Intact Bayesian perceptual decision making and metacognition in autism

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Introduction

Key terms
- **Perceptual Decision making** = process of making inferences about the environment based on sensory informations, can involve metacognitive process.
- **Bayesian perception** = making perceptual decision is a process combining prior, reward and likelihood informations.

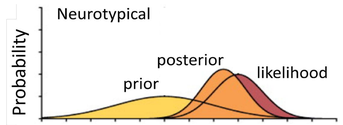
Atypical perception is a core phenotype of Autism Spectrum Disorder (ASD).

Bayesian view of atypical perception in ASD:
- Attenuated prior or enhanced likelihood.
- Predicts:
  → Reduced effect of prior knowledge in individuals with ASD.
  → Individuals with ASD will be more suboptimal compared to NT.
- However only a few studies in ASD directly investigated perceptual decision-making and perceptual metacognition.

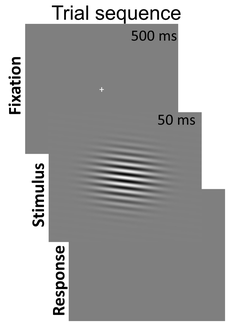
Aims:
- Perceptual decision making: To test whether and how the integration of prior, likelihood, and reward differs between individuals with ASD and NT.
- Metacognitive skills: To test whether and how confidence report in individuals with ASD reflect their performance and rely on sensory evidence and prior knowledge.

Bayesian decision-making

Perceptual decisions combine[1,2] :
1. **Prior** (Initial probability for a given stimulus)
2. **Likelihood** (Sensory uncertainty)
3. **Reward** (Cost associated to a decision)



Method

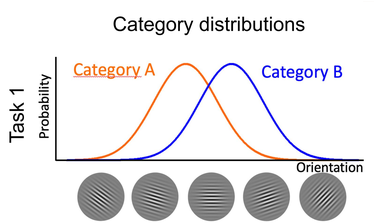


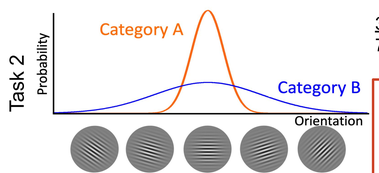
Population

Prior task: 45 NT, 31 ASD

Likelihood task: 40 NT, 17 ASD

Reward task: 48 NT, 30 ASD





Main manipulation

1. Prior experiment:
Category probabilities across blocks
A = 25% A = 50% A = 75%

2. Reward experiment:
Points per correct answer across blocks
A = 1pt A = 2pts A = 3pts

3. Likelihood experiment:
7 levels of contrast

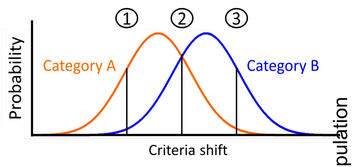
Optimality calculation

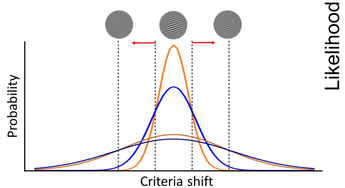
Example for the prior task:
Difference between the optimal criteria shift ($C_{optimal}$) and individual criteria.

$\beta_{optimal}$ = (1 - base rate) / (base rate)

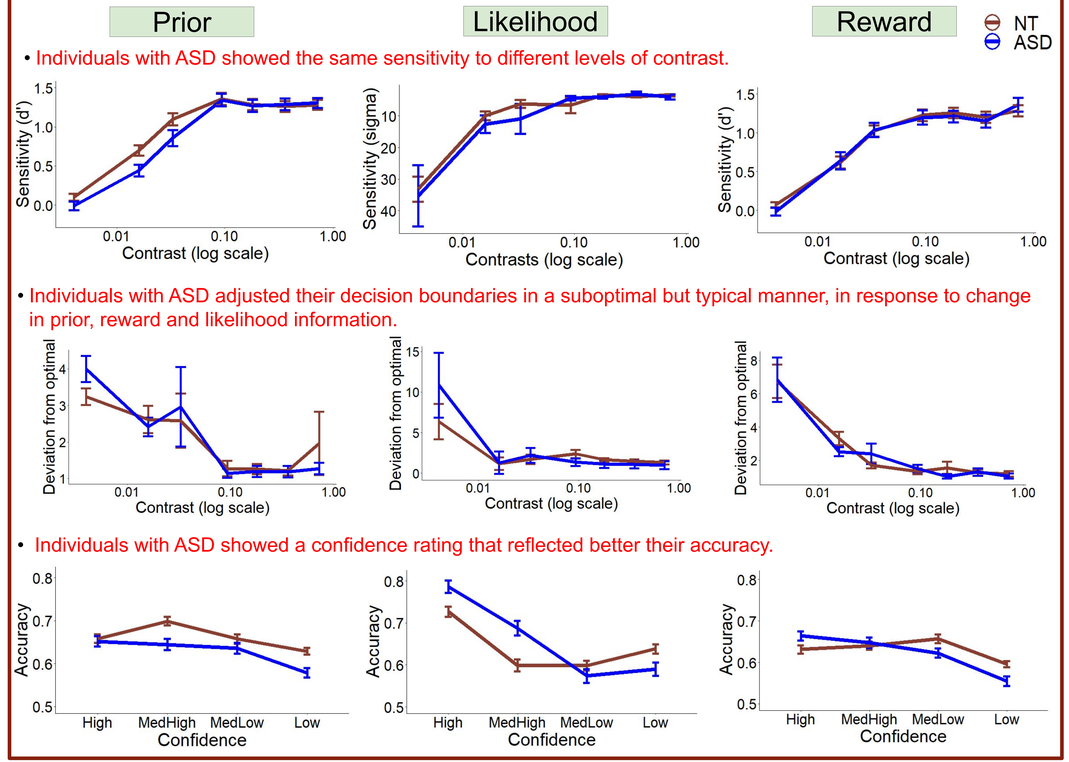
$C_{optimal} = \log(\beta_{optimal})/d'$

Predictions





Results



Conclusions

- In perceptual decision-making, when integrating prior, likelihood, and reward information, individuals with ASD and NT are suboptimal to the same extent.
- Surprisingly, individuals with ASD demonstrate enhanced metacognition abilities in some conditions.

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