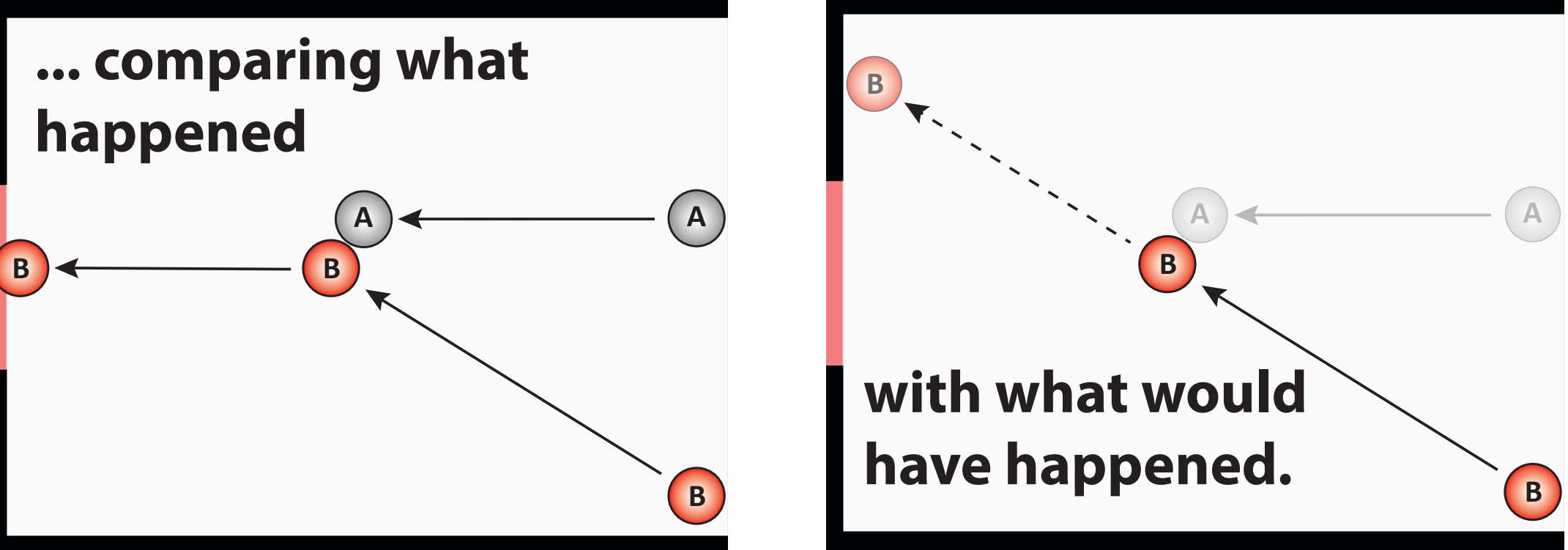


# A counterfactual simulation model of causal judgments

Tobias Gerstenberg, Noah Goodman, David Lagnado & Josh Tenenbaum

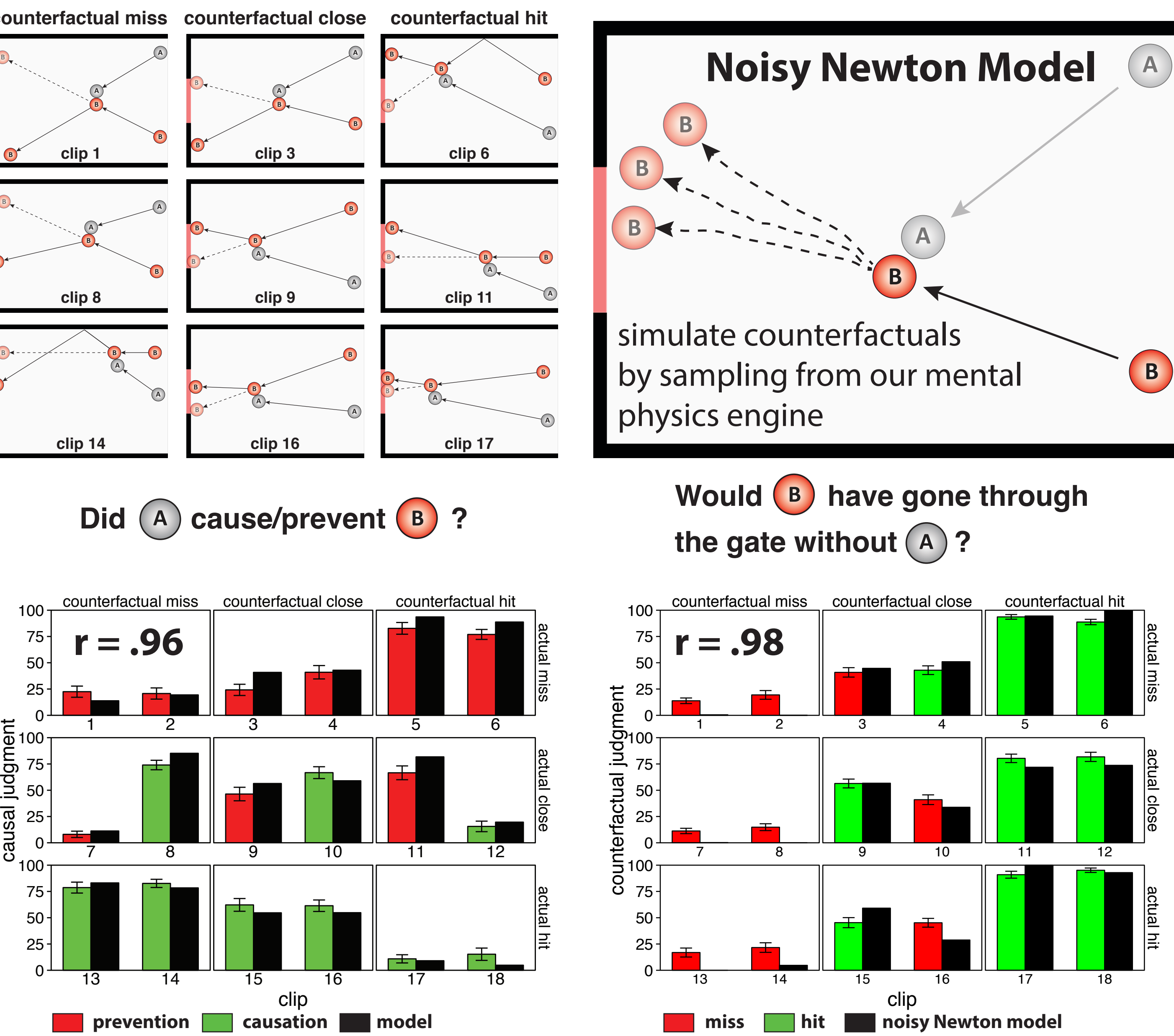
## The simple story

We make causal judgments, by...



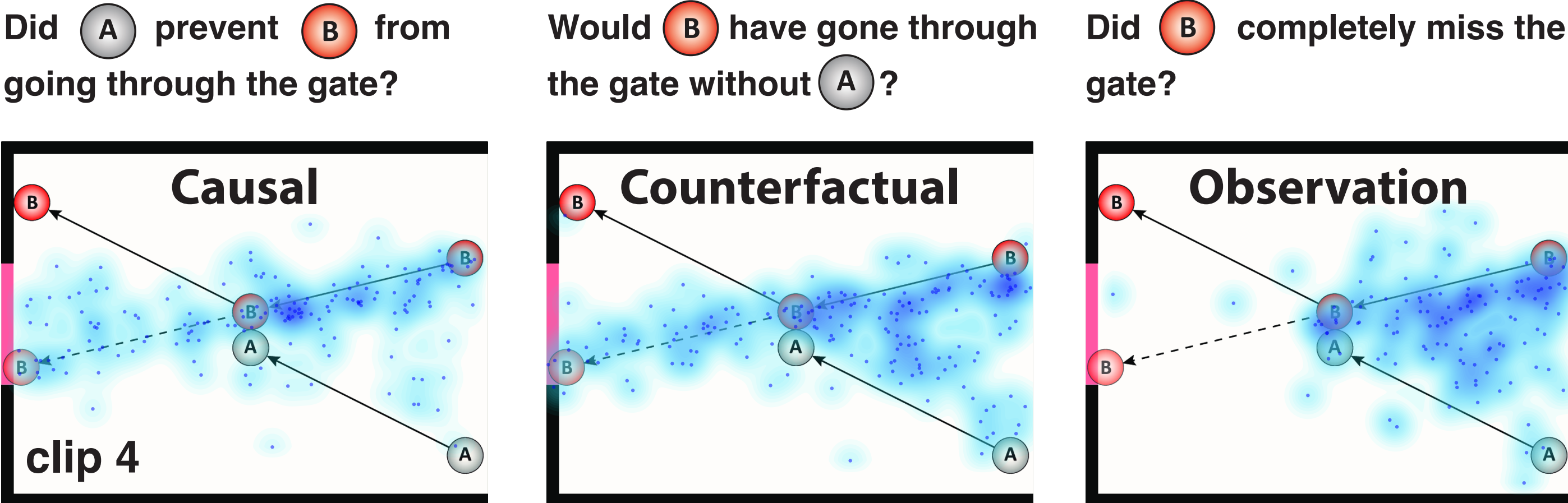
- Causal judgments are determined by our subjective degree of belief that the candidate cause made a difference to the outcome.
- We use our intuitive theory of the domain to simulate what the relevant counterfactual outcome would have been.

## Exp 1: Causes & Counterfactuals



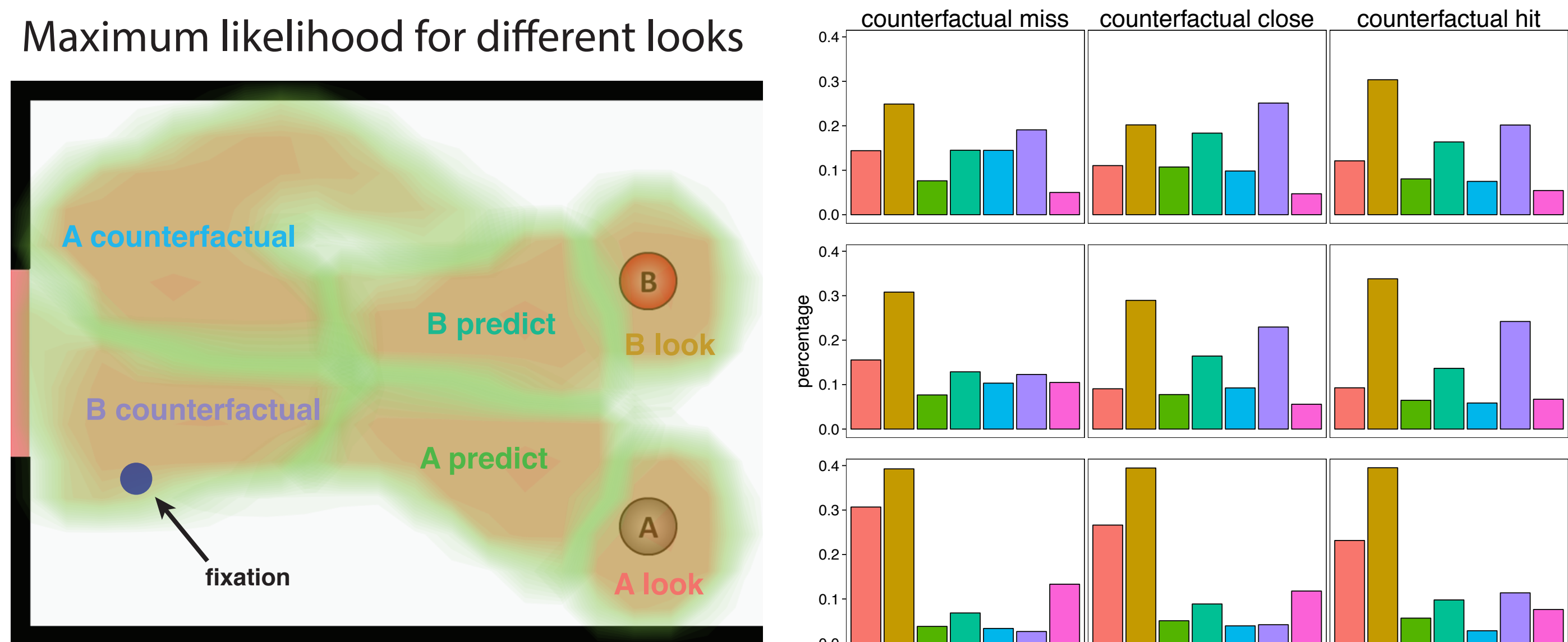
## Exp 3: Eye-tracking causality

### Fixations before collision

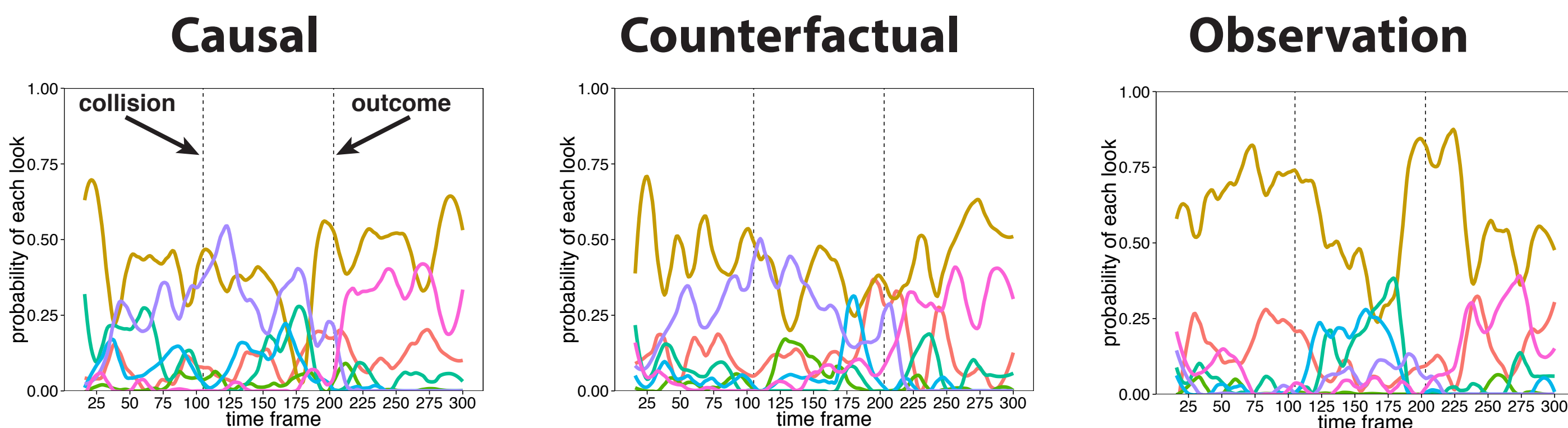


- Many more fixations to where B would have gone in the causal and counterfactual condition.

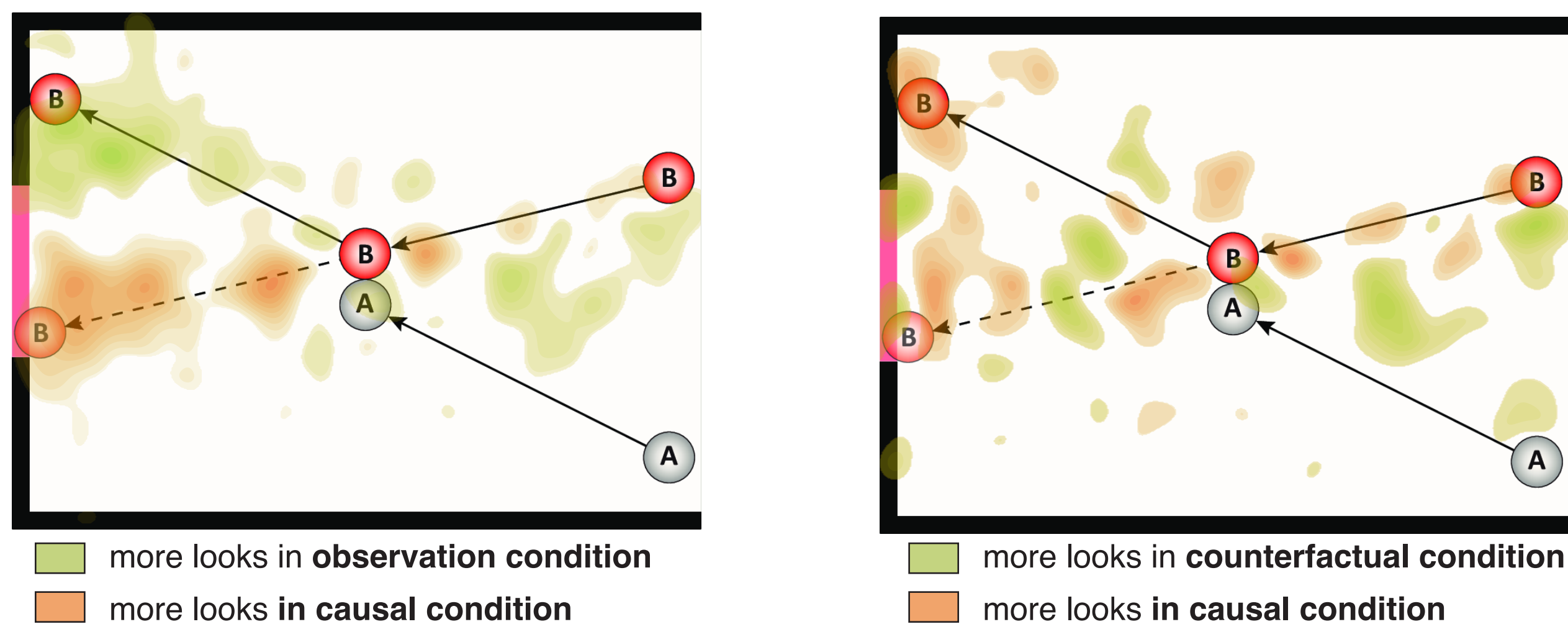
### Hidden Markov Model of people's fixations



### Fixations over time

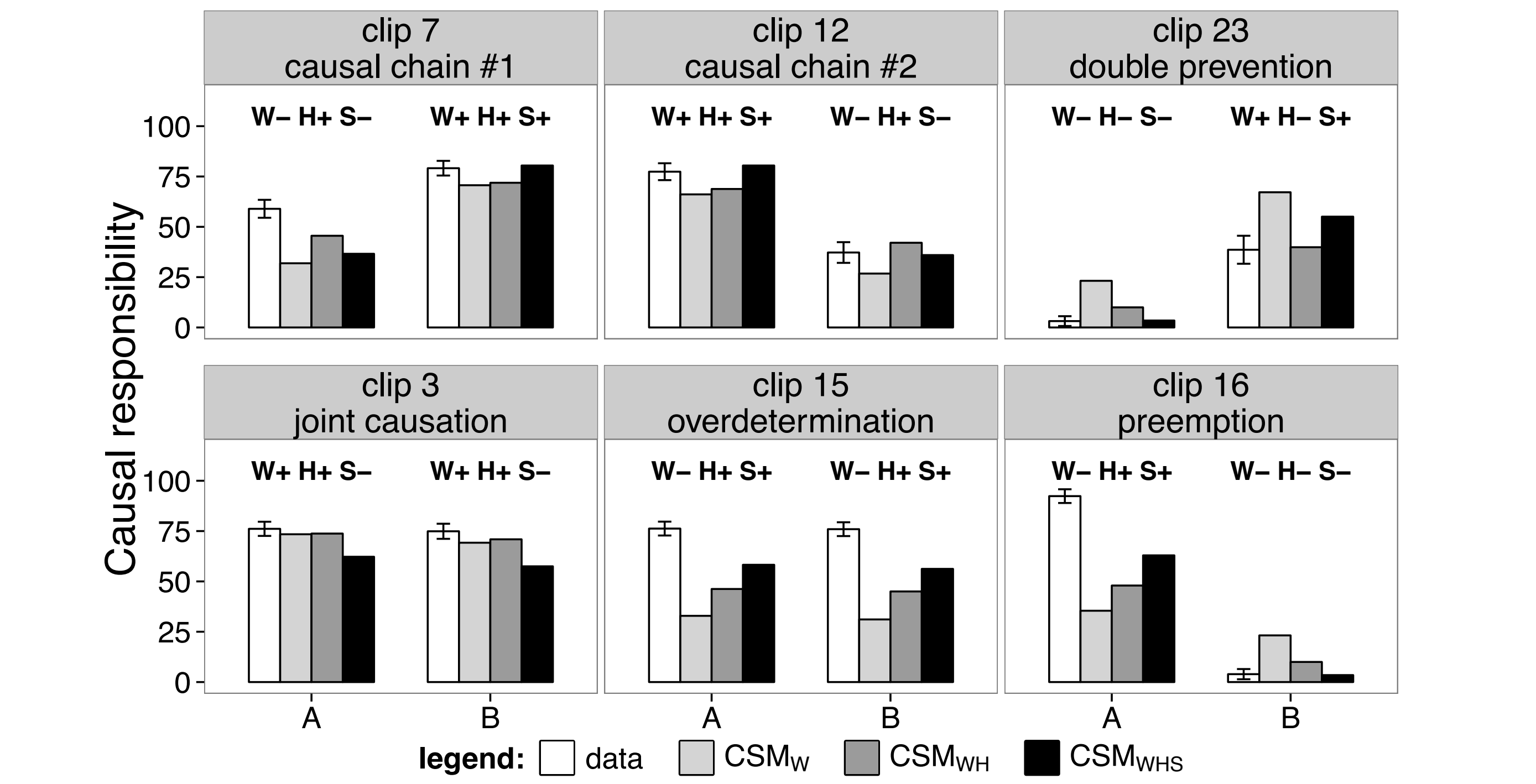
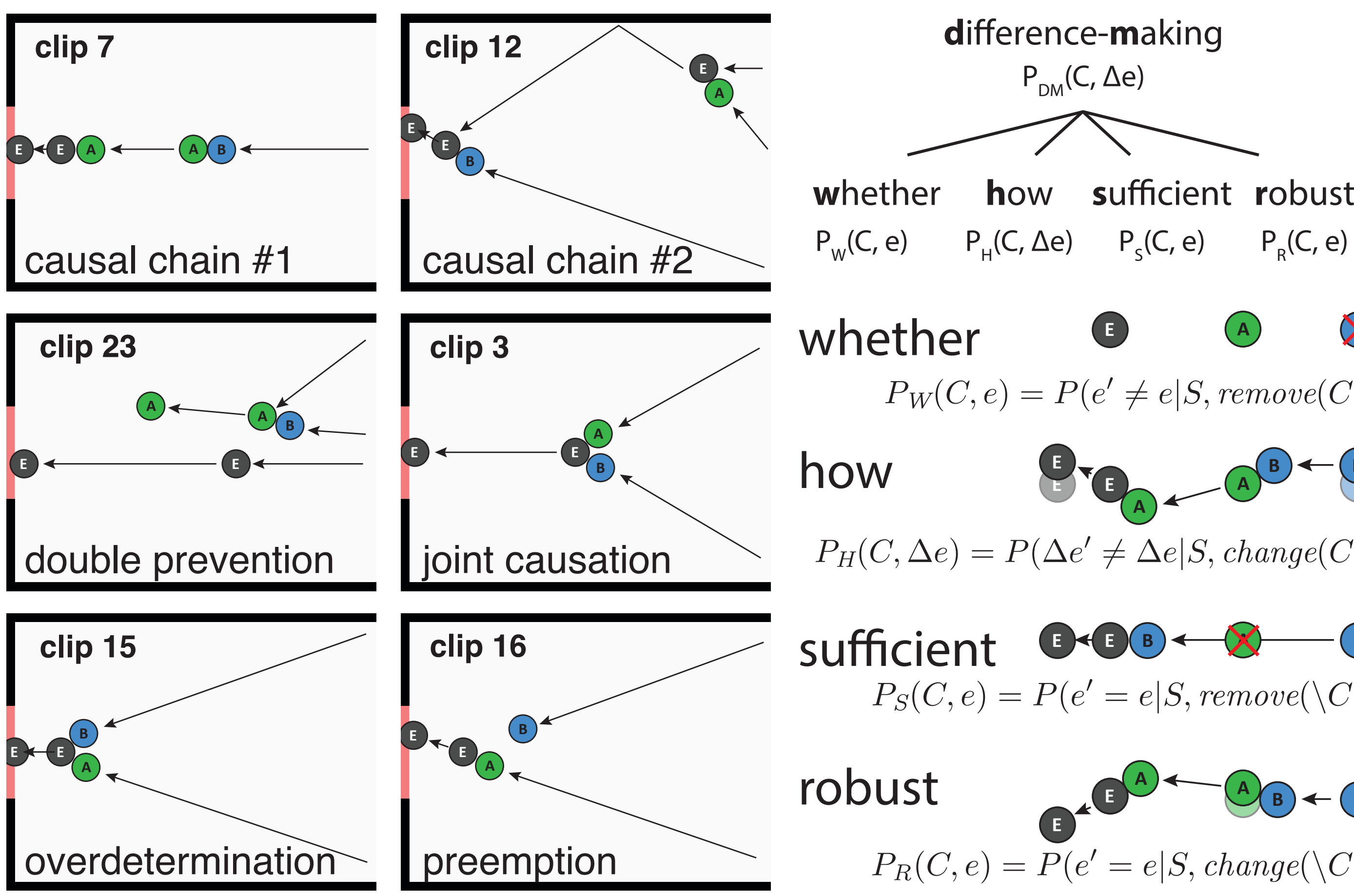


### Differences in fixations between conditions

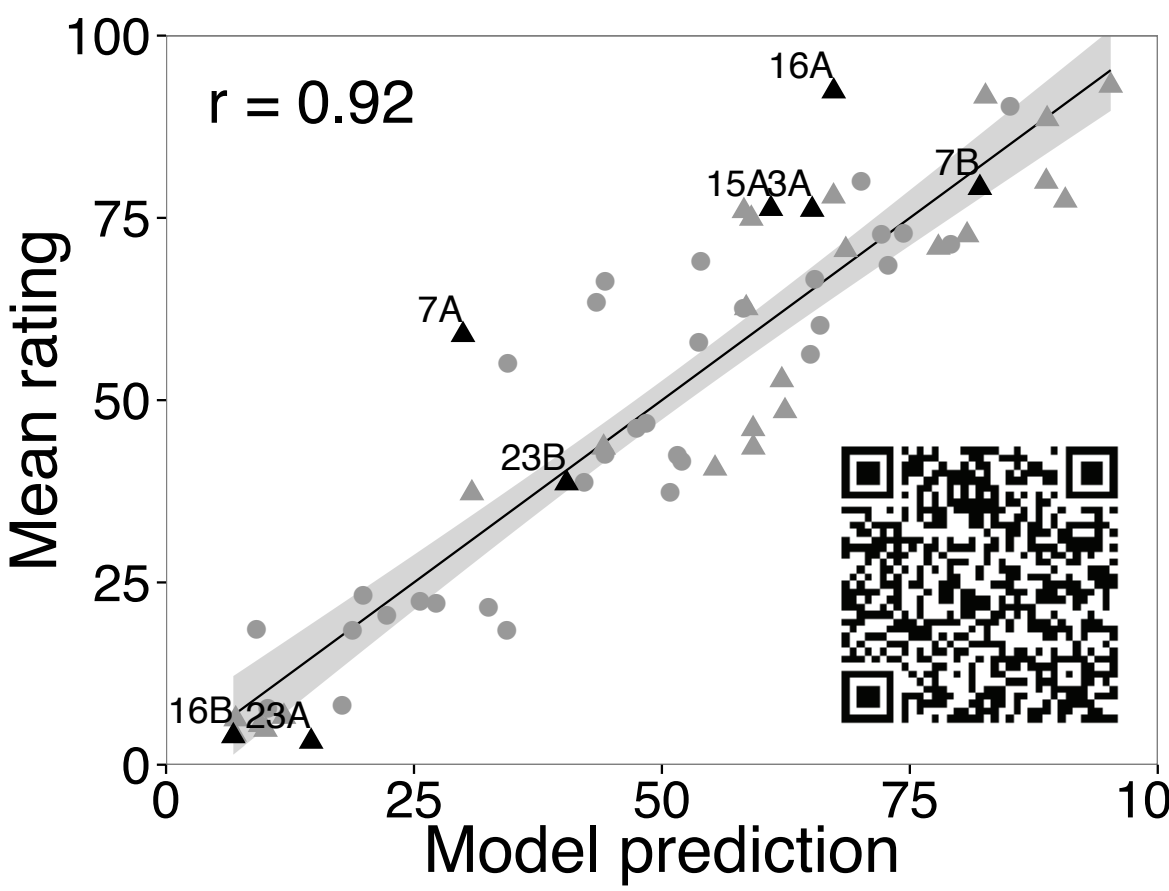


- Looking patterns between causal and counterfactual condition are very similar. Most counterfactual looks when uncertain.
- People spontaneously engage in counterfactual simulation but only in the causal condition not in the observation condition.

## The complex story



- Unifying theory of causal judgment that captures different aspects of causation in terms of counterfactual contrasts operating on a generative domain theory.
- Explains people's graded causal judgments to a high degree of quantitative accuracy.
- Provides the tools to better understand causal language (cause vs. enable).



## Acknowledgements & References

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