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Social uncertainty is heterogeneous and sometimes valuable

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To win friends, help the needy, avoid exploitation, or influence strangers, people must make decisions that are inherently uncertain. In their compelling and insightful perspective on resolving social uncertainty¹, FeldmanHall and Shenhav (henceforth F&S) join a growing movement combining computational approaches with social psychological theory². Here, we highlight theory and evidence suggesting important avenues for enriching their model.

F&S define social uncertainty as the “degree to which a person’s uncertainty about [...] their own future states and actions depends on their uncertainty about the states and actions of others”. This is surely a central source of uncertainty in social life; further ground can be covered by distinguishing varieties of uncertainty that differentially influence social behaviour. For example, people are more selfish when they are uncertain about what *outcomes* their decisions will produce for others³, but less selfish when they are uncertain about the *impact* of those outcomes on others’ welfare⁴. People also intuitively distinguish between *epistemic uncertainty*, which is resolvable with additional information, and *aleatory uncertainty*, which arises from randomness and is not resolvable with additional information⁵. It remains to be seen whether the unresolvable uncertainty arising from the inherent opacity of other minds is a special form of aleatory uncertainty, or an entirely different species. Regardless, it is already clear that uncertainty does not uniformly affect social interactions.

In describing how people resolve social uncertainty, F&S draw on a Bayesian framework that accurately characterizes not just predictions of others’ behaviours^{6,7,8}, but also people’s global impressions about others’ competence and moral character⁸. Bayesian inference provides a benchmark for establishing whether belief updating is “optimal” in an information-theoretic sense. Systematic deviations from Bayes optimality could indicate social biases arising from heuristics¹, reveal maladaptive social psychopathologies^{1,9}, or even identify cognitive strategies that are optimal in an ecological sense - for example, maintaining uncertainty about the moral character of badly behaving others, which can help preserve relationships in case initial bad impressions turn out to be mistaken⁸.

Finally, F&S’s perspective raises an intriguing question: to what extent is social uncertainty aversive and thus something people wish to reduce? Much of social life involves trading off costs and benefits for oneself and others, and robust evidence shows that when people face such tradeoffs, they can find uncertainty attractive rather than aversive^{3,4}. When uncertainty

conceals how self-serving decisions will affect others, people exploit this “moral wiggle room” to behave selfishly^{3,4,10}, and prefer not to resolve uncertainty, even when doing so costs nothing^{3,4}. In this way, uncertainty helps people preserve their moral self-image.

We applaud F&S for advocating a productive and powerful inquiry into the computational substrates of social uncertainty. The challenge for future research will be to incorporate multiple varieties of uncertainty into models of social inference; to better characterize when social inference departs from the Bayesian ideal; and to develop new models that can illuminate when uncertainty is something people wish to avoid versus embrace.

References

1. FeldmanHall, O., & Shenhav, A. (2019). Resolving uncertainty in a social world. *Nature human behaviour*, 1.
2. Cushman, F. & Gershman, S. Editors' introduction: Computational approaches to social cognition. *Top. Cogn. Sci.* 11, 281–298 (2019).
3. Dana, J., Weber, R. A. & Kuang, J. X. Exploiting moral wiggle room: Experiments demonstrating an illusory preference for fairness. *Econ. Theory* 33, 67–80 (2006).
4. Kappes, A. et al. Uncertainty about the impact of social decisions increases prosocial behaviour. *Nat. Hum. Behav.* 2, 573–580 (2018).
5. Ülkümen, G., Fox, C. R. & Malle, B. F. Two dimensions of subjective uncertainty: Clues from natural language. *J. Exp. Psychol. Gen.* 145, 1280–1297 (2016).
6. Behrens, T. E. J., Hunt, L. T., Woolrich, M. W. & Rushworth, M. F. S. Associative learning of social value. *Nature* 456, 245–249 (2008).
7. Diaconescu, A. O. et al. Inferring on the Intentions of Others by Hierarchical Bayesian Learning. *PLOS Comput. Biol.* 10, e1003810 (2014).
8. Siegel, J. Z., et al. Beliefs about bad people are volatile. *Nat. Hum. Behav.* 2, 750–756 (2018).
9. Huys, Q. J., Guitart-Masip, M., Dolan, R. J., & Dayan, P. (2015). Decision-theoretic psychiatry. *Clinical Psychological Science*, 3(3), 400-421.
10. Haisley, E. C., & Weber, R. A. (2010). Self-serving interpretations of ambiguity in other-regarding behavior. *Games and Economic Behavior*, 68(2), 614-625.

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