Modelling Speed-Accuracy Trade-Offs in Confidence Judgements

Stef Herregods, Pierre Le Denmat, Kobe Desender
KU Leuven, Department of Psychology and Educational Sciences

Introduction

During decision-making, we **strategically adapt** to situations by trading off accuracy for speed. Processes underlying decision-making and its strategic adaptations can be accurately represented by the **drift diffusion model (DDM)**.

Decision confidence plays an important role in decision-making. Previous studies suggest that decision confidence results from the **continuation of evidence accumulation after making a decision**. However, it is unclear how agents decide to stop sampling evidence for confidence judgements.

Research Questions

- Can a DDM extended with confidence boundaries accurately represent the computation of confidence?
- Do agents have strategic control over confidence through changes in confidence boundaries?

Extending the Drift Diffusion Model

Decision-Making

Noisy evidence accumulates over time, until reaching a **decision boundary** and making a decision. Changes in speed-accuracy are represented through a change in **decision boundary separation.**
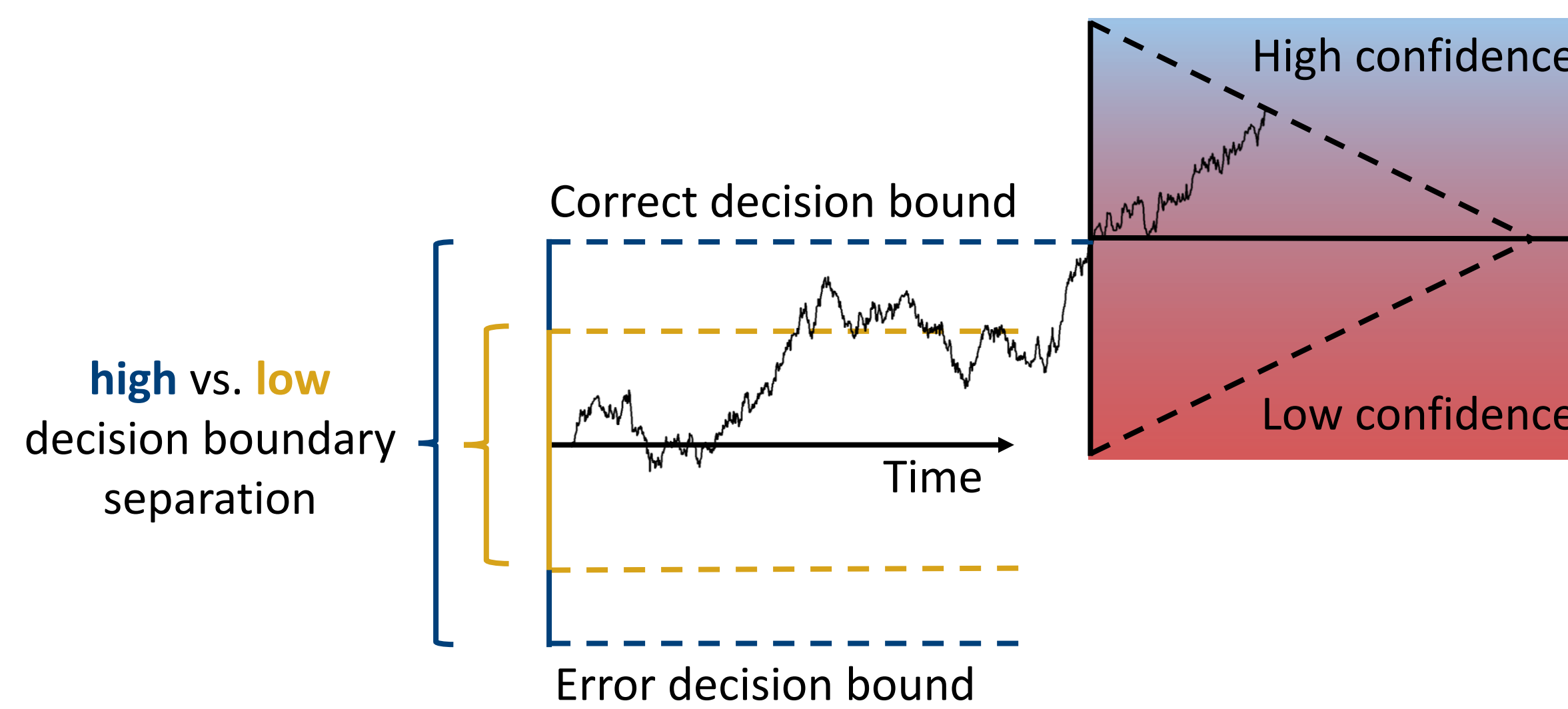
Confidence

Evidence accumulation continues after making a decision, until a **secondary confidence boundary** is reached. Post-decisional evidence determines the confidence judgement.
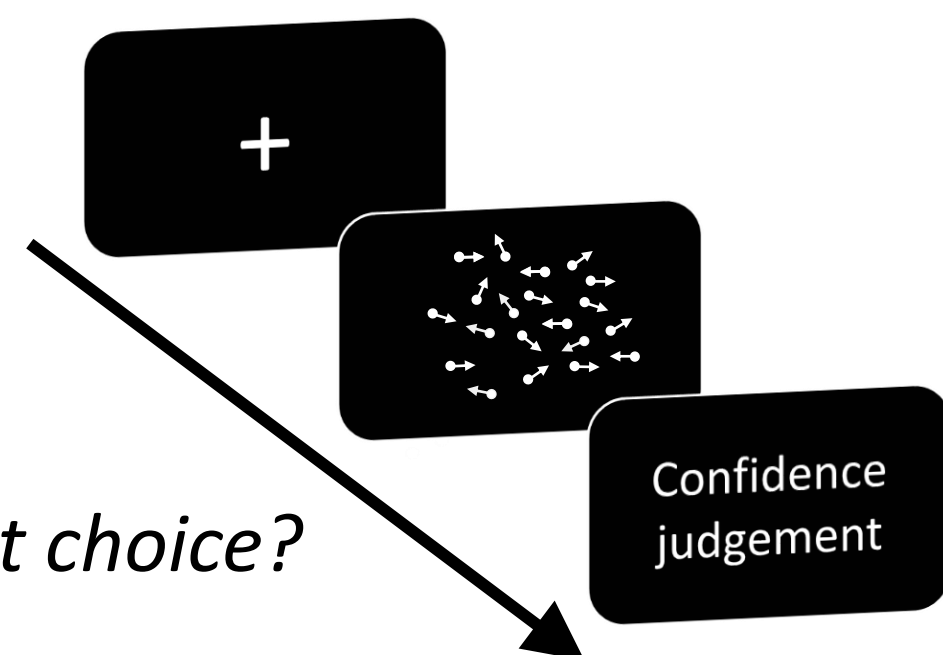

Methods

Task Procedure

1. **Dot motion decision task**:
   In which direction do most of the dots move?
2. Confidence judgement (CJ):
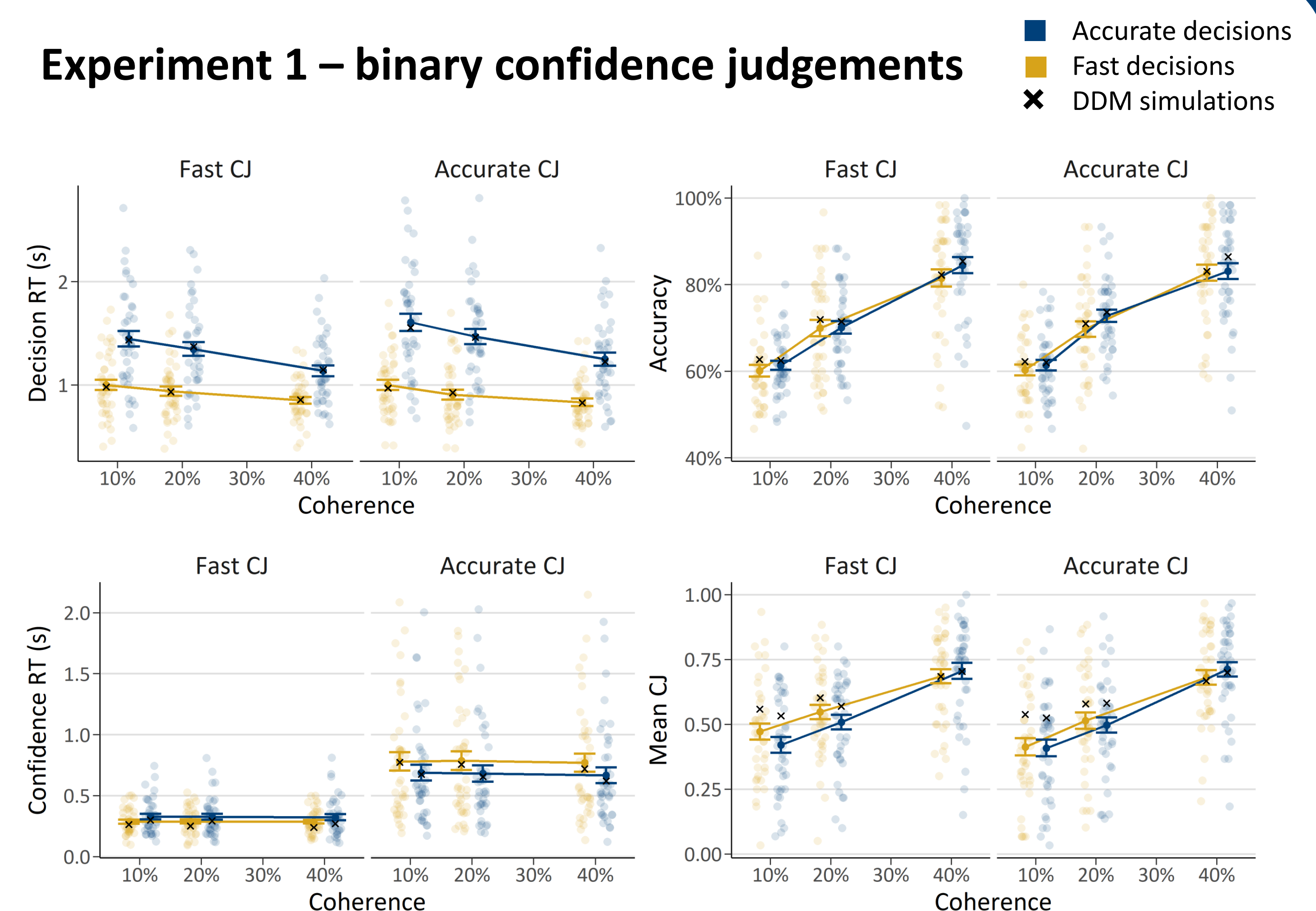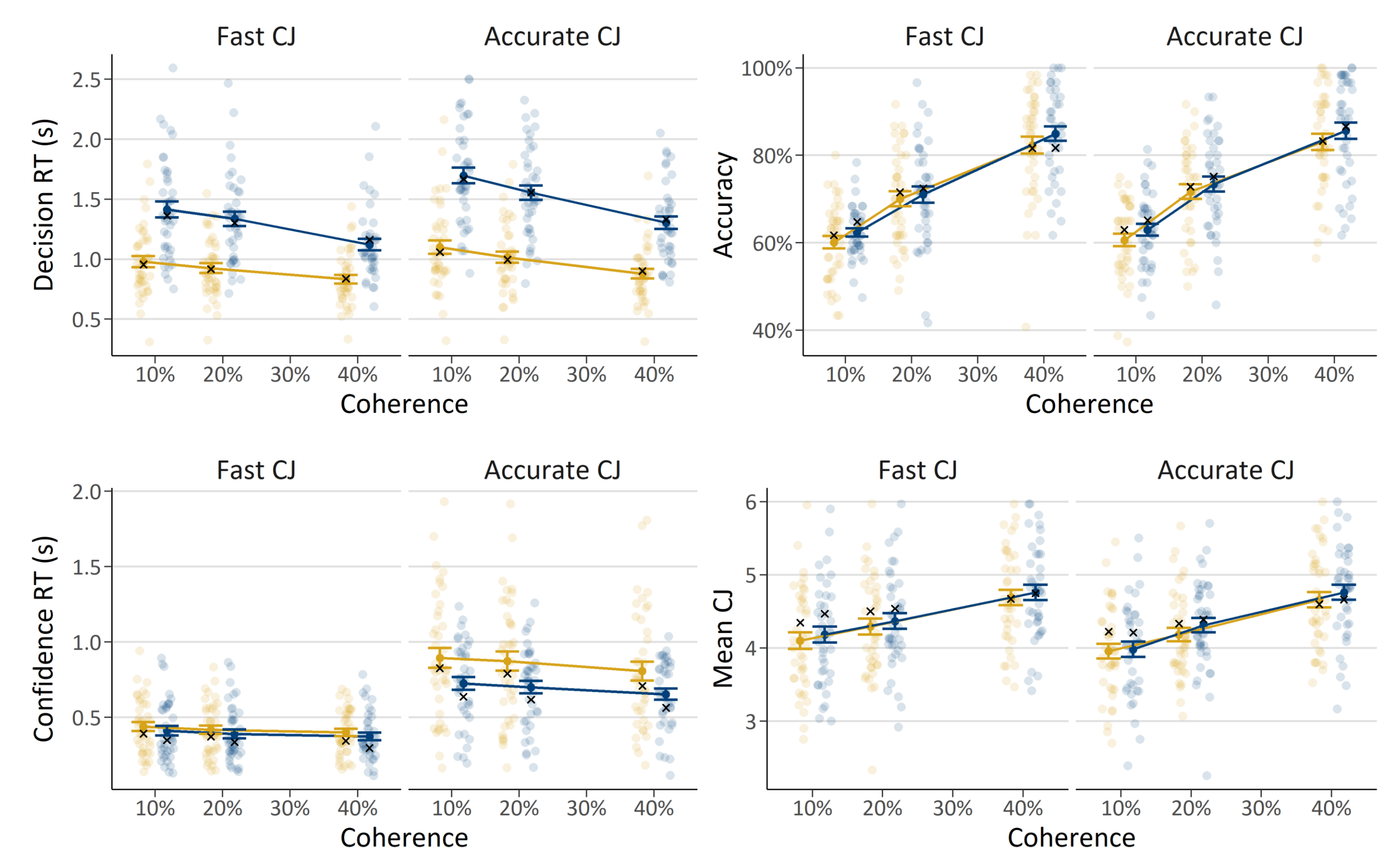   *How confident are you that you made the correct choice?*

Manipulations

- Instructions:
  - Fast (F) ⟺ Accurate (A) decisions
  - Fast (F) ⟺ Accurate (A) confidence judgements
- Coherence of the moving dots:
  - Higher coherence → easier decision

Results – Boundary Separation

Experiment 1 – binary confidence judgements
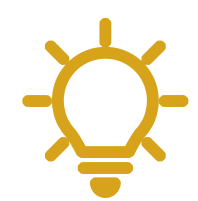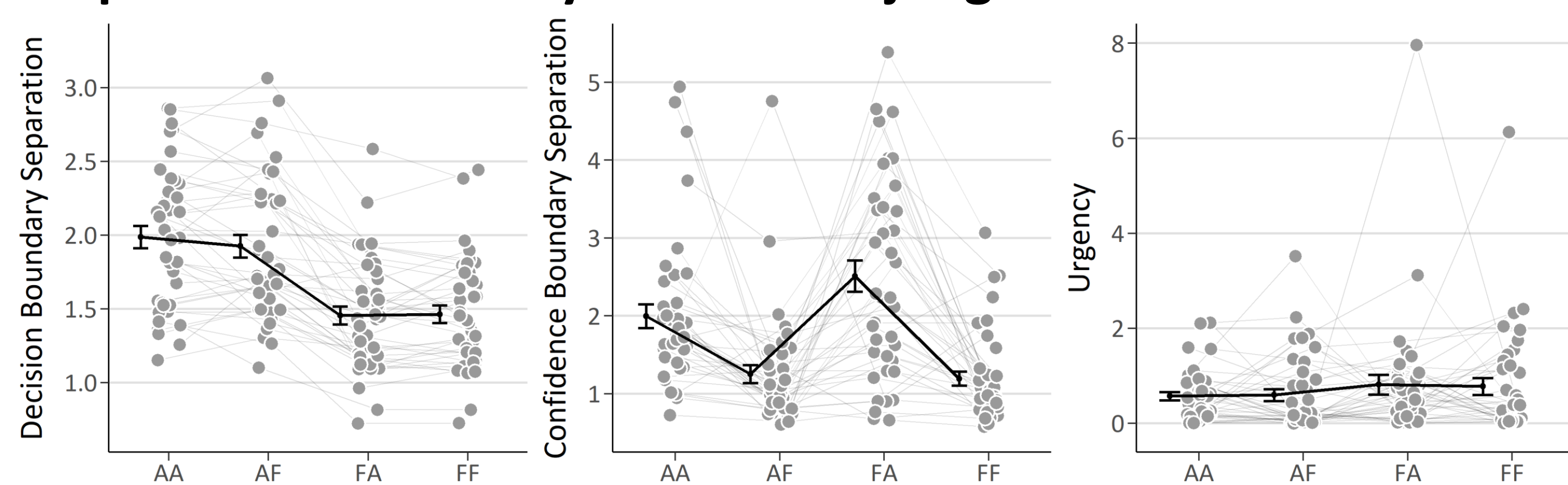
> **AA**: **A**ccurate decision – **A**ccurate confidence judgement
> **FA**: **F**ast decision – **A**ccurate confidence judgement

Experiment 2 – discrete confidence scale

To map post-decisional evidence onto a discrete confidence scale, we allowed the high and low confidence boundaries to vary separately.

Results – Model Fit

Experiment 1 – binary confidence judgements

- Accurate decisions
- Fast decisions
- × DDM simulations

Experiment 2 – discrete confidence scale
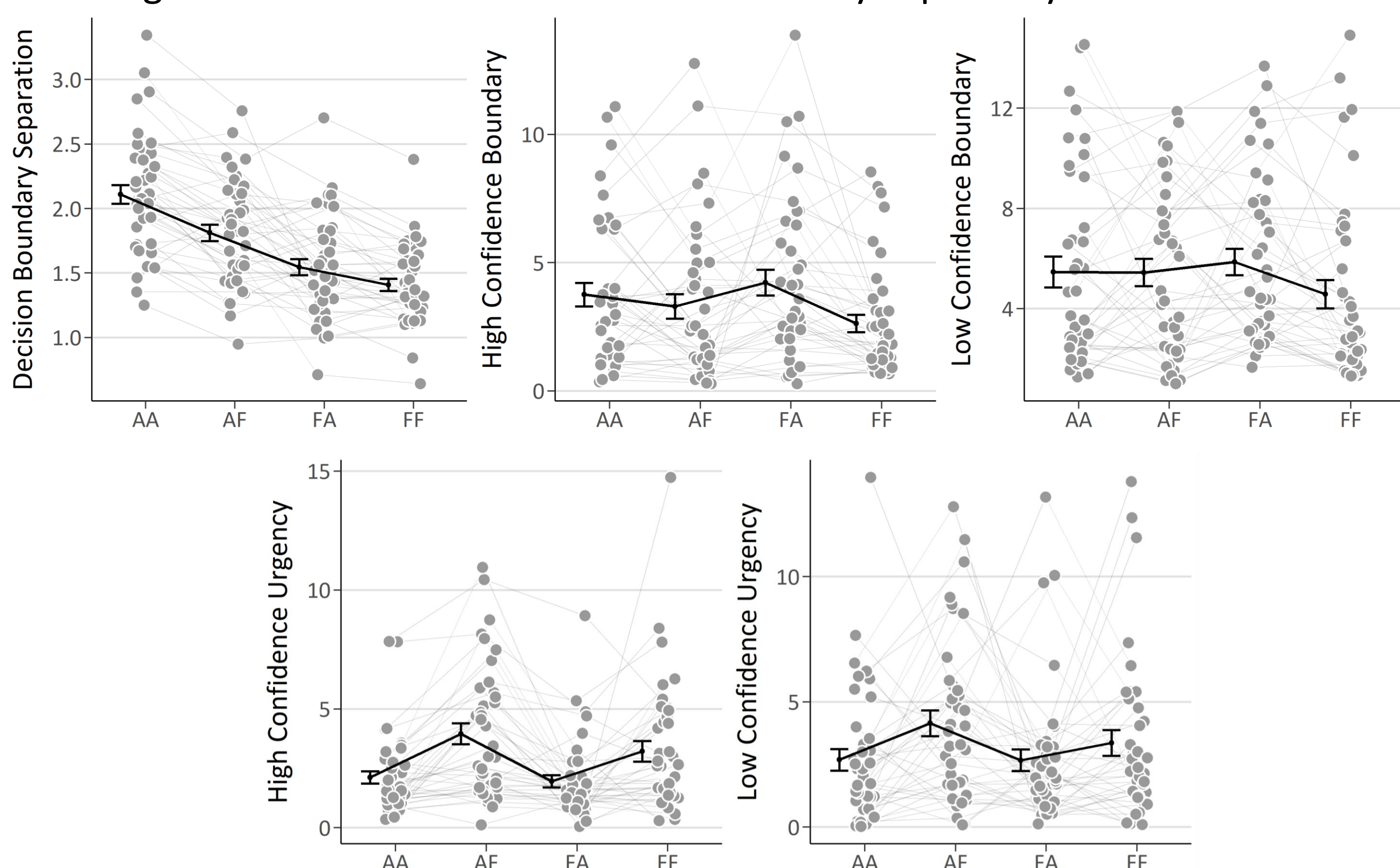
Conclusion

- A DDM with additional confidence boundaries captured the data well in terms of accuracy, reaction times, confidence reaction times and confidence judgements, across all speed-accuracy manipulations.
- Similar to the decision-making process, the computation of confidence is under strategic control.
- Within a DDM-framework, this is expressed through changes in decision- and confidence boundaries.