf.io/v9nm4/>).

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