

**Should we commit or should we switch?**  
**Aligning goals in sequential social**  
**decision-making**

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# **Two families of coordination problems**

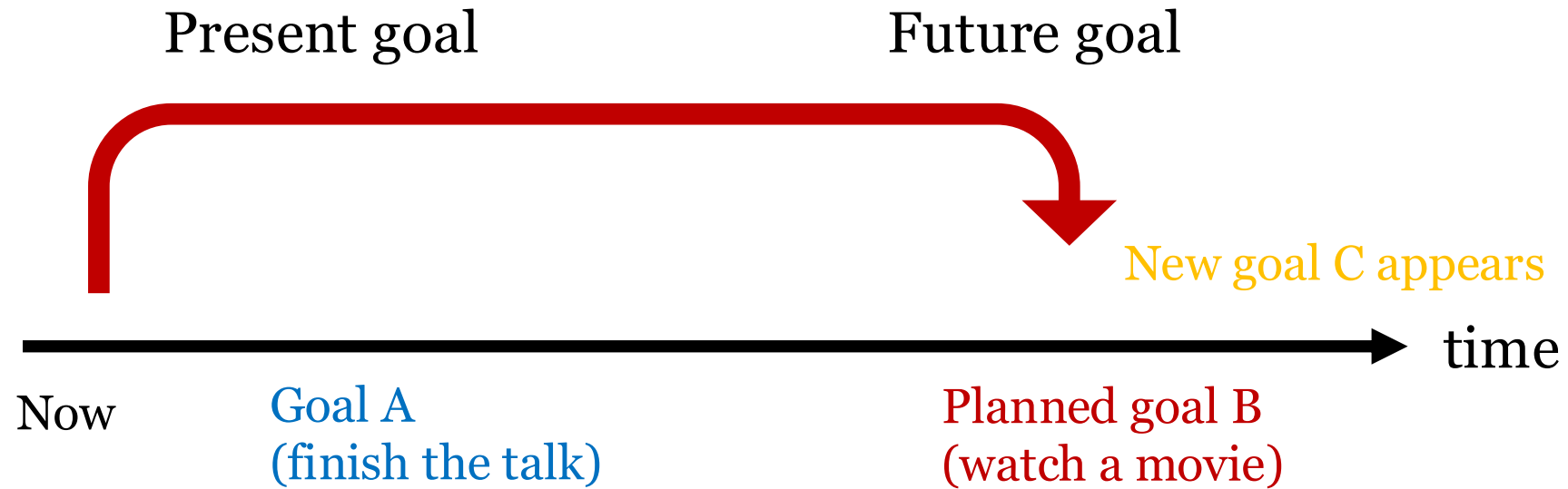
1. Sequential coordination problems

2. Social coordination problems

# **1. Sequential coordination problems**

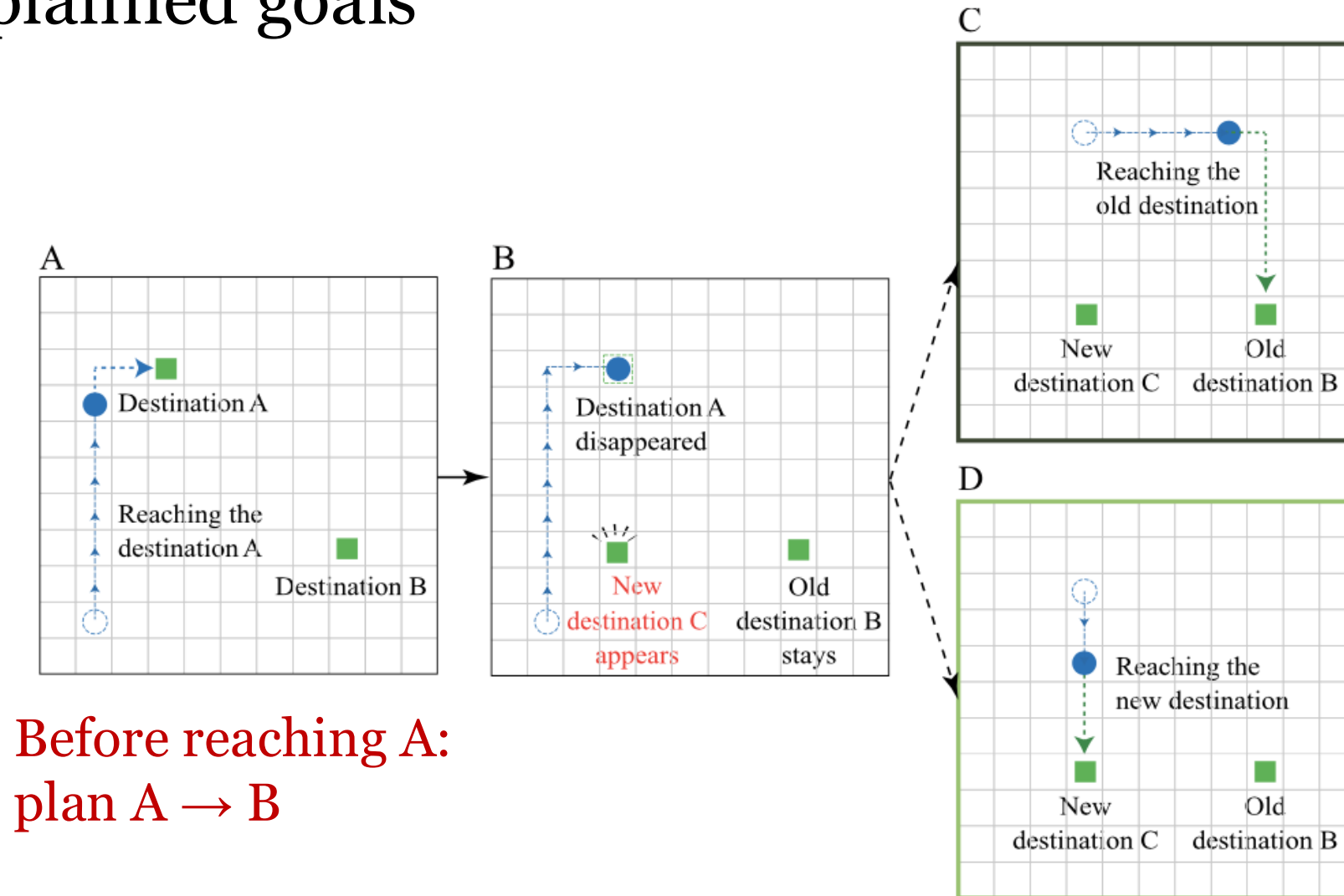
- Conflicting goals arise over time; how can one act coherently over time?
- Individuals plan ahead and tend to commit to it
  - People constantly hold partial plans in mind that bind future action (Bratman, 1987).

# Ongoing partial plans bind future choices



Before reaching A, the agent can already  
commit to the sequence  $A \rightarrow B$

# Sequential tasks reveal a memory-based bias toward planned goals



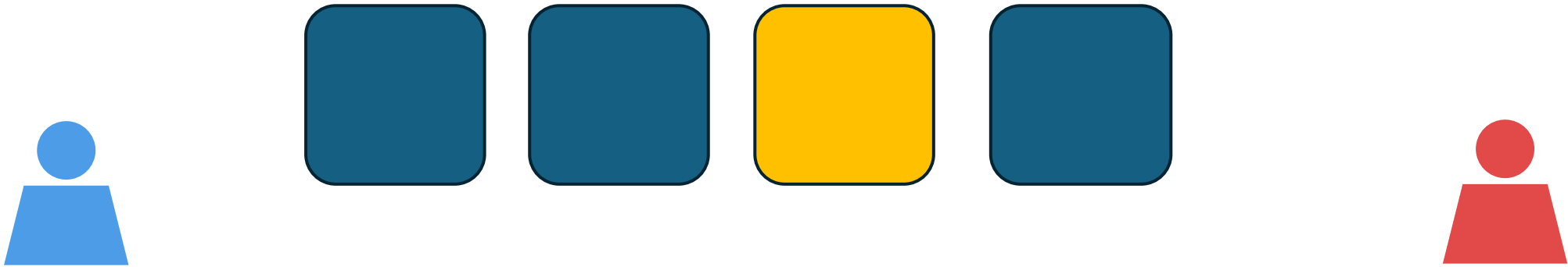
Before reaching A:  
plan  $A \rightarrow B$

Bias to old goal as  
it has been  
committed as part  
of an unfolding  
plan.

## **2. Social coordination problems**

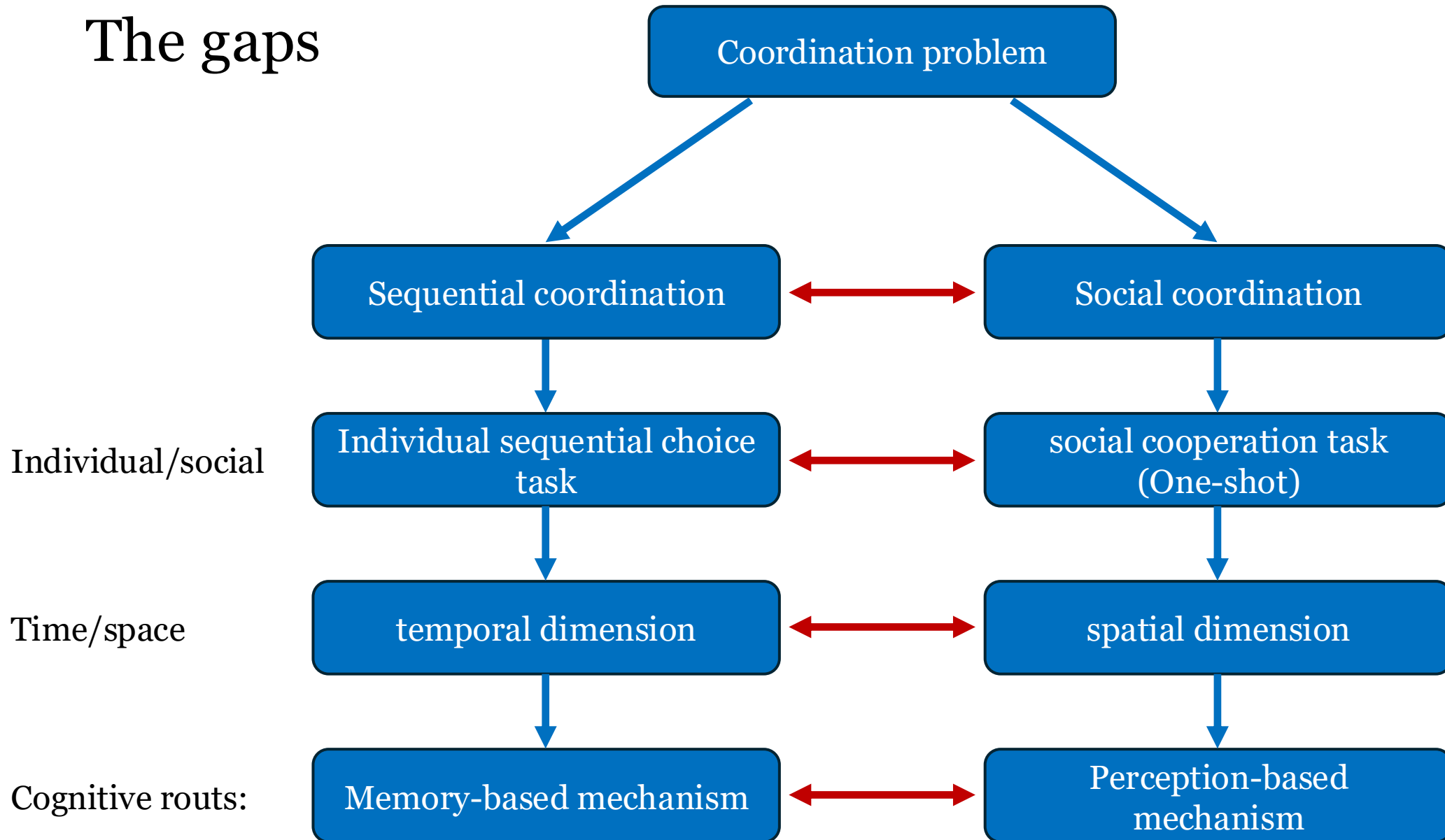
- Multiple goals exist simultaneously; people need to converge (without communication).
- Salient option as focal points (Schelling, 1960)

# Spatial task reveal perceptual salience bias



Perception-based salience as focal points (Grueneisen et al., 2015)

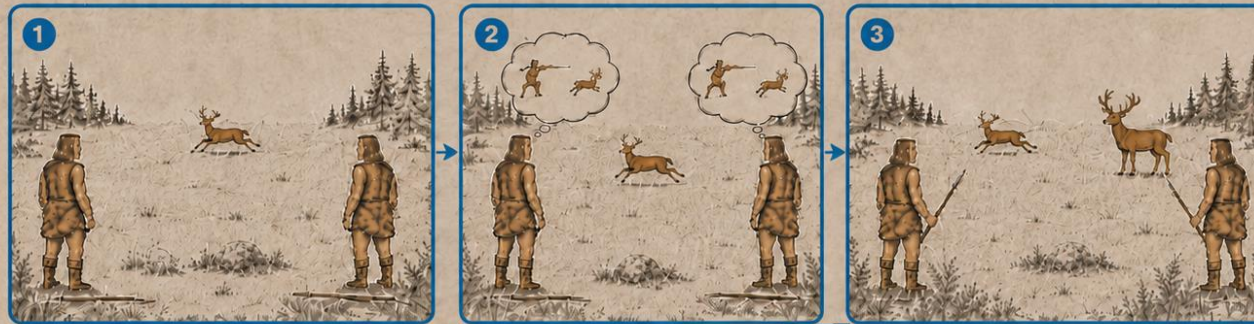
# The gaps



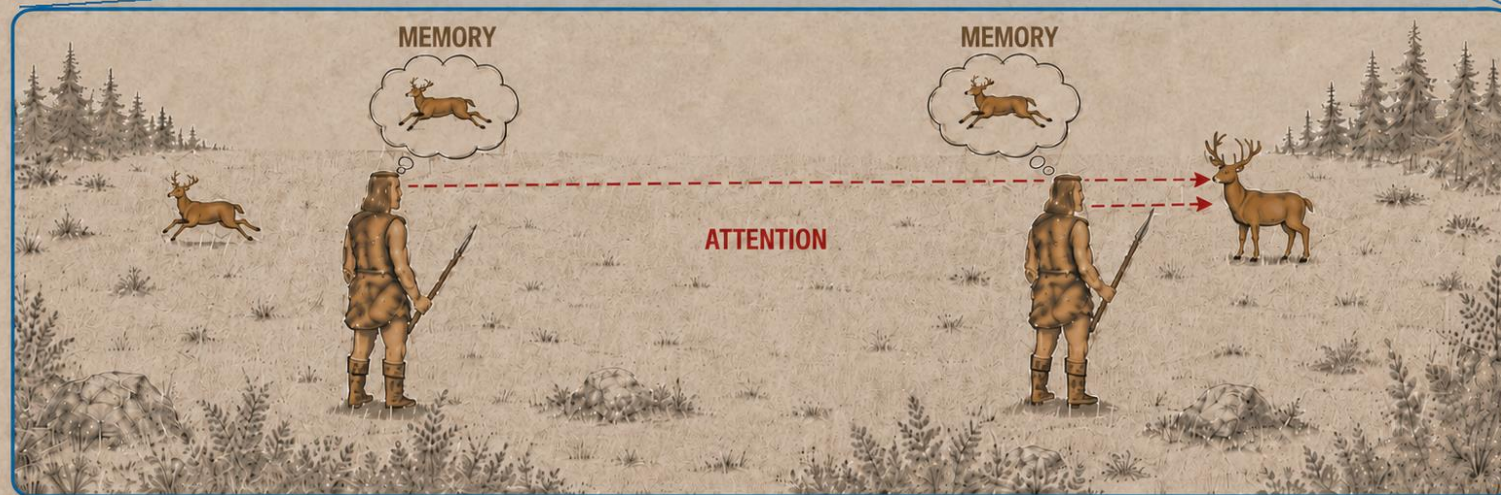


# Real-world dynamic social coordination

Sequential  
dimension

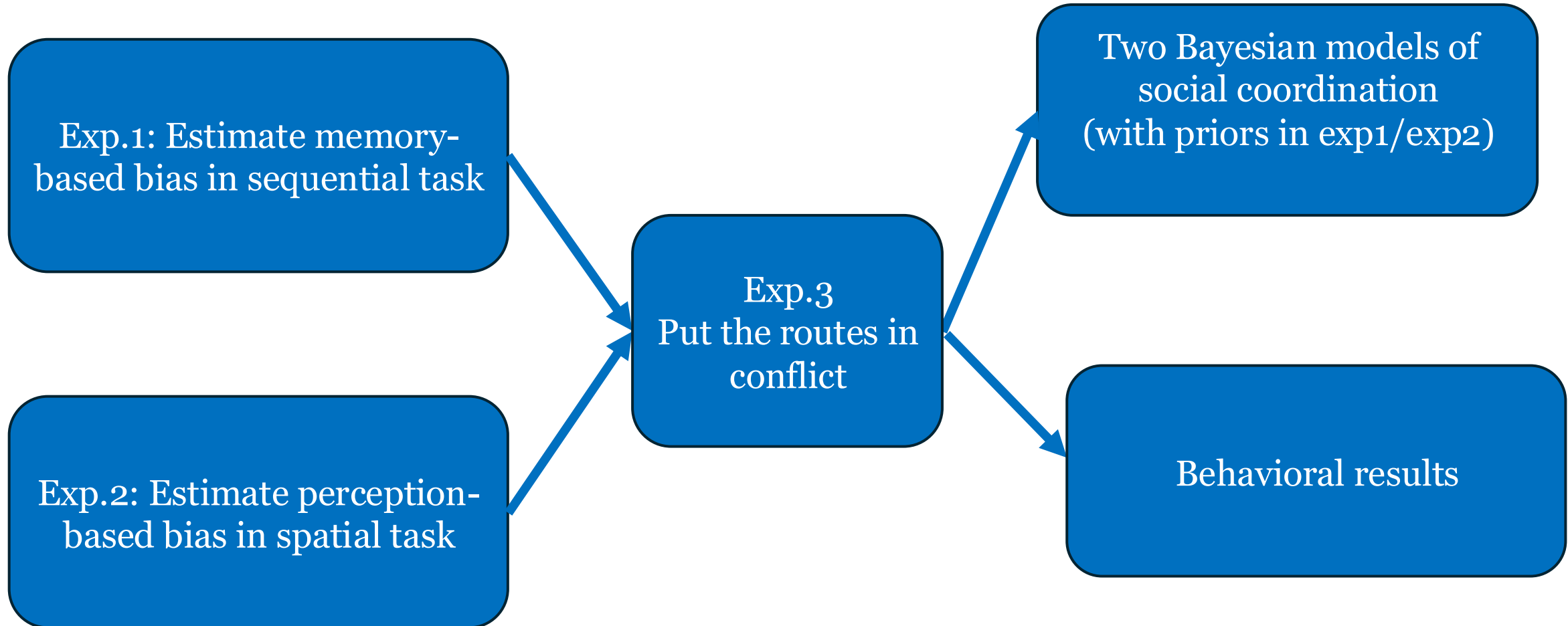


Spatial  
dimension



How do people align their goal in dynamic social coordination?

## Current study:



# Experiment 1: turn-taking sequential task

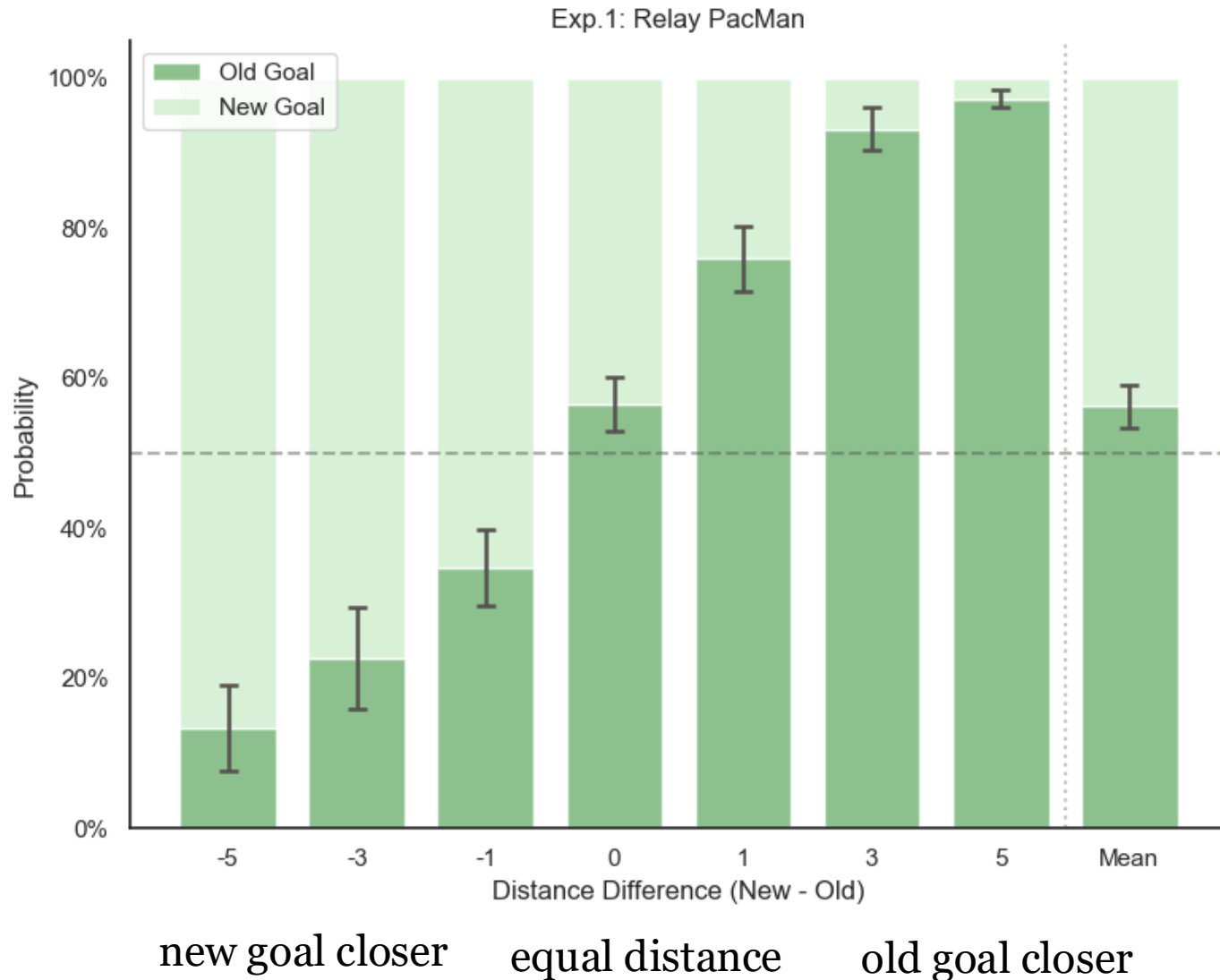
- Dyads take turns controlling one agent
- Coordinate a sequence of goals (temporal dimension)



$N = 20$  Dyads; each 210 trials

Dyads, as a system, are also biased toward old goals?

# Memory-based bias to old goal



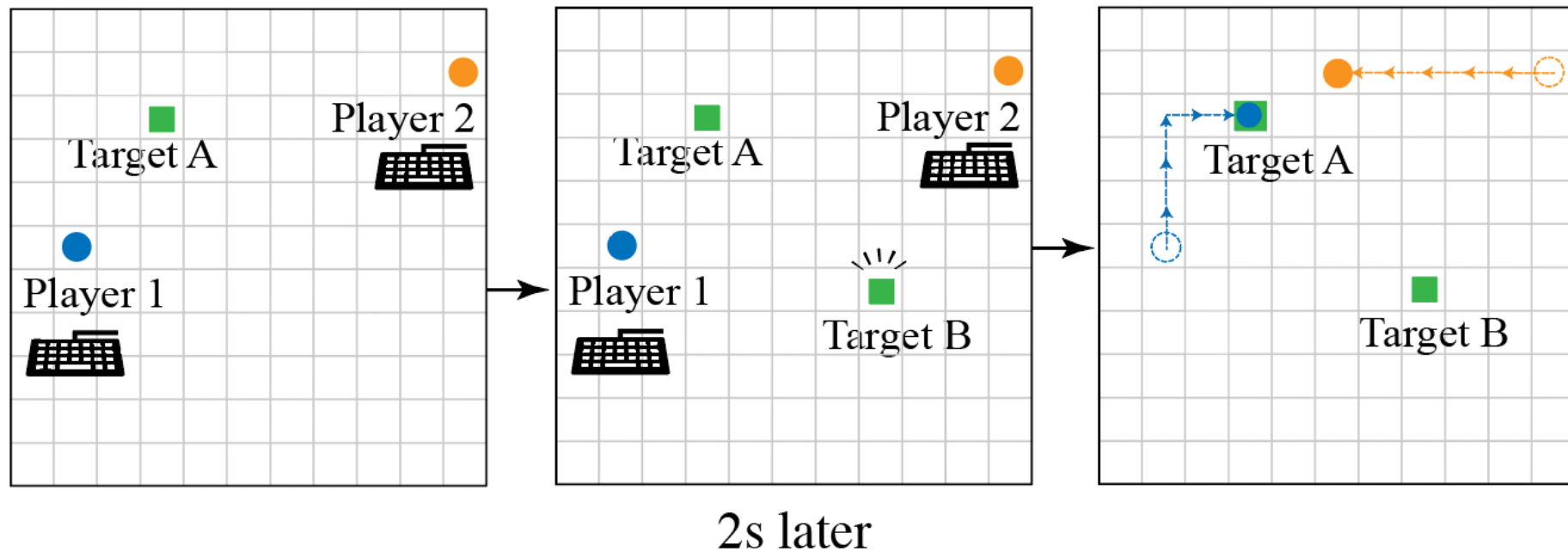
$N = 20$  Dyads

Overall old-goal choice: 56.3%  
( $p < .001$  versus 50%)

Memory-based bias along  
temporal dimensions can  
extend to dyadic settings.

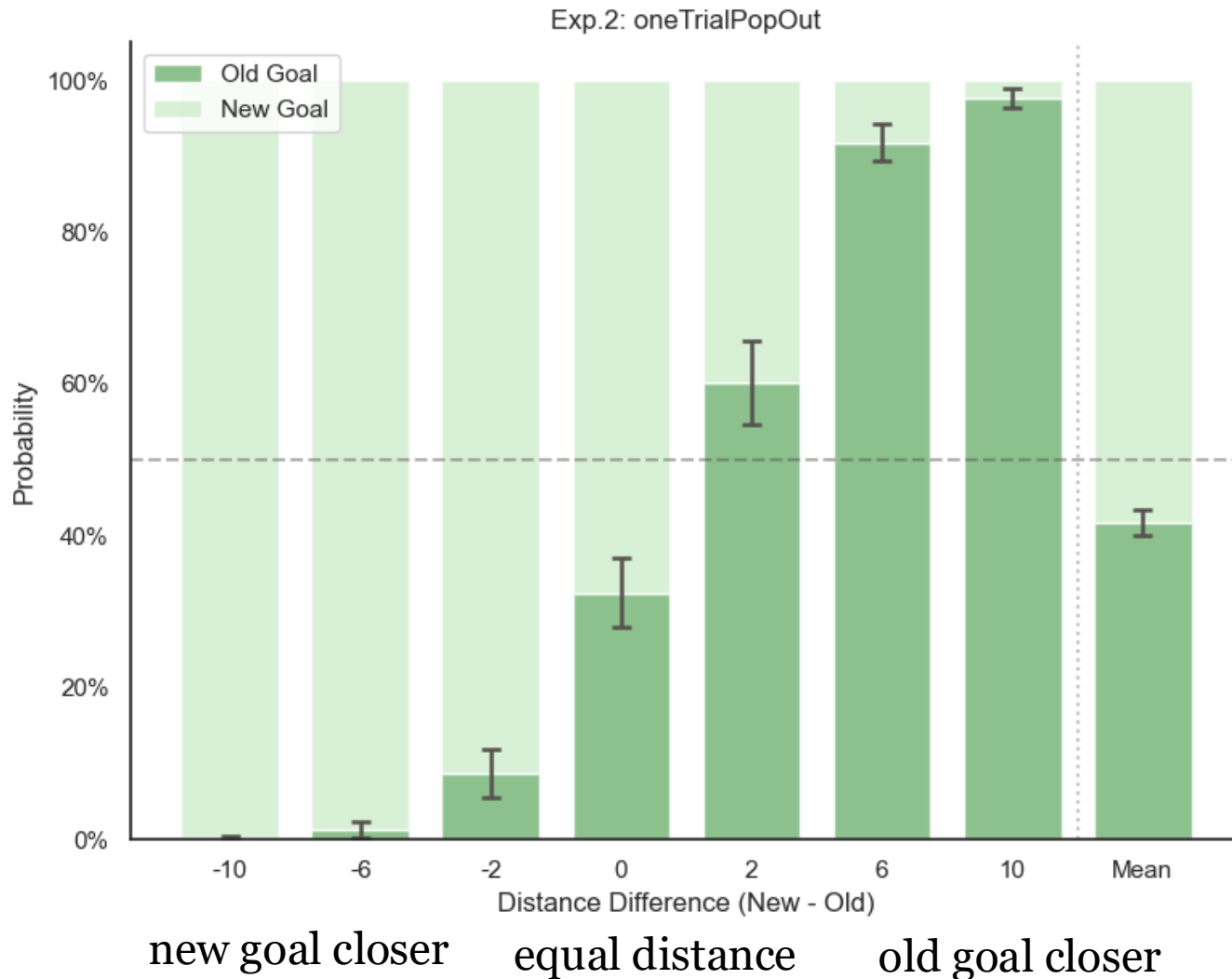
## Experiment 2: spatial coordination task

- Dyads control their own agents to reach the same goal.
- Social coordination, independent trial



Onset object serves as a focal point in one-shot coordination?

# Perception-based bias to new goal

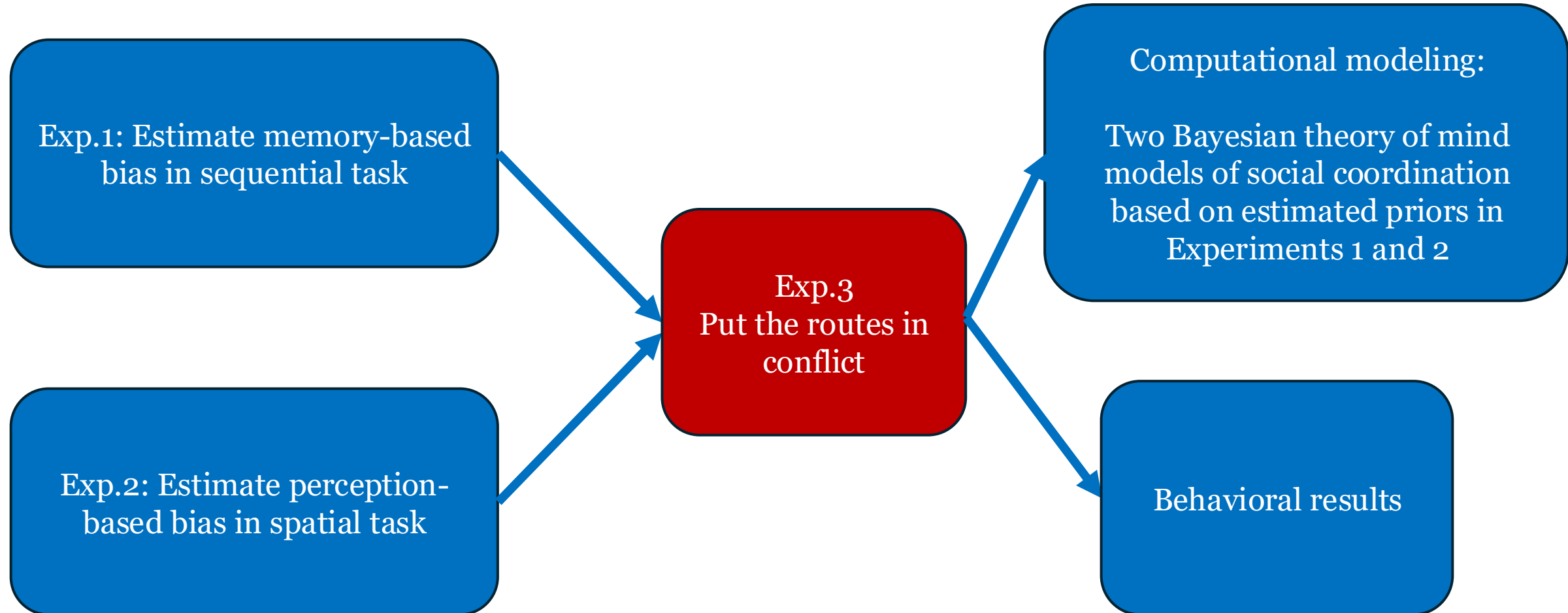


$N = 20$  Dyads

Overall new-goal choice: 58.0%  
( $p < .001$  versus 50%)

The onset of a new object can  
elicit an attention-based bias in  
one-shot social coordination.

# From two biases to a critical test

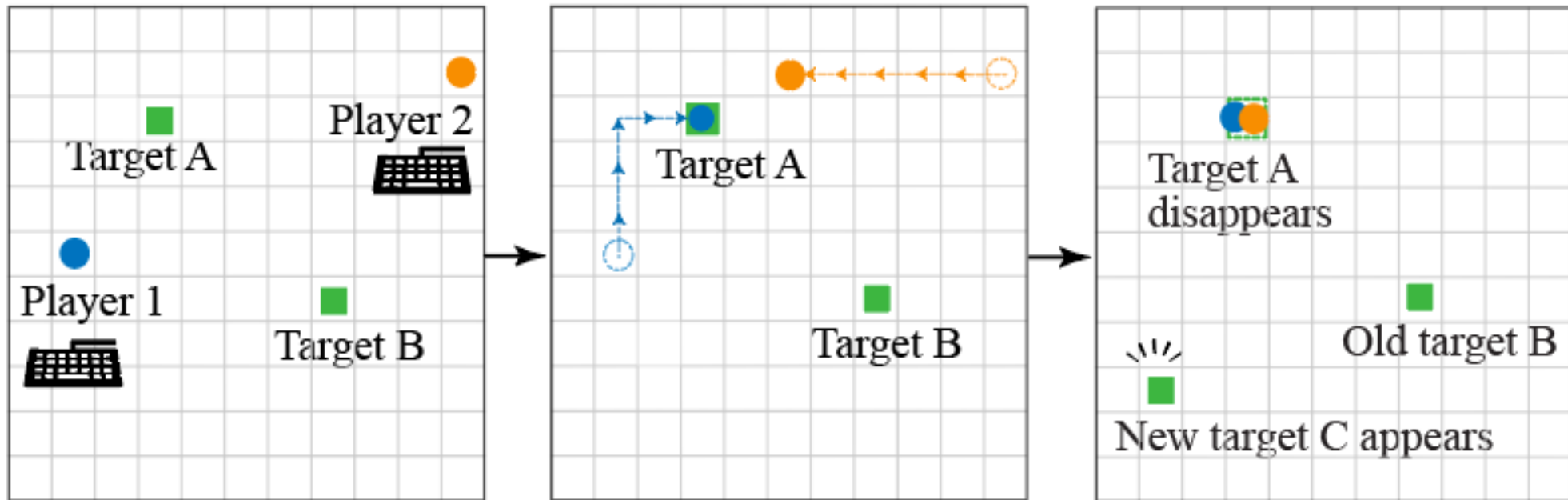


# Experiment 3: Putting the two routes in conflict in social coordination

Spatial

+

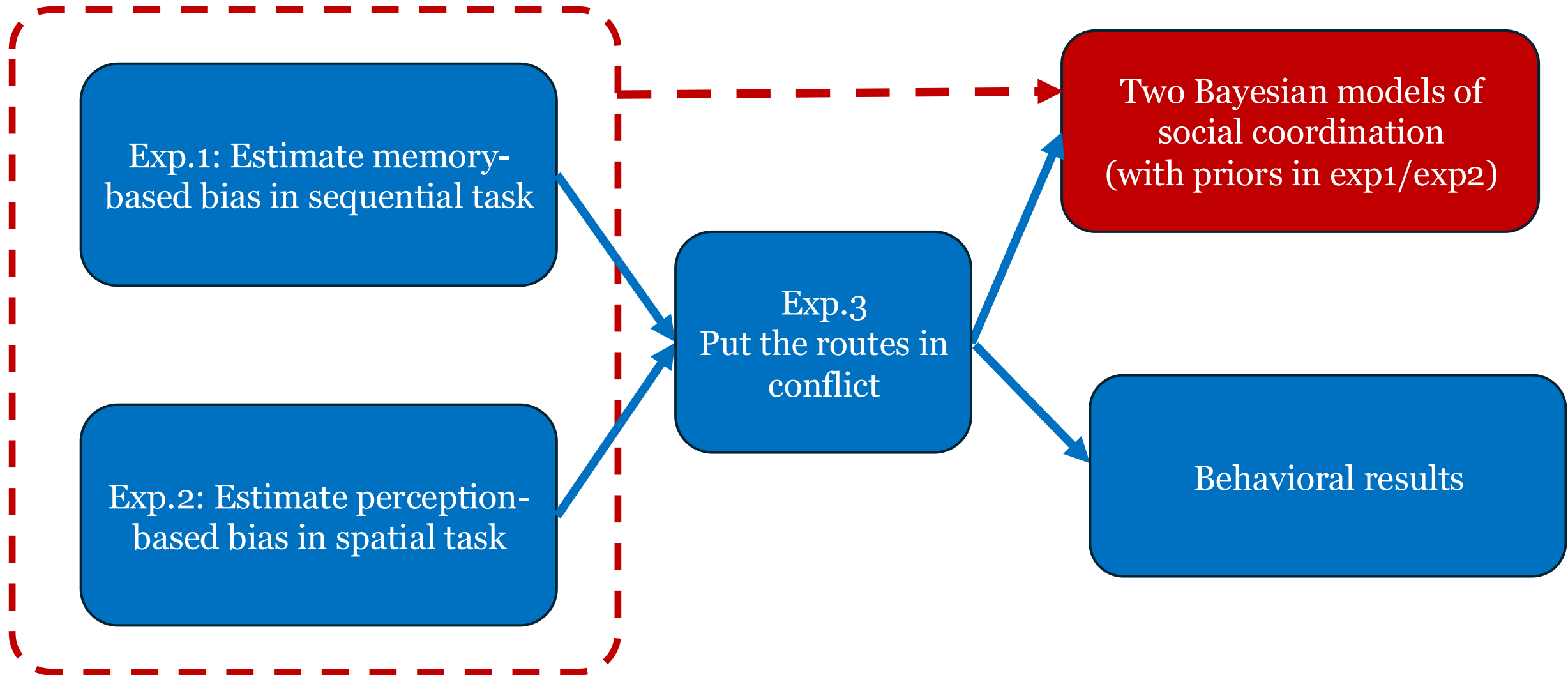
Temporal



Old goal = memory priority (Exp.1)  
New goal = perception priority (Exp.2)



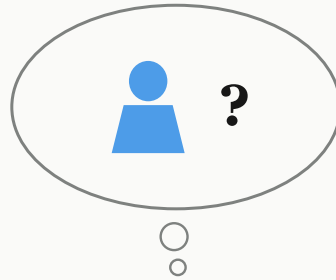
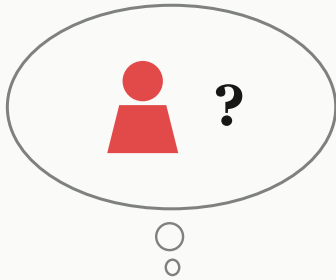
# Two Bayesian theory of mind models of social coordination: individual-ToM and Shared-agency



# Individual Theory of Mind

Individual  
Memory Prior

Inferred  
partner goal



Coordination emerges if  
two private decisions converge.

# Shared-Agency

Joint perception  
Prior



Coordination starts from  
a dyad-level shared goal.

# Individual Theory of Mind model



**What's your goal?**

Individual prior: memory-bias to old goal

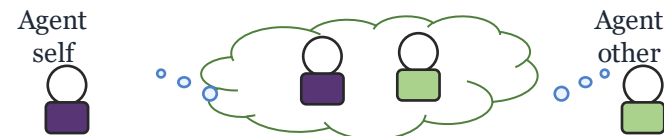
1 **Infer other's goal**  $P(\text{goal}_{\text{other}}) \propto P(a | \text{goal}_{\text{other}}) P(\text{goal}_{\text{other}})$

2 **Individual goal selection**  $\text{Goal}_{\text{self}} \sim P(\text{goal}_{\text{other}}) P(\text{goal}_{\text{self}})$

3 **Action generated by individual goal/plan**  $\text{Action} \sim P(\text{action} | \text{goal}_{\text{self}})$

Infer each other's goal with memory-bias  
→ Aligned actions when individual goals converge

# Shared-Agency model



**What's our goal?**

Shared Prior:  
Joint perception bias to new goal

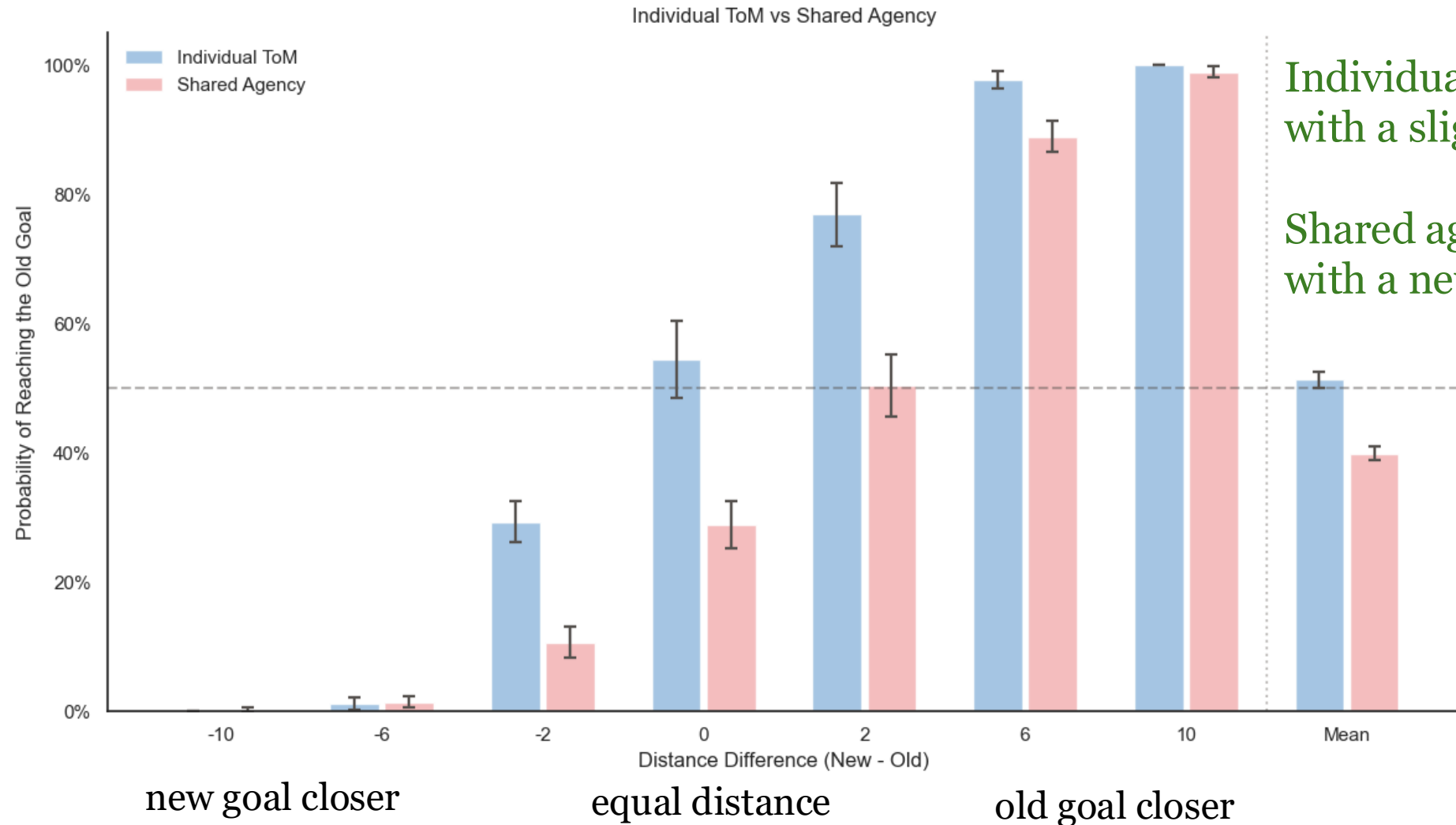
1 **Infer joint goal**  $P(\text{goal}_{\text{we}}) \propto P(a_{\text{joint}} | \text{goal}_{\text{we}}) P(\text{goal}_{\text{we}})$

2 **Joint goal selection**  $\text{Joint Goal} \sim P(\text{goal}_{\text{we}})$

3 **Action generated by joint plan**  $\text{Joint Action} \sim P(\text{action}_{\text{joint}} | \text{goal}_{\text{we}})$   
 $\text{Action} \in \text{Joint Action}$

Infer a shared goal with perception-bias  
→ joint plan and actions

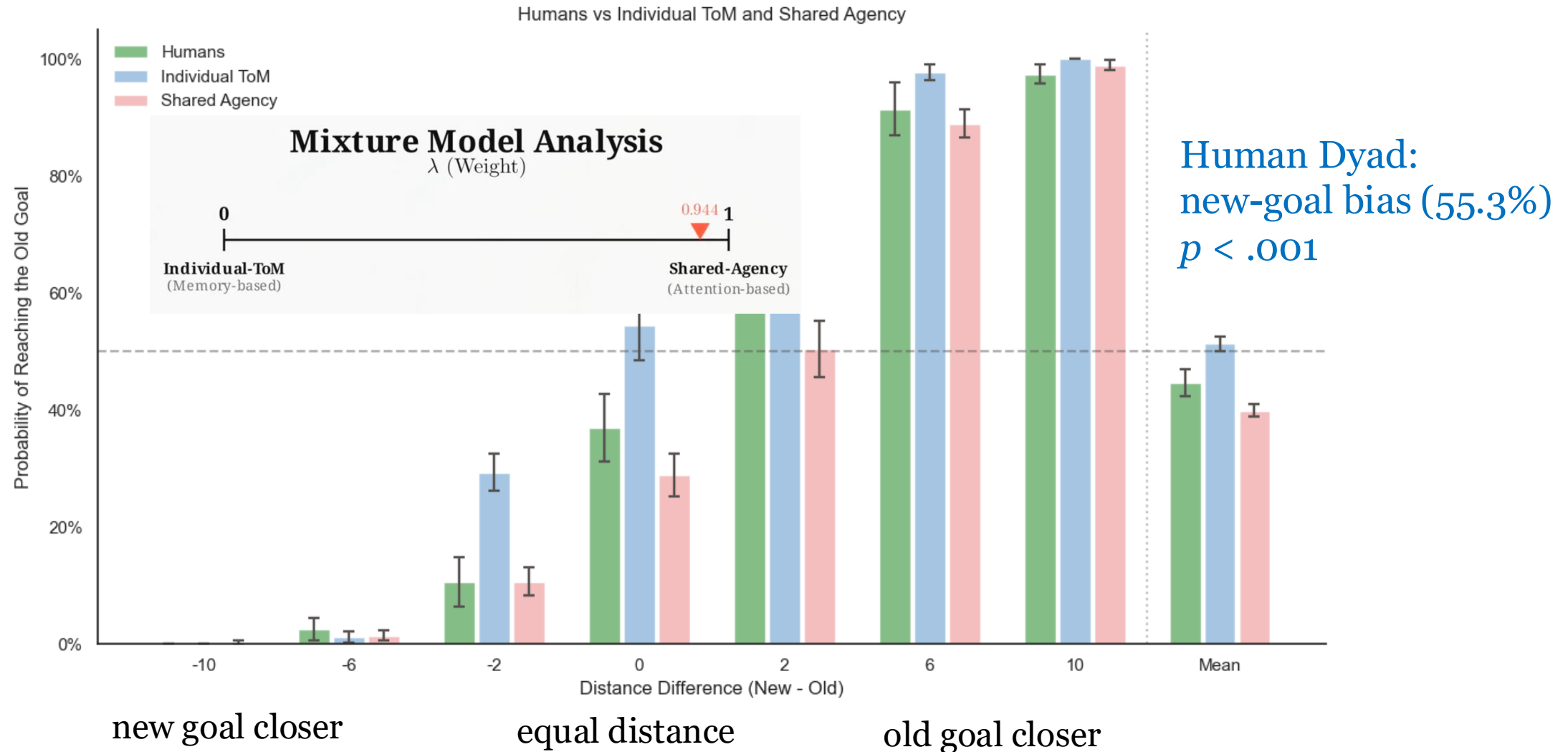
# Model simulations



Individual ToM predicts dyads with a slight old-goal bias,

Shared agency predicts dyads with a new-goal bias.

# Exp. 3: Human choices favor the Shared-Agency account



# Takeaway

- People solve dynamic social coordination problems with two routes
- **Memory-based route for temporal dimension**
  - Plans create a memory prior
- **Perception-based route for spatial dimension**
  - mutually available cues create a shared-perception prior
- When two routes compete (in non-linguistic settings), human social coordination are better captured by a shared-agency account.
- Future work: When future plans can be **communicated**, will the partner commit to a joint future plan despite joint attention capture?

# Thank you!

