Investigation of the Interplay Between Natural and Learned Priors in Autistic and Non-Autistic Individuals

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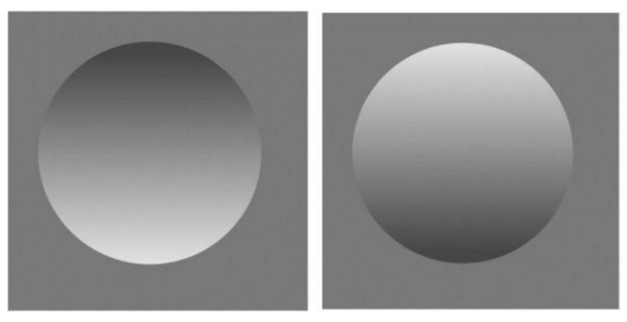
Introduction

1. Background

- According to the Bayesian theory of perception, decisions on perceptive stimuli are based on sensory evidence and **prior knowledge**[1].

Ex: Light from above[2] Oblique effect[3]



- Atypical perception in **Autism Spectrum Disorder** (ASD) has been attributed to attenuated priors (i.e., imbalance hypothesis)[4]:
  - Intact use of explicit experimental priors[5] and natural priors[6].
  - **What about learning priors and unlearning existing priors?**

- Prior knowledge can be separated into:
  - **Natural priors** –extracted from the environmental statistics during the perceptual development– ex: enhanced sensitivity to cardinal orientations (e.g., 0° / 90° / 180°) compared to oblique orientations (i.e., oblique effect[8]).
  - **Experimental priors** –induced by a task– ex: mean of presented orientations.

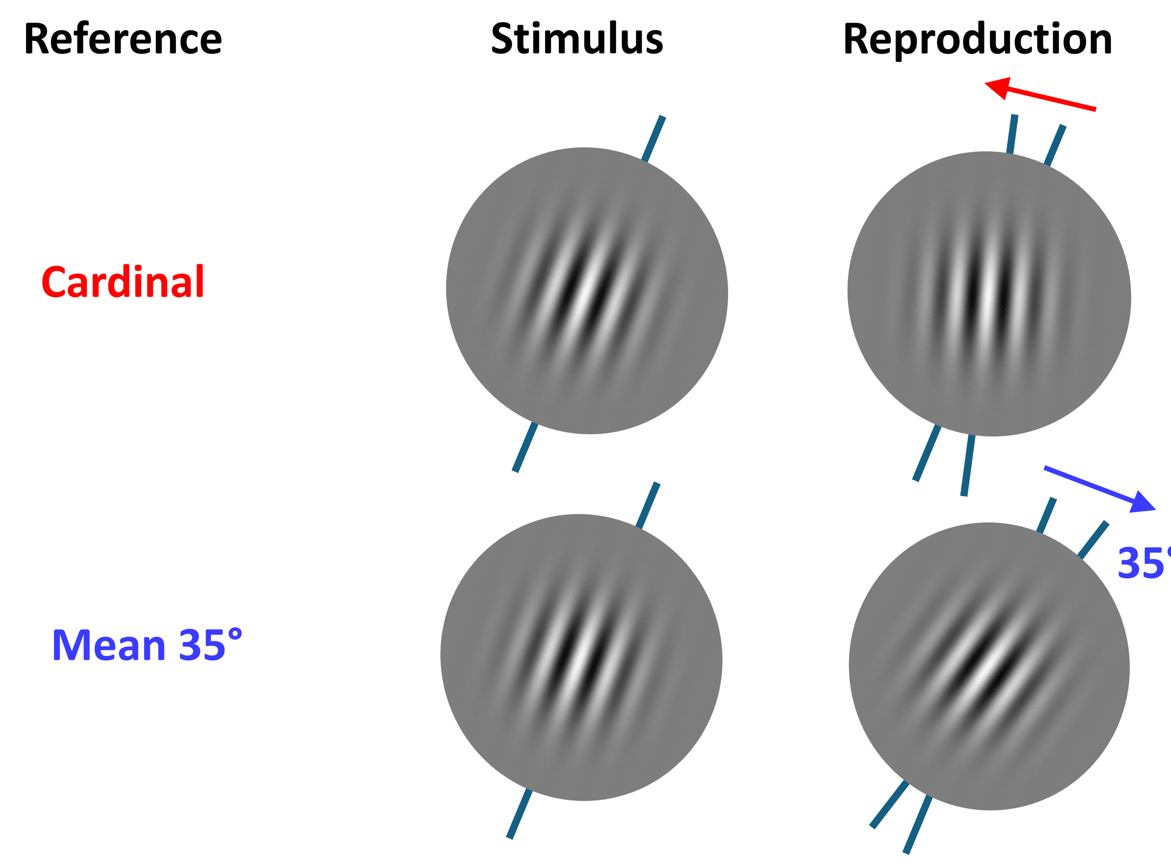
- However, the way these two types of prior interact and influence perceptual decisions when competing remains unknown.

2. Objectives

- To directly compare the effect of natural vs. experimental priors on perceptual decision within the same task across non-autistic and autistic groups.

3. Key concepts

- Investigation of prior of reference with **regression to the mean** = Stimulus attracted to the prior of reference (natural vs. experimental).



4. Hypotheses in autism

After long exposure to a mean at 35°

- **Less flexibility** to change the prior of reference

→ more regression to the cardinal

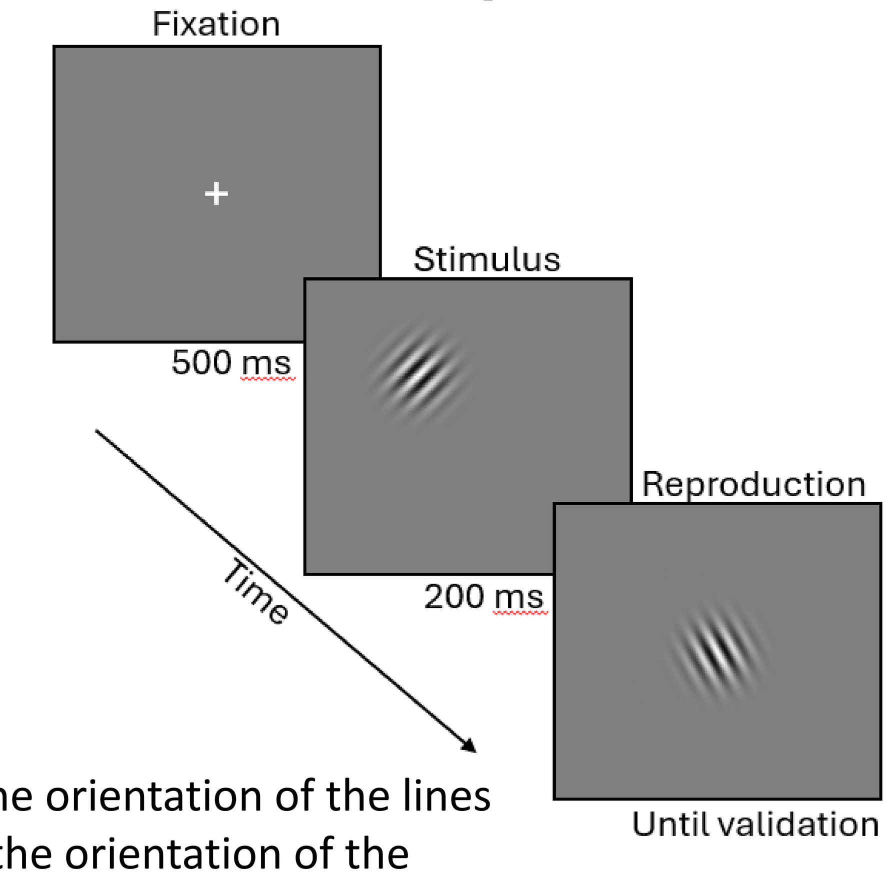
- **Less robust natural prior**

→ more regression to the mean

- **Similar** use of the two kinds of prior

Method

Trial sequence



- **Task**: Adjust the orientation of the lines to reproduce the orientation of the stimulus.
- **Participants**: Autistic (n = 3) and non-autistic (n = 3).

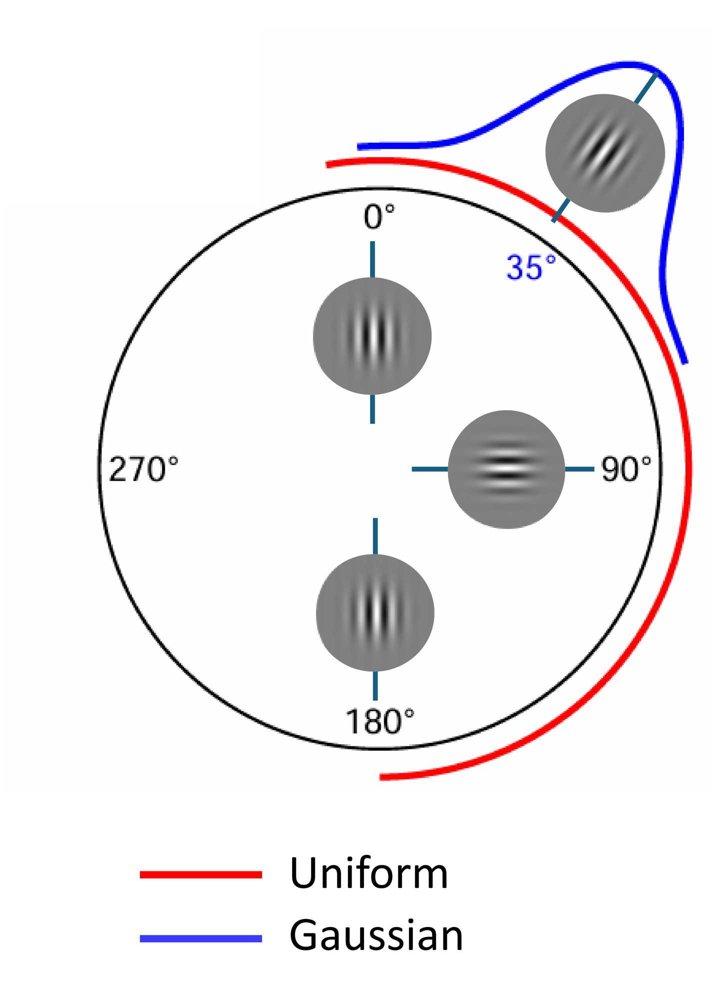
Blocks

1. **Pre-test**
→ Uniform distribution, from -10° to 180°
→200 trials
→Purpose: investigating the natural prior (attraction to the cardinals)

2. **Learning**
→Gaussian distribution, mean = 35°, sd = 10°
→400 trials
→Purpose: teaching a new mean to modify the prior of reference (from natural/cardinals to experimental/mean)

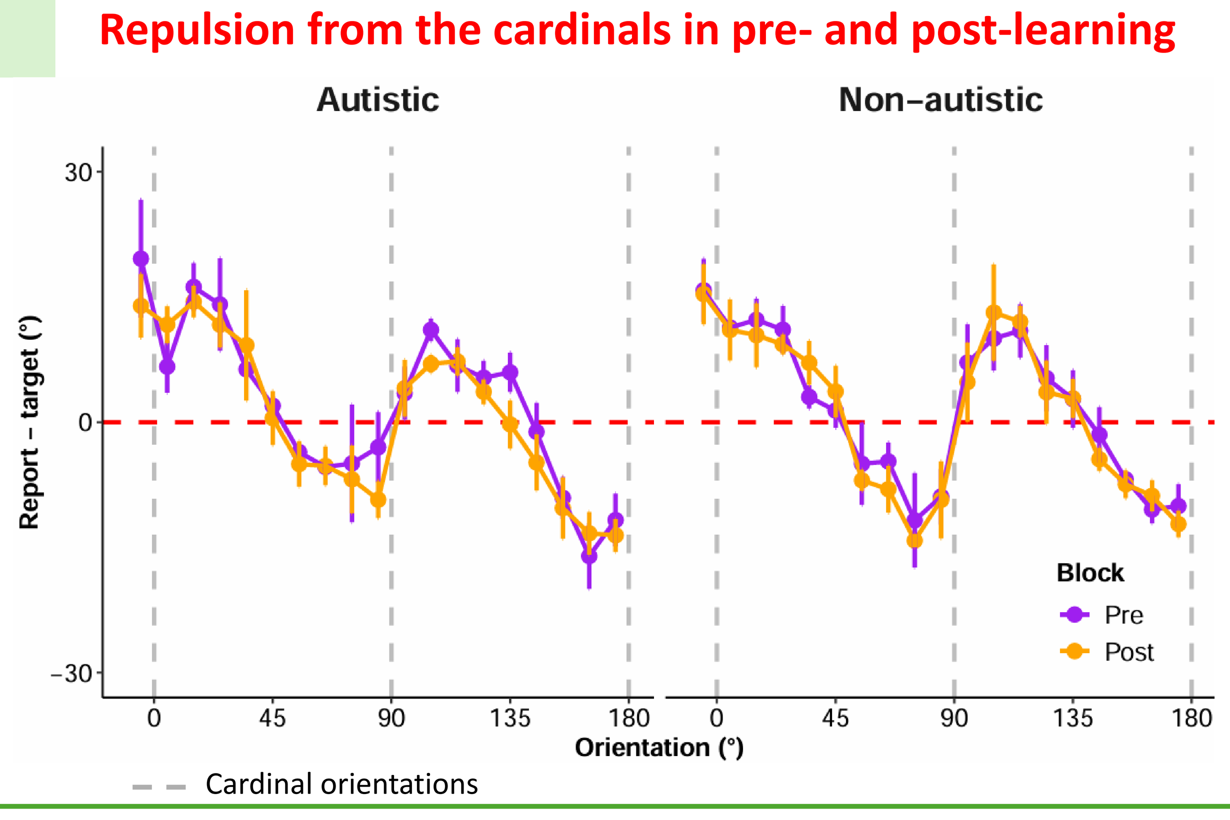
3. **Post-test**
→ Same as pre-test
→ Purpose: testing the change in prior of reference

Distributions

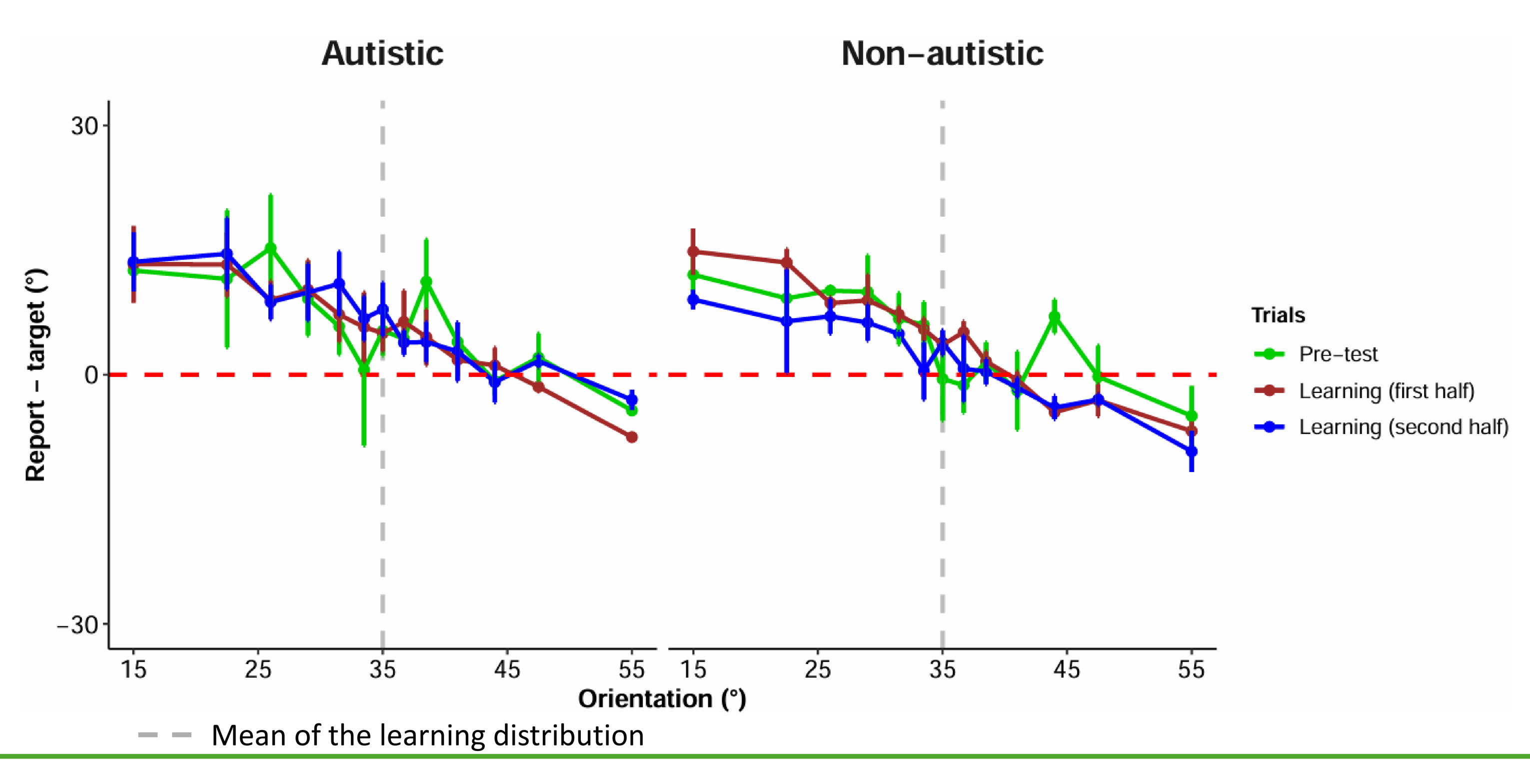


Results

Repulsion from the cardinals in pre- and post-learning



No change of prior of reference during the learning phase



Discussion

- While performing the reproduction of orientation task, all participants showed a strong repulsion from the cardinal orientations.
- The exposure to the experimental prior (mean = 35°) did not affect the effect of natural priors (i.e., repulsion).
- The error in the reproduction task, and prior of reference, are not modified throughout the learning block.
- More participants are required to test for any differences between groups.

Contrary to suggested views, autistic individuals have intact integration of natural and experimental priors.

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