Know Your Network: Sensitivity to Structure in Social Learning

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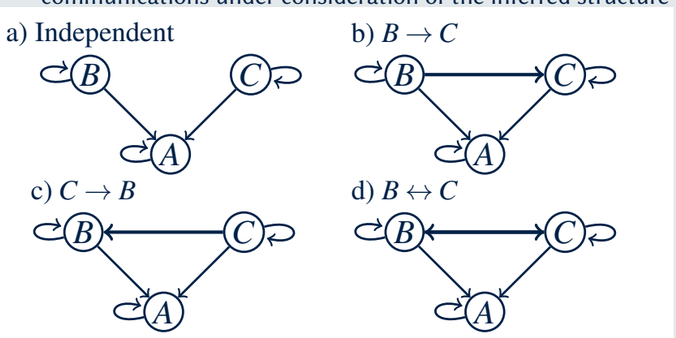
Overview

It has been suggested that people are sensitive to structural dependencies between information sources when dependencies are explicitly stated (Fränken, Theodoropoulos, Moore, & Bramley, 2020; Whalen, Griffiths, & Buchsbaum, 2018). Here, we investigated whether people:

1. Can *infer* structural dependencies between sources from sources' belief communications
2. Accurately weigh the evidential value of sources' belief communications under consideration of the inferred structure



Task

(a). For each of the four network conditions shown above, 81 Prolific workers observed initial evidence $\in \{red, blue\}$ followed by 10 belief communication from two sources (panel a; *note*: we investigated two forms of communication for the cyclic structure)

(b). studied the belief communications of their peers and provided a guess about structural dependence (panel b)

(c). made a judgment about the shared environment (panel c)

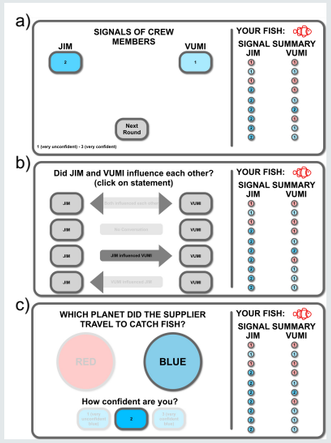


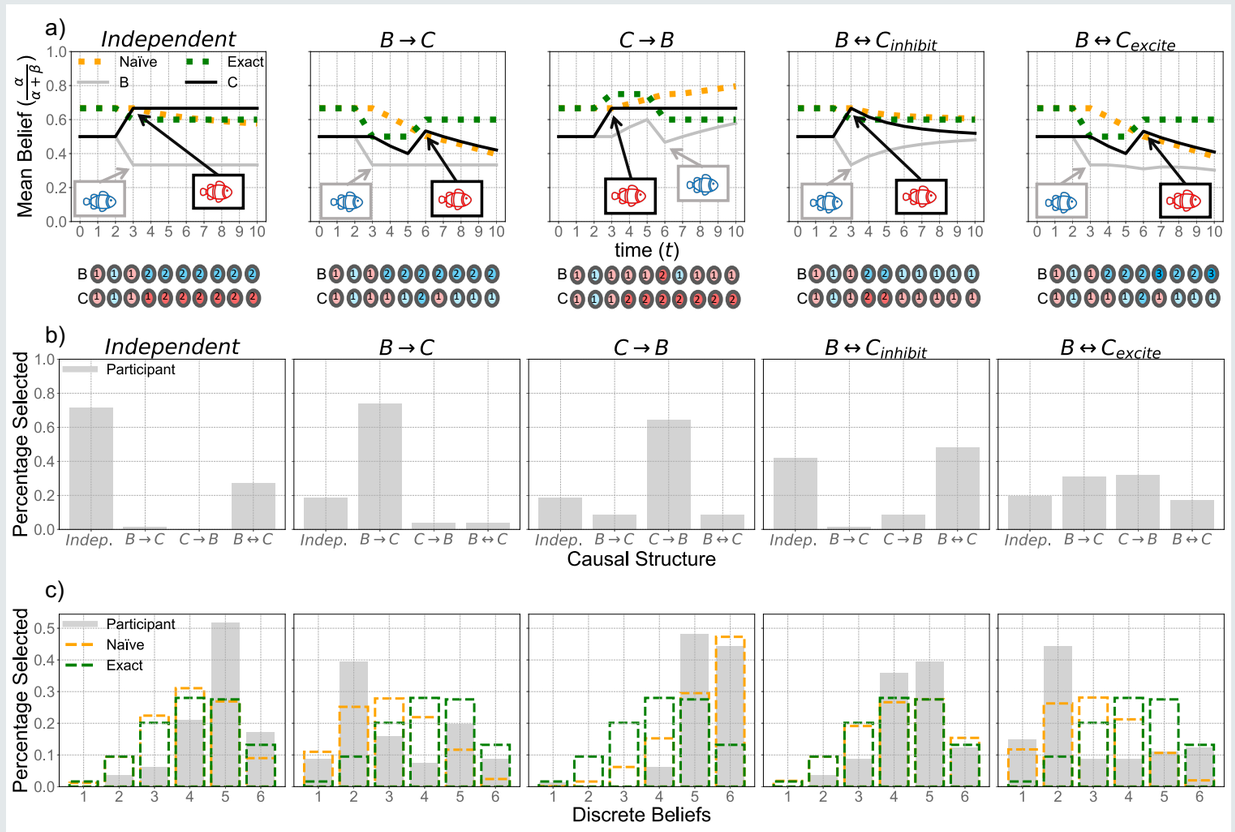
Table: Inferred posterior means over networks $G \in \mathcal{G}$

		Inferred			
		Indep.	$B \rightarrow C$	$C \rightarrow B$	$B \leftrightarrow C$
True	Indep.	**0.67**	0.13	0.17	0.03
	$B \rightarrow C$	0.13	**0.73**	0.03	0.11
	$C \rightarrow B$	0.23	0.03	**0.72**	0.02
	$B \leftrightarrow C$	0.02	0.04	0.05	**0.88**

Normative (posterior) structure judgments inferred from communication signals

Model Simulations and Results

We contrasted participants' judgments about the environment with an "exact" normative (Bayesian) model and a "naïve" account that combined communication signals of sources with their own evidence in a structure insensitive way (i.e., treating all signals as independent). Panel a provides an overview of model simulations, participants structure judgments are shown in panel b, and participants' environmental (planet) judgments in panel c. Here, binary planet judgments and associated confidence (1-3) were transformed to a 6-node discrete belief scale where 1=very confident blue and 6=very confident red.



Model Comparison and Discussion

- Participants correctly identified independent and acyclic network structures
- Modeling results provide evidence for a naïve social learning account that integrates social evidence with the learner's own observations in a structure insensitive way
- Our results suggests that while people are capable of using communication patterns to identify social influences, they are still misled by the distortions of evidence that these network dynamics can produce

Table: Model fits to participants' environmental (planet) judgments

Data	Learner	BIC	τ	$N_{best-fit}$
Full (405 trials)	Baseline	1451.3	-	8
	Non-Social	1401.7	3.99	19
	Exact	1414.5	3.5	4
	Naïve	**1265.7**	6.24	**50**

References

Fränken, J.-P., Theodoropoulos, N. C., Moore, A. B., & Bramley, N. R. (2020). Belief revision in a micro-social network: Modeling sensitivity to statistical dependencies in social learning. In *Proceedings of the 42nd annual conference of the cognitive science society.*

Whalen, A., Griffiths, T. L., & Buchsbaum, D. (2018). Sensitivity to shared information in social learning. *Cognitive science*, *42*(1), 168–187.

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