

# The Weighting of Prior Information in Confidence

Marika Constant, Elisa Filevich

1 - Berlin School of Mind and Brain; 2 - Bernstein Center for Computational Neuroscience (BCCN), Berlin; 3 - Humboldt-Universität zu Berlin, Faculty of Life Sciences, Department of Psychology



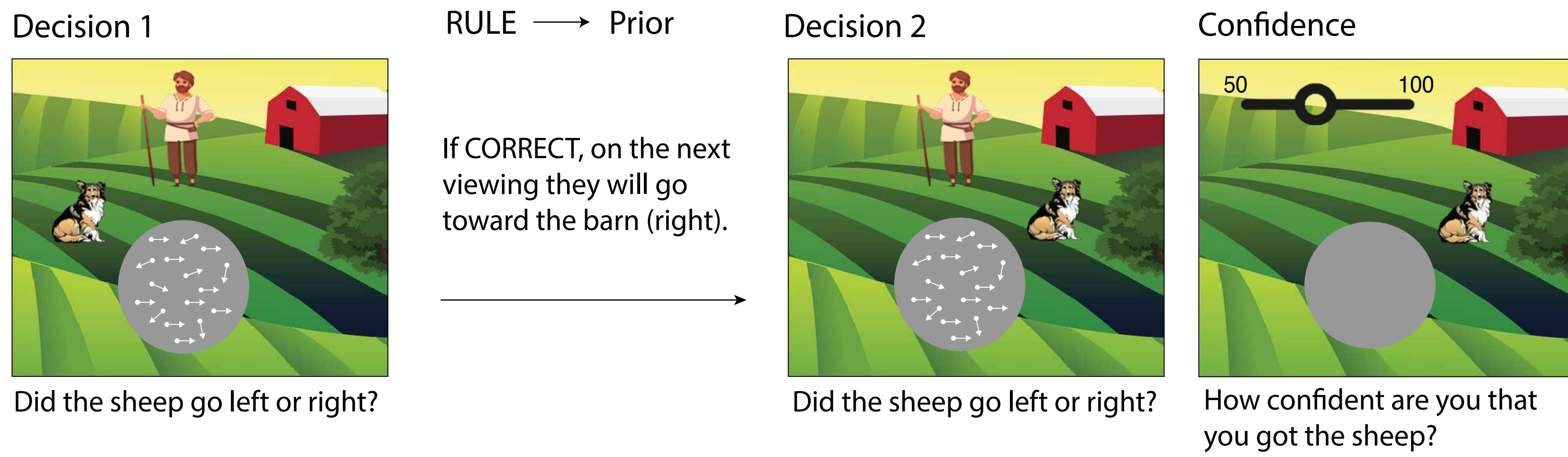
## Introduction

Standard Bayesian models of confidence have considered its computation to be based on the perceived posterior probability correct<sup>1,2,3</sup>. This assumes confidence to involve the optimal integration of priors and likelihoods. However, this may not be the case, and it is critical to understand how priors are integrated at the confidence level in order to make quantitative predictions about confidence across different situations. Here, we examined how information from priors is weighted in decisions, confidence, and metacognitive access.

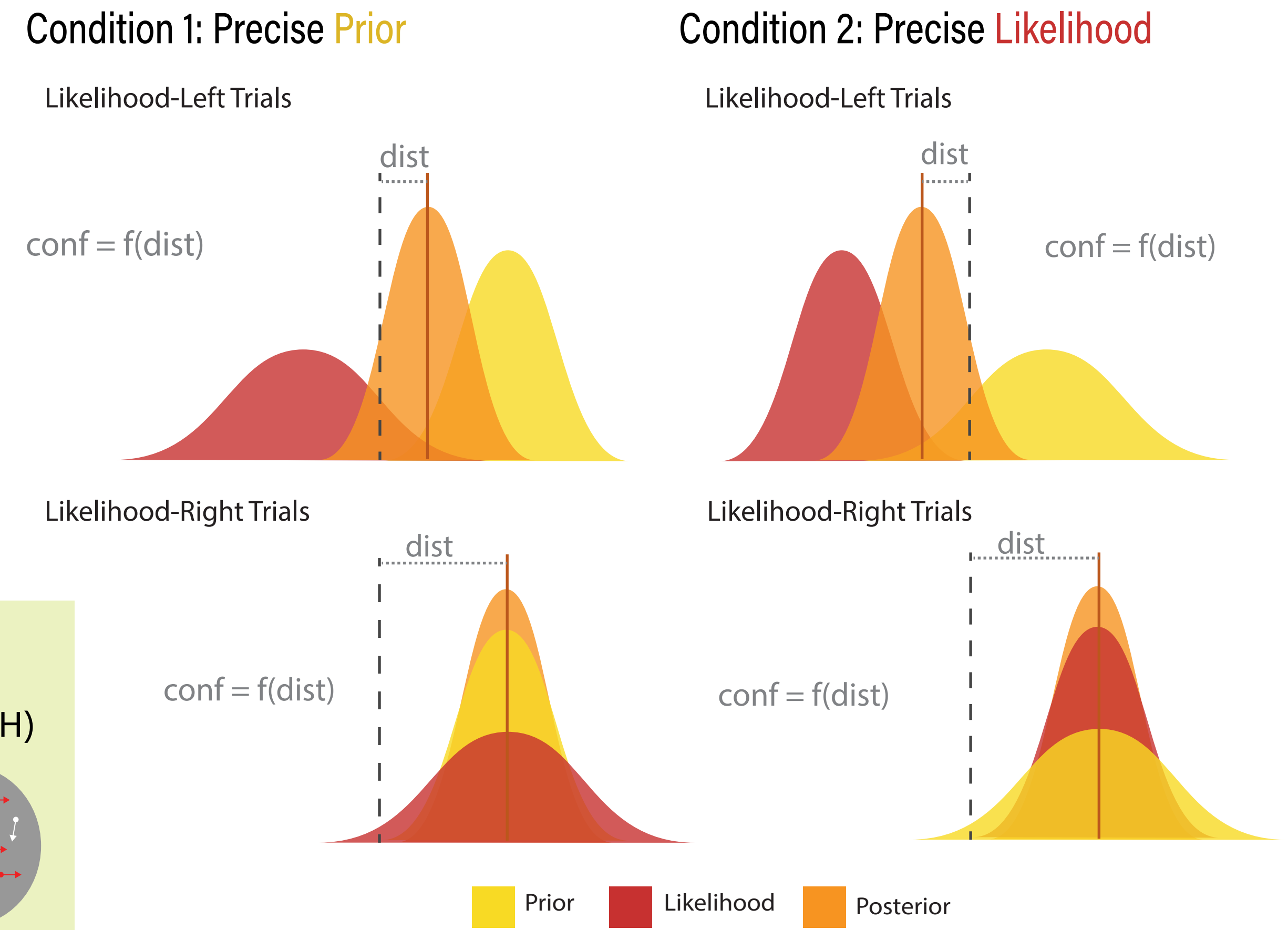
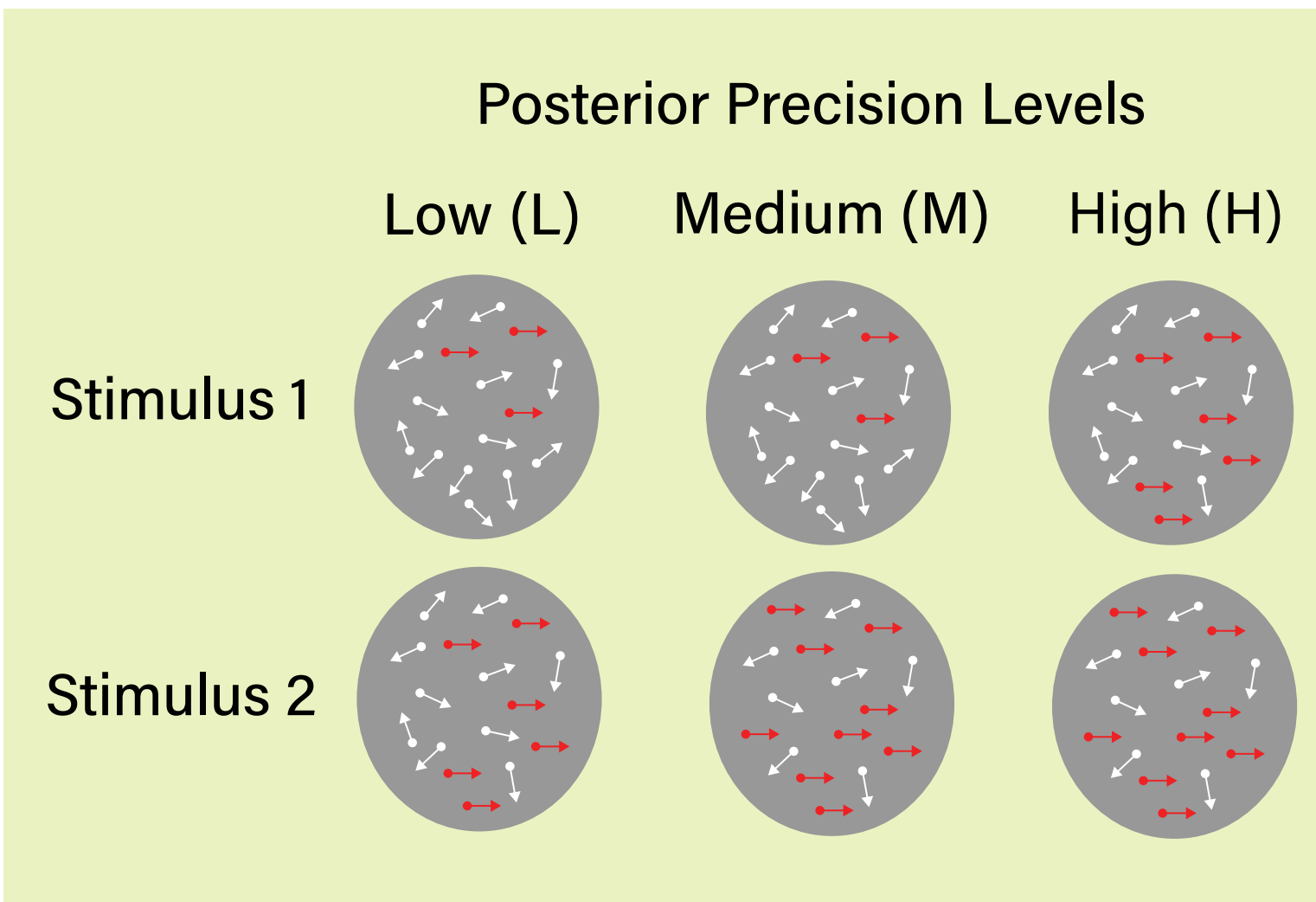
## Research Questions

- How are priors weighted at the perceptual decision and confidence levels?
- Do we have different metacognitive access to information from priors and likelihoods?

## Game-ified Task

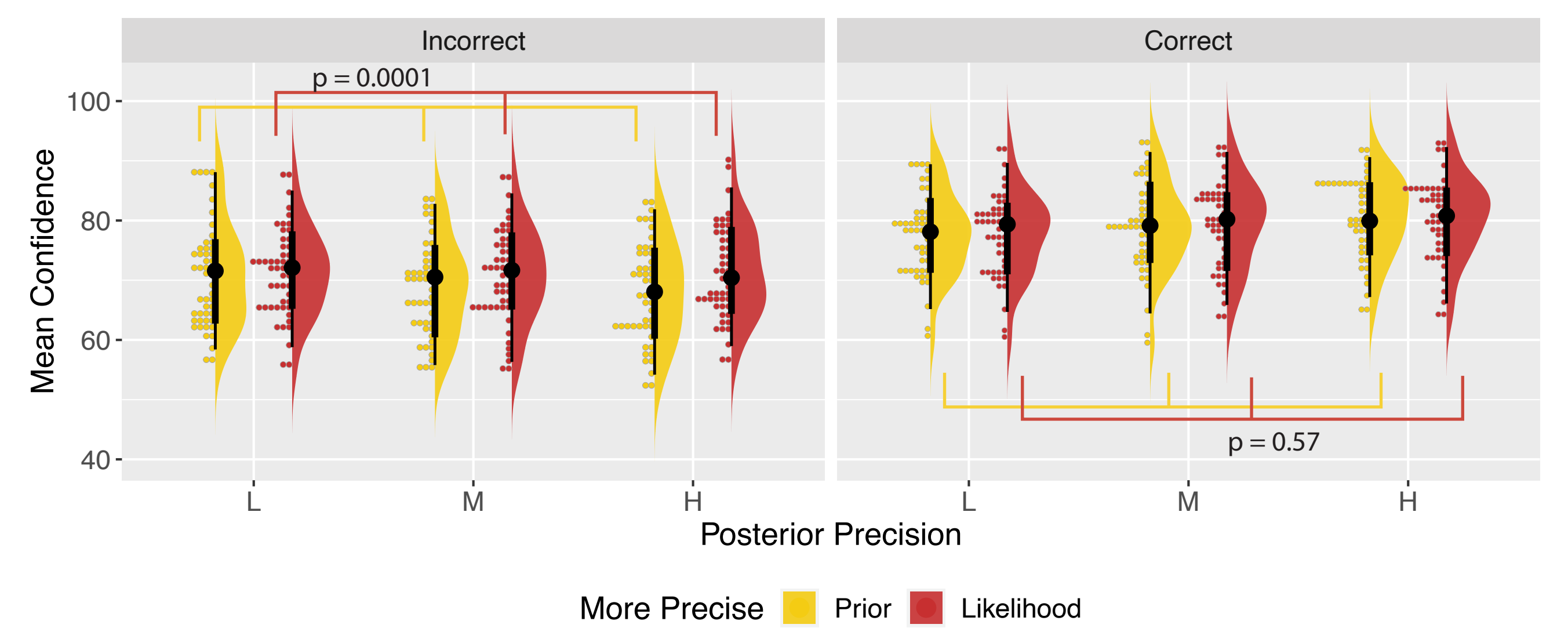
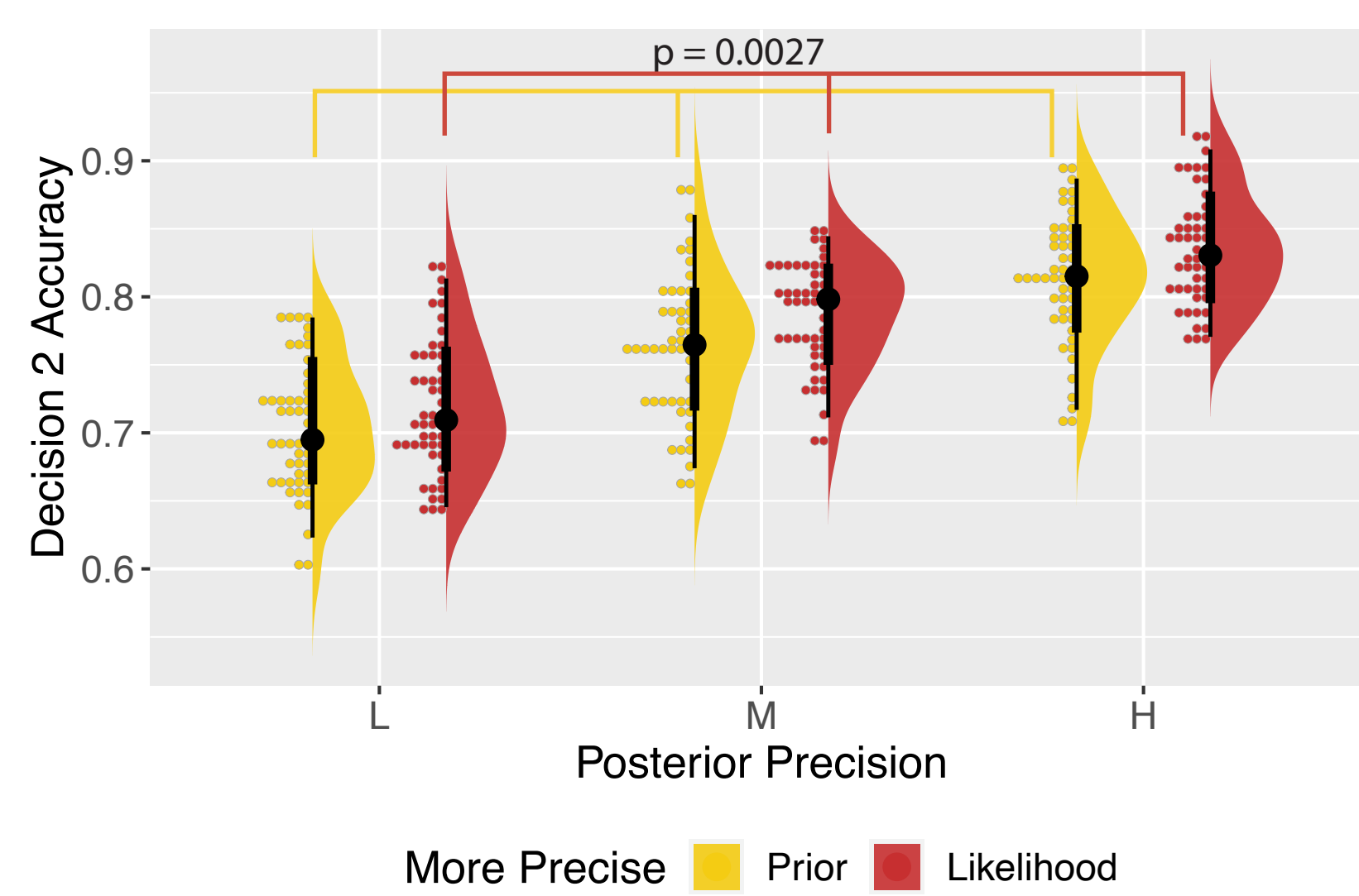
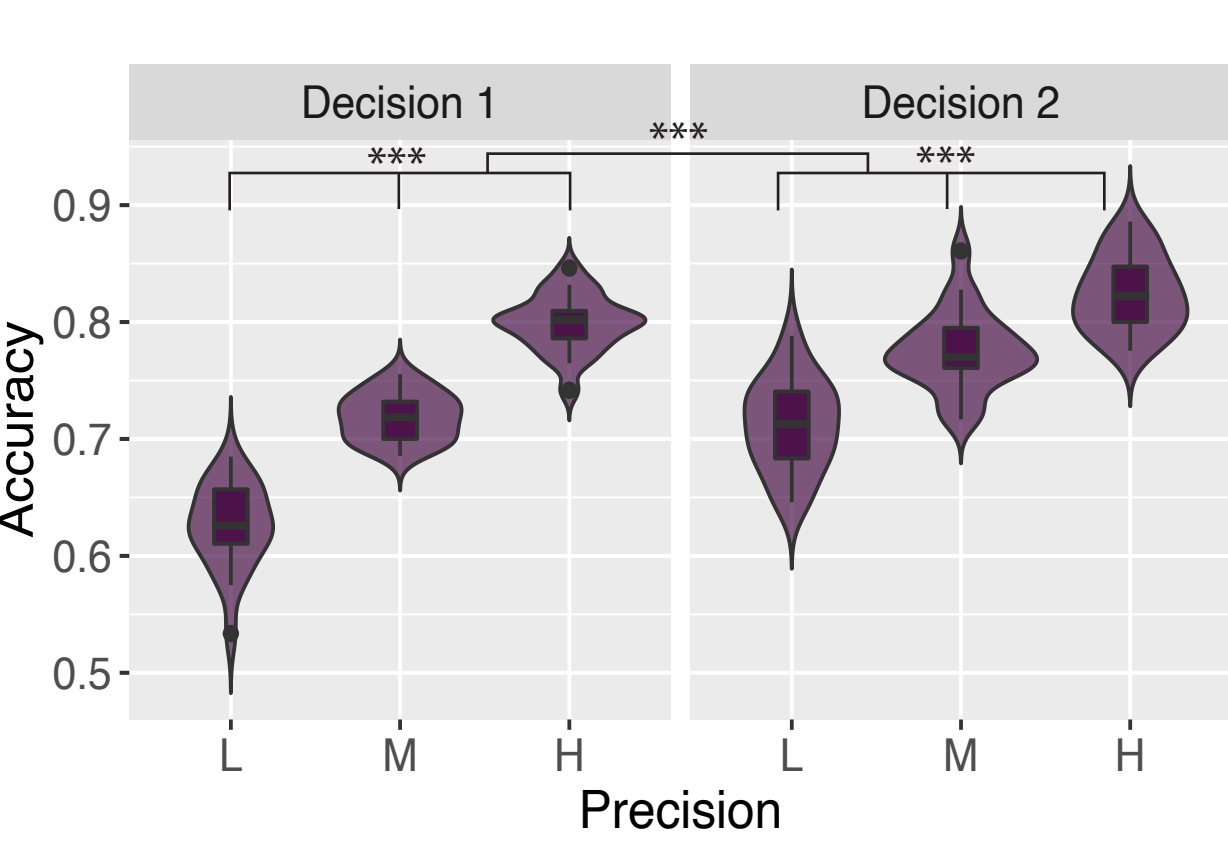


- dual-decision task allows priors and likelihoods to come from the same type of information, and be matched in precision
- 3 stimulus precision levels (leading to prior and likelihood precision), combined for 3 posterior precision levels per condition
- Precision levels yoked to medium level (71%) staircase
- 720 trials total (120 / condition and posterior precision level)



→ If the prior is weighted optimally relative to the likelihood, then Condition 1 will equal Condition 2 (for accuracy, confidence, and metacognitive efficiency).

## Behavioural Results

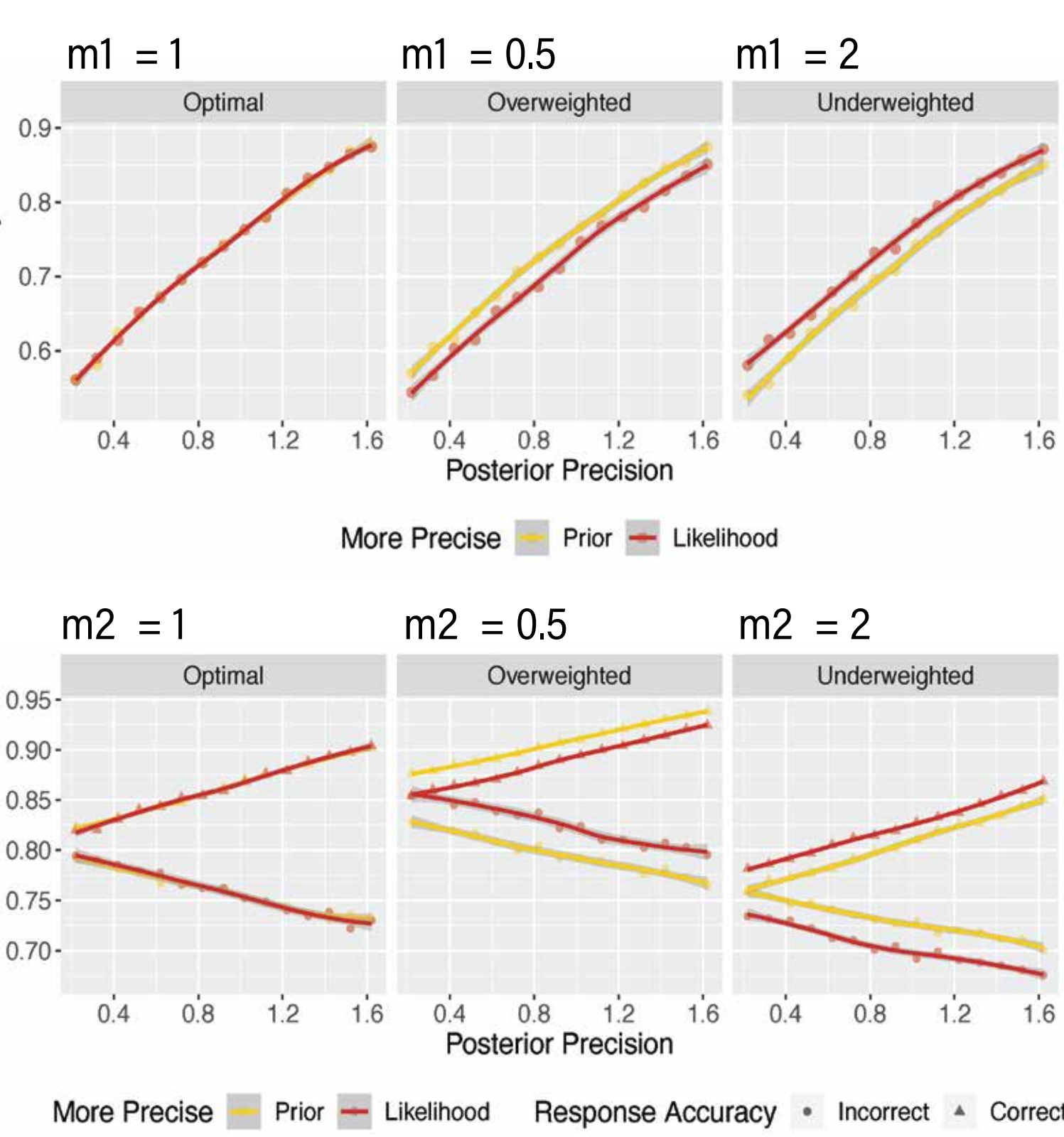


- Precision manipulation worked
- Participants used the prior

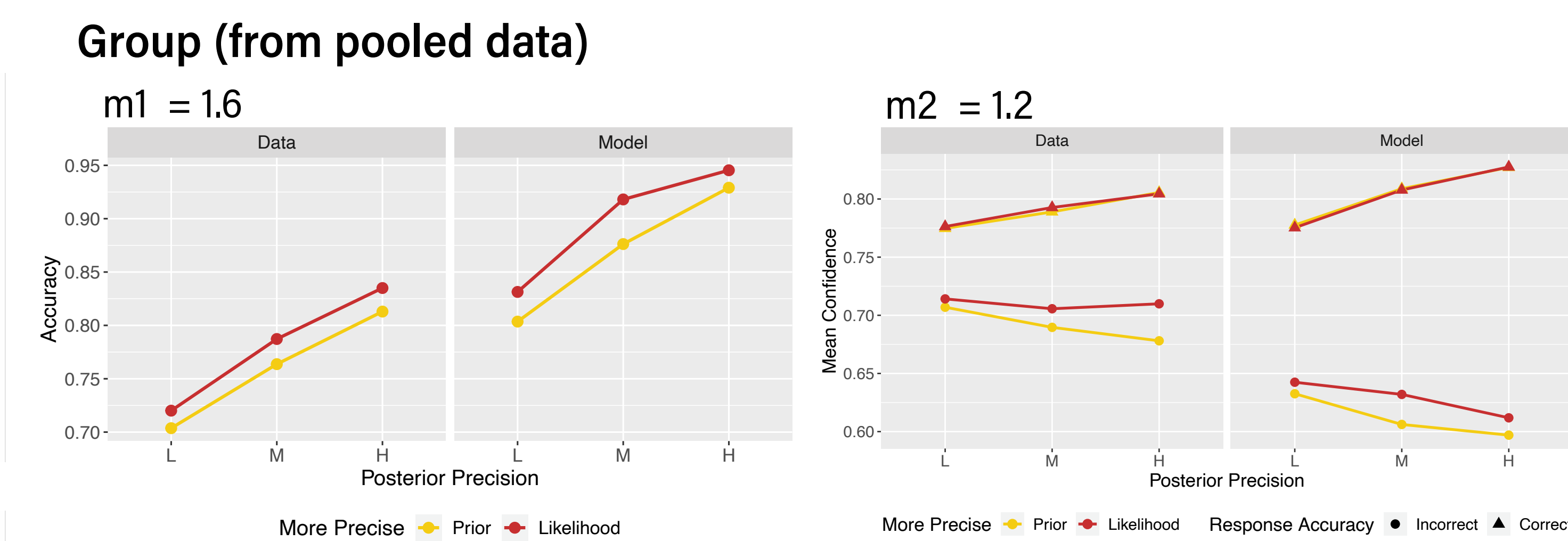
→ accuracy depends on condition, with higher accuracy when the likelihood is more precise, suggesting underweighting of the prior

→ mean confidence does not depend on condition following correct trials, suggesting the prior not to be suboptimally weighted in confidence  
→ mean confidence suggests the prior to be overweighted following incorrect trials

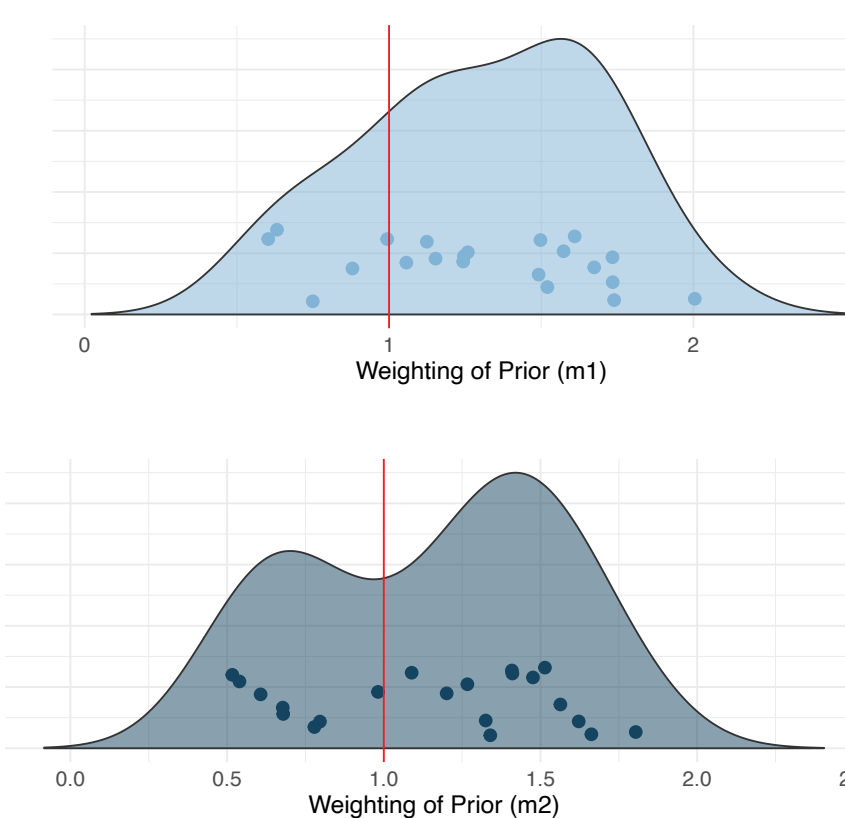
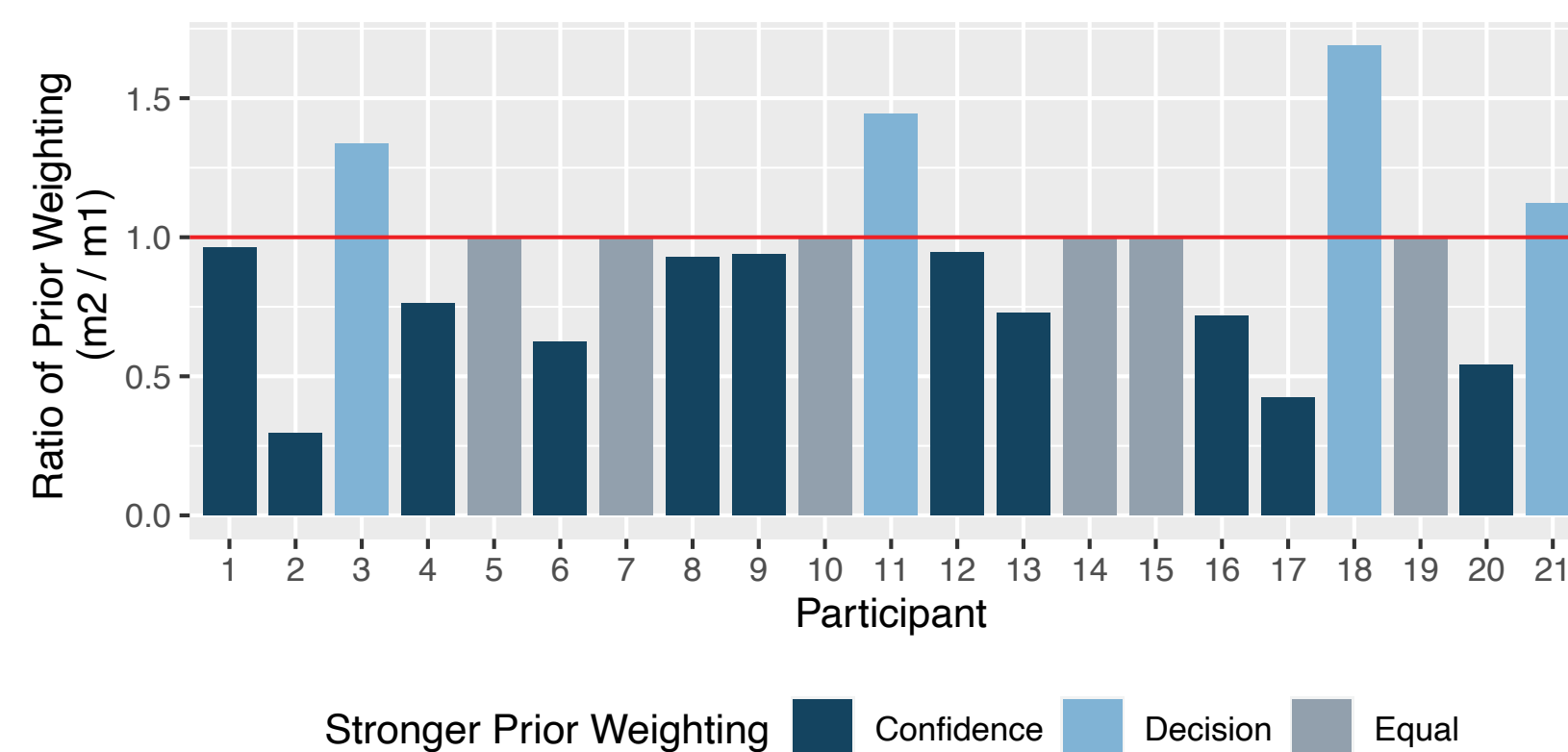
## Model Predictions



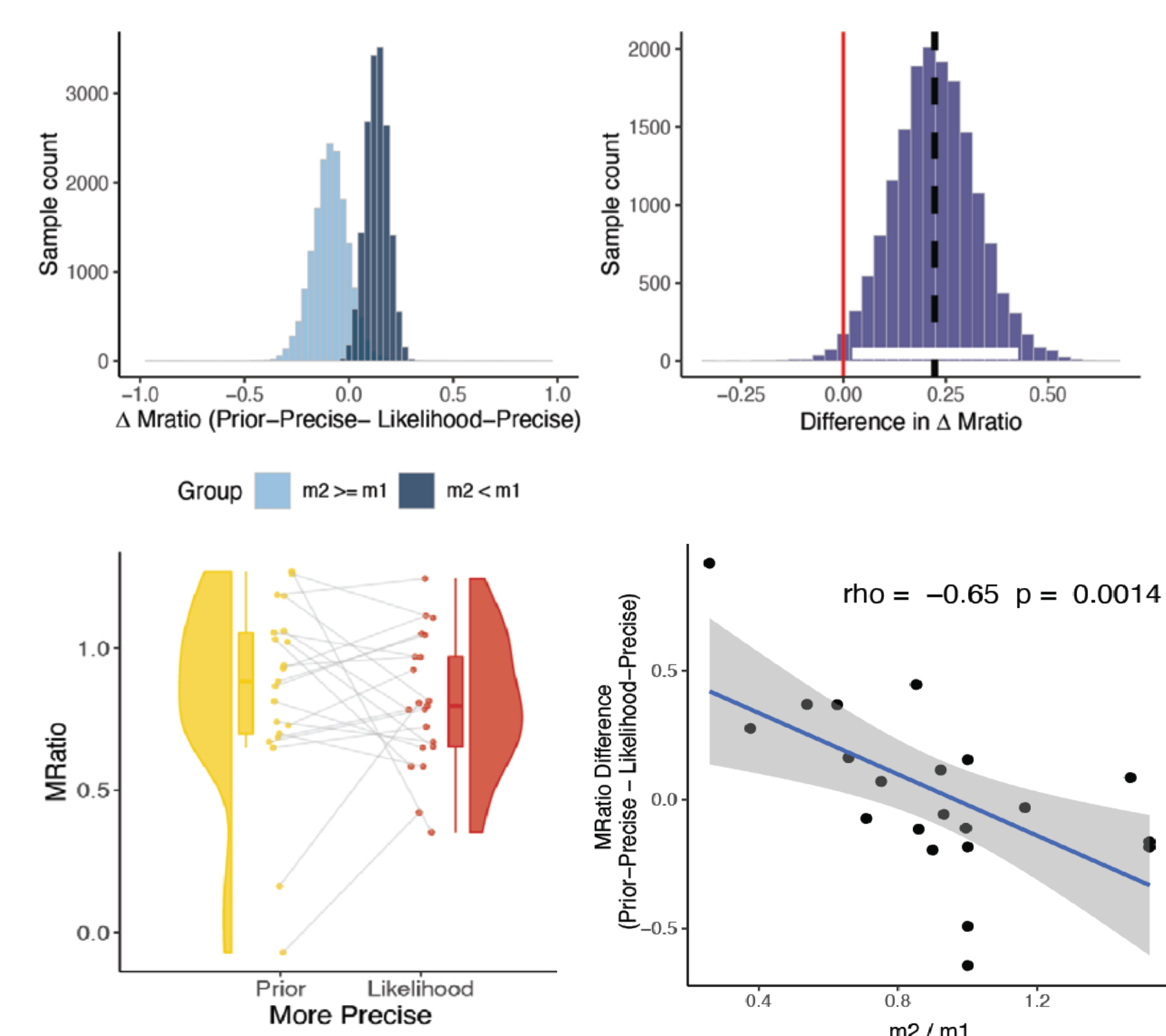
## Modeling Results



### Subjectwise



## MRatio Results



- pattern of m2 < m1 associated with MRatio difference between conditions
- priors used in metacognitive confidence judgments more than in perceptual decisions, leading to a higher MRatio

## Discussion

- people have access to prior information at the level of explicit, introspective confidence, even when they did not use that information in their decisions
- integration of priors might continue post-decisionally, or confidence judgments may allow enhanced access to information from priors
- may shed light onto clinical cases with supposed underweighting of priors, in terms of the processing level where this occurs

### References

- Sanders et al., 2016, *Neuron*, 90, 499
- Pouget et al., 2016, *Nat. Neurosci.*, 19, 366
- Fleming & Daw, 2017, *Psychol. Rev.*, 124, 91