

Cooperation and Decision Time

Anthony M. Evans & David G. Rand

Correspondence: A.M.Evans@uvt.nl

Posted: May 14, 2018

Forthcoming in Current Opinion in Psychology

We review two fundamentally different ways that decision time is related to cooperation. First, studies have experimentally manipulated decision time to understand how cooperation is related to the use of intuition versus deliberation. Current evidence supports the claim that time pressure (and, more generally, intuition) favors cooperation. Second, correlational studies reveal that self-paced decision times are primarily related to decision conflict, not the use of intuition or deliberation. As a result, extreme cooperation decisions occur more quickly than intermediate decisions, and the relative speed of highly cooperative versus non-cooperative decisions depends on details of the design and participant pool. Finally, we discuss interpersonal consequences of decision time: people are judged based on how quickly they cooperate, and decision time is used as a cue to predict cooperation.

Keywords: Cooperation; Social Dilemmas; Dual-process theories; Cognitive Conflict

Cooperation among strangers is necessary for the success of small groups and large-scale societies [1, 2]. But when and why are people willing to forego personal interest for the collective good? As one window into these questions, psychologists and behavioral economists have used decision time to understand the processes underlying cooperation.

We illustrate two fundamentally different ways that decision time is related to cooperation: First is the *experimental* manipulation of decision time (e.g., the external application of time pressure), which affects the extent to which decisions are based on intuition versus deliberation [3, 4]. Current evidence regarding time pressure and, more generally, intuition indicates that making people decide quickly and intuitively increases cooperation, while making people decide slowly and deliberately increases defection [5-7]. Second is the *correlation* between (self-paced) decision time and cooperation. Although decision time correlations have often been used to make inferences about intuition versus deliberation, recent work has shown that this interpretation is generally incorrect [8, 9]. Instead, self-paced decision times are more likely to reveal feelings of conflict: Low-conflict decisions – where one option is clearly preferable to the other(s) – tend to be faster, while high-conflict decisions – where multiple options are similarly attractive – tend to be slower.

After describing these two ways that time influences cooperation, we conclude by reviewing recent studies on the interpersonal consequences of decision time. People believe that those who cooperate quickly are more trustworthy than those who cooperate slowly, and people use decision time as a cue to predict whether cooperation will occur [10, 11]. Decision time, in short, gives insight into how cooperative decisions are made, and how people judge the decisions of others.

Experimental Manipulations of Decision Time

Experimental manipulations of decision time are typically interpreted within the framework of dual-process models, which conceptualize decisions as arising from a competition between intuitive versus deliberative cognitive processes. Among the many ways that this distinction has been characterized [12, 13], intuition and deliberation can be differentiated by the tradeoff between ease and flexibility [14]: intuitive processes are relatively effortless, automatic, and/or fast, but intuition is also insensitive to the details of the decision setting; on the other hand, deliberative processes are relatively effortful, controlled, and/or slow, but deliberation allows responses to be tailored to the situation at hand.

The Social Heuristics Hypothesis (SHH) applies this ease-flexibility tradeoff to cooperation, arguing that intuitive responses implement behavior which is payoff-maximizing in the long run, whereas deliberation favors behavior which is payoff-maximizing in the current situation [7, 15-19]. In the long run, cooperation is payoff-maximizing due to reputation effects and institutional sanctions [20]. Therefore, the SHH predicts that in atypical situations where defection is payoff-maximizing – such as one-shot anonymous interactions – intuition (and, more specifically, time pressure manipulations) should favor cooperation, while deliberation should favor defection.

Current evidence regarding the effects of intuitive processing on cooperation supports the SHH: Time pressure poses a methodological challenge because it is not possible to *force* people to decide quickly – and as a result, many time pressure studies have high rates of non-compliance (e.g., [7, 21-25]). Non-compliance makes it difficult to draw inferences about the causal effect of time constraints: excluding non-compliant participants can cause selection

effects, but including untreated participants dilutes any actual causal effect [26]. However, two recent studies resolved the non-compliance problem by having participants practice with the interface before making their decisions; importantly, both studies confirmed the key SHH prediction that deliberation reduces cooperation [5, 27]. Furthermore, a field experiment with an ingenious design avoided non-compliance issues and demonstrated that time pressure increased cooperation in a real-world setting outside the lab [28].

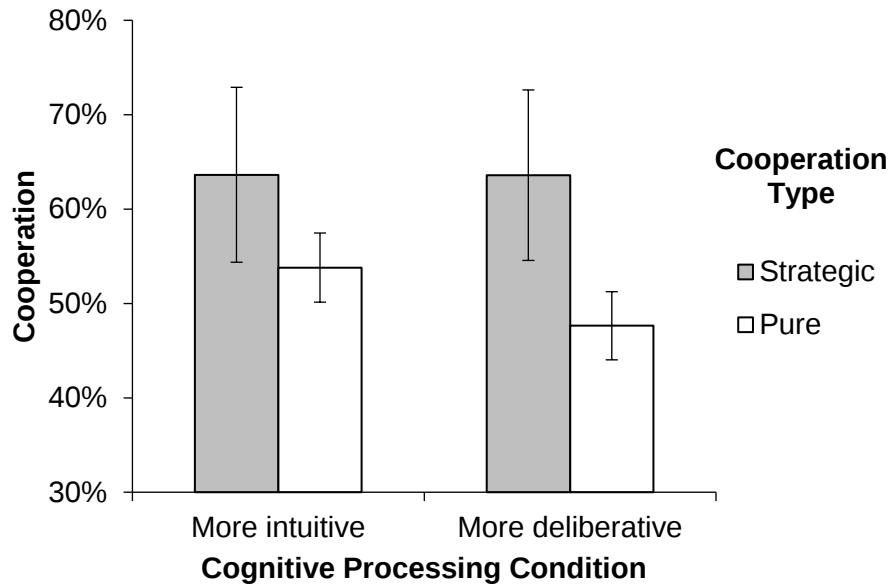


Figure 1: In economic games where cooperation can potentially be a payoff-maximizing choice (i.e., “strategic cooperation” games), there is no effect of promoting intuition versus deliberation. Conversely, in situations where defection is strictly payoff-maximizing (i.e., “pure cooperation” games), promoting intuition leads to more cooperation than promoting deliberation. The pattern revealed in these data (from a meta-analysis of 67 studies [6], total $N = 17,647$; cooperation from Ultimatum Games studies scaled such that offering half is 100% cooperation) suggests that this is because intuitive responses are less sensitive to context – when switching from strategic to pure cooperation, deliberative responses result in a greater decrease in cooperation than intuitive responses. Error bars indicate 95% confidence intervals.

The SHH also makes predictions about when the manipulation of intuition versus deliberation should influence behavior. For example, if deliberation favors responses that are payoff-maximizing, then promoting deliberation should only reduce cooperation when defection is the payoff-maximizing choice. A large meta-analysis of studies experimentally manipulating use of intuition versus deliberation is consistent with this prediction [6]: as illustrated in Figure 1, intuition increased cooperation in games where non-cooperation was strictly payoff-maximizing (e.g. one-shot anonymous games), but intuition had no effect in games where it could be payoff-maximizing to cooperate (e.g., games in which reciprocity was possible). Similarly, a large meta-study examining one-shot games found that time pressure only increased cooperation among participants who understood that defection was payoff-maximizing [29]; and a series of experiments found that applying time pressure to a Stag-Hunt game led to increased cooperation and reduced sensitivity to the payoffs [30]. Another important prediction of the SHH is that cues

that do not change the strategic nature of the setting should not impact the effect of intuition versus deliberation. For example, in a one-shot anonymous Prisoner's Dilemma game (where defection is strictly payoff-maximizing), deliberation should always favor defection. Consistent with this prediction, cooperation was found to be higher under time pressure, even when participants played with out-group members and when the game was framed using competitive language [5, 31].

Finally, the SHH also makes predictions about how individual differences should moderate the role of intuition versus deliberation. Intuition should only favor cooperation for people for whom prosocial behavior is typically payoff-maximizing. Evidence on gender differences is consistent with this prediction: social norms typically prescribe stronger altruistic preferences for women compared to men [32]; in turn, meta-analytic evidence suggests that unilateral giving is intuitive for women, but not for men [33] (these findings are in contrast to multilateral cooperation, which is typically payoff-maximizing – and intuitive – for both genders [34]). Experimental evidence also shows that repeated exposure to settings where cooperation is payoff-maximizing leads to “spillovers,” inducing greater prosociality in subsequent one-shot interactions [17, 35] – a finding which, although not directly related to decision time per se, supports a key element of the SHH.

Correlational decision time and feelings of conflict

Other work has looked at the *correlational* relationship between (self-paced) decision time and cooperation: Initial studies interpreted self-paced decision time as an indicator of whether decisions were made intuitively or deliberately, as speed is a defining feature of intuition [21, 36-39]. Yet, recent findings suggest that self-paced decision time is typically related to feelings of conflict, not the use of intuition or deliberation [8, 9]. When an actor has a strong desire to cooperate (or defect), she feels little conflict and thus decides quickly. In contrast, when the decider has weak or ambivalent preferences, there is more conflict and it takes longer to reach a decision. According to this view, decision time reveals the computational process of evidence accumulation: the decision-maker acquires information until there is sufficient evidence to select a final response, and the presence of conflicting or ambiguous evidence causes this process to unfold more slowly [8, 9].

As discussed above, external time pressure (and, more generally, intuition) increases cooperation [5, 7, 27, 33]. In contrast, *correlational* decision time predicts the extremity, rather than the absolute level, of cooperation: as illustrated by Figure 2, full cooperation and full defection occur quickly while intermediate responses occur more slowly [8]. In other words, there is an inverted-U relationship between self-paced decision time and cooperation. This is because unambiguously cooperative people strongly prefer maximal cooperation (and choose it quickly), while unambiguously selfish people strongly prefer maximal defection (and choose *that* quickly). Conflicted people, on the other hand, are torn between the options; they take longer and are also more likely to select an intermediate response. Importantly, the relationship between conflict and extreme decisions is mediated by decision time: High-conflict decisions are associated with slower decision times, and slower decision times predict less extreme responses [8, 40].

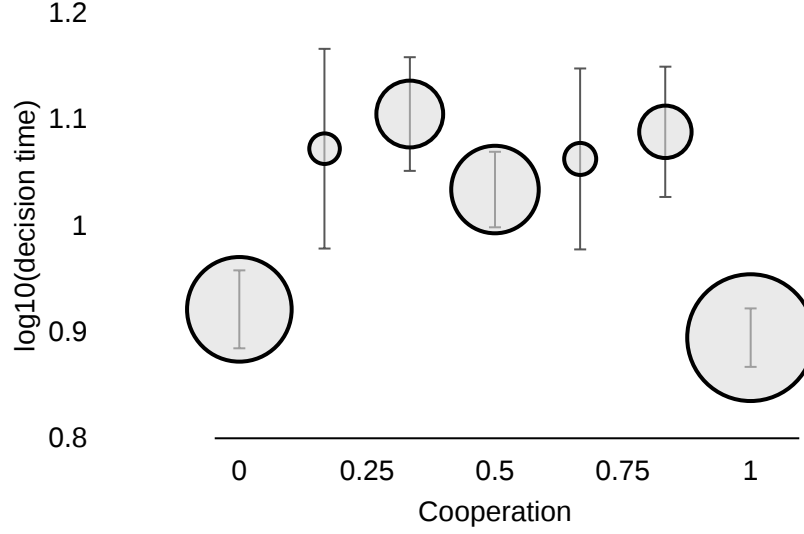


Figure 2: Self-paced decision times are faster for both maximally selfish and maximally cooperative decisions, while being slower for intermediate decisions. Therefore, the zero-order correlation between cooperation and self-paced decision times (which can be visualized by averaging across the x-axis for each value on the y-axis) depends on the relative frequency of fully selfish versus cooperative decisions. In experimental settings where fully selfish decisions are more common, most fast decisions will be selfish and thus there will be a positive correlation between decision time and cooperation. Conversely, in experimental settings where fully cooperative decisions are more common, most fast decisions will be cooperative and thus there will be a negative correlation between decision time and cooperation. Shown are data from the one-shot anonymous Prisoner's Dilemma and Public Goods Games studies from [8] and [21], total $N = 1,454$. Dot sizes are proportional to the number of observations. Error bars indicate 95% confidence intervals.

The conflict model of decision time leads to specific predictions about how individual differences will influence the relationship between decision time and cooperation: For example, individuals with strong preferences to cooperate should be faster to choose cooperation than defection; indeed, this is the case [41]. Presumably, habitual cooperators feel little conflict about cooperating with strangers and hence they need little time to reach a decision. On the other hand, the inverse is true for individuals with strong preferences to defect (i.e., those with individualistic or competitive orientations) [42]. In summary, people feel less conflicted (and decide more quickly) when they make decisions that are in line with their pre-existing preferences and habitual behavior.

By the same logic, the environmental prevalence of cooperation should also influence whether cooperation occurs quickly or slowly. Reciprocal decisions, those that mirror previously observed behavior, occur more quickly and are associated with less conflict than non-reciprocal decisions [40]. In high-cooperation environments, cooperation occurs more quickly than defection; the reverse is true in low-cooperation environments. As a result, individuals who come from cultures where cooperation among strangers is prevalent (i.e., the USA) are faster to choose cooperation than individuals from cultures where cooperation at zero-acquaintance is less common (i.e., India) [43]. Similarly, manipulating the payoff structure of the game to make

cooperation attractive increases the relative speed of cooperation, whereas making defection more attractive increases the relative speed of non-cooperative choices [9].

Importantly, the effects of intuition and conflict on cooperation are independent and dissociable [8]: Forcing people to respond intuitively (or deliberatively) has no effect on feelings of conflict or decision extremity; and manipulating feelings of conflict influences decision extremity, but not the mean-level of cooperation or the extent to which decisions are intuitive or deliberative. Taken together, these findings demonstrate that studies of external time pressure and correlational decision time reveal different cognitive processes. When an individual decides quickly, it is often not the case that her decision was made intuitively (although there are some domains where decision times can provide insight into the use of intuition versus deliberation [44]).

The Social Consequences of Decision Time

In addition to shaping the intrapersonal processes underlying cooperation, there are also interpersonal consequences of making a quick or slow decision. People use decision time to judge the intentions underlying cooperative decisions, and to predict if others will cooperate [10, 11].

People draw inferences about others' preferences based on how their decisions are made [45, 46]. When judging others' behavior, people make stronger judgments based on decisions that are made quickly and without considering all the available information [11]. In other words, people who "cooperate without looking" are seen as more trustworthy than those who only cooperate after taking the time to carefully weigh the costs and benefits of cooperation. Choosing to cooperate quickly (or without learning about the costs of doing so) functions as a signal of a desire to do the right thing, regardless of the financial costs [47]. Conversely, those who decide to cooperate slowly are seen as conflicted or doubting [48].

In other situations, people may observe decision time, but not learn about the final decision. In other words, people will see a decision was made quickly (or slowly), but not know if the decision-maker cooperated. Under these conditions, people use decision time to predict behavior, correctly believing that fast decisions are more extreme than slow decisions [10]. However, these effects only occur when decision time cannot be attributable to an external source, such as time pressure. Decision time only affects predicted behavior when it can be attributed to the decision-maker. As a result of this process, when people interact with fast partners, they assume that these partners made extreme decisions and people, in turn, are also more likely to select extreme decisions themselves [10].

Conclusion

Human cooperation is vital for the success of small-scale groups and society at large. Understanding when and why people cooperate may yield solutions to some of the modern world's most pressing problems. For example, insights into social dilemmas have been applied to understand and facilitate pro-environmental behavior and to confront the challenges of unethical behavior and corruption [49, 50]. Decision time is one tool that can be used to understand the processes underlying cooperation. Research on experimental time pressure and correlational decision time has led to a better understanding of the personal and environmental factors that shape cooperation.

Acknowledgments

DGR gratefully acknowledges funding from the Templeton World Charity Foundation (grant no. TWCF0209), and the Defense Advanced Research Projects Agency NGS2 program (grant no. D17AC00005).

References and Recommended Reading

Papers of particular interest, published within the period of review, have been highlighted as:

* Of special interest

** Of outstanding interest

1. Dawes, R.M., *Social dilemmas*. Annual review of psychology, 1980. **31**(1): p. 169-193.
 2. Rand, D.G. and M.A. Nowak, *Human Cooperation*. Trends in Cognitive Sciences, 2013. **17**(8): p. 413-425.
 3. Kahneman, D., *Thinking, Fast and Slow*. 2011, New York, NY: Farrar, Straus and Giroux.
 4. Sloman, S.A., *The empirical case for two systems of reasoning*. Psychological Bulletin, 1996. **119**(1): p. 3.
 5. Everett, J., et al., *Deliberation erodes cooperative behaviour – even towards competitive outgroups, even when using a control condition, and even when controlling for sample bias*. Journal of Experimental Social Psychology, 2017. **73**: p. 76-81.
- * A large pre-registered experiment testing the effects of time constraints on cooperation. The experimental design solves the issue of non-compliance with the time constraints by giving participants practice with the interface before making a decision. The results confirm the SHH's prediction that deliberation increases selfishness.
6. Rand, D.G., *Cooperation, fast and slow: Meta-analytic evidence for a theory of social heuristics and self-interested deliberation*. Psychological Science, 2016.
- ** A meta-analysis of 67 studies of cooperation in economic games (total N = 17,647) comparing the effect of experimentally manipulating reliance on intuition versus deliberation. The findings support the SHH's prediction that deliberation reduces cooperation in games where defection is the payoff-maximizing responses ("pure cooperation" games), but not in games where cooperation can be payoff-maximizing ("strategic cooperation" games).
7. Rand, D.G., et al., *Social Heuristics Shape Intuitive Cooperation*. Nature Communications, 2014. **5**: p. 3677.

8. Evans, A.M., K.D. Dillon, and D.G. Rand, *Fast but not intuitive, slow but not reflective: Decision conflict drives reaction times in social dilemmas*. Journal of Experimental Psychology: General, 2015. **144**(5): p. 951-966.

** This article shows that fast decisions are more extreme than slow decisions; that correlational decision times are explained by feelings of conflict (not the use of intuition vs deliberation); and that the effects of conflict and cognitive processing mode (intuitive vs. deliberative) on cooperation are independent and dissociable.

9. Krajbich, I., et al., *Rethinking fast and slow based on a critique of reaction-time reverse inference*. Nature communications, 2015. **6**: p. 7455.

* This article demonstrates that preference strength can explain the relationship between decision time and cooperation; demonstrates the direction of this relationship can be reversed by changing the experimental design (scaling the multiplier on public goods contributions); and proposes evidence accumulation models as a framework to understand decision time processes.

10. Evans, A.M. and P.P.F.M. van de Calseyde, *The effects of observed decision time on expectations of extremity and cooperation*. Journal of Experimental Social Psychology, 2017. **68**: p. 50-59.
11. Jordan, J.J., et al., *Uncalculating cooperation is used to signal trustworthiness*. Proceedings of the National Academy of Sciences, 2016. **113**(31): p. 8658-8663.
12. Kahneman, D., *A perspective on judgment and choice: Mapping bounded rationality*. American Psychologist, 2003. **58**(9): p. 697-720.
13. Evans, J.S.B. and K.E. Stanovich, *Dual-process theories of higher cognition advancing the debate*. Perspectives on Psychological Science, 2013. **8**(3): p. 223-241.
14. Rand, D., et al., *Cyclical population dynamics of automatic versus controlled processing*. Psychological Review, 2017.
15. Bear, A., A. Kagan, and D.G. Rand, *Co-Evolution of Cooperation and Cognition: The Impact of Imperfect Deliberation and Context-Sensitive Intuition*. Proc Roy Soc B, 2017. **284**(1851).
16. Bear, A. and D.G. Rand, *Intuition, deliberation, and the evolution of cooperation*. Proceedings of the National Academy of Sciences, 2016. **113**(4): p. 936-941.
17. Peysakhovich, A. and D.G. Rand, *Habits of Virtue: Creating Norms of Cooperation and Defection in the Laboratory*. Management Science, 2016. **62**(3): p. 631-647.
18. Jagau, S. and M. van Veelen, *A general evolutionary framework for the role of intuition and deliberation in cooperation*. 2017. **1**: p. 0152.

19. Mosleh, M. and D.G. Rand, *Population Structure Promotes the Evolution of Intuitive Cooperation and Inhibits Deliberation*. Scientific Reports, 2018. **8**(1): p. 6293.
20. Jordan, J.J., A. Peysakhovich, and D.G. Rand, *Why we cooperate*, in *The Moral Brain: Multidisciplinary Perspectives*, J. Decety and T. Wheatley, Editors. 2015, MIT Press: Cambridge, MA.
21. Rand, D.G., J.D. Greene, and M.A. Nowak, *Spontaneous giving and calculated greed*. Nature, 2012. **489**(7416): p. 427-430.
22. Bouwmeester, S., et al., *Registered Replication Report: Rand, Greene, and Nowak (2012)*. Perspectives on Psychological Science, 2017: p. 1745691617693624.
23. Rand, D.G. and G.T. Kraft-Todd, *Reflection Does Not Undermine Self-Interested Prosociality*. Frontiers in Behavioral Neuroscience, 2014. **8**: p. 300.
24. Verkoeijen, P.P.J.L. and S. Bouwmeester, *Does Intuition Cause Cooperation?* PLoS ONE, 2014. **9**(5): p. e96654.
25. Cone, J. and D.G. Rand, *Time Pressure Increases Cooperation in Competitively Framed Social Dilemmas*. PLoS ONE, 2014. **9**(12): p. e115756.
26. Rand, D.G., *Reflections on the Time-Pressure Cooperation Registered Replication Report*. Perspectives on Psychological Science, 2017: p. 1745691617693625.
27. Isler, O., J. Maule, and C. Starmer, *Is intuition really cooperative? Improved tests support the social heuristics hypothesis*. PLoS ONE, 2018. **13**(1): p. e0190560.
28. Artavia-Mora, L., A.S. Bedi, and M. Rieger, *Intuitive Help and Punishment in the Field*. European Economic Review, 2017. **92**: p. 133-145.
29. Strømland, E., S. Tjøtta, and G. Torsvik, *Understanding and Intuitive Cooperation*. Available at SSRN: <https://ssrn.com/abstract=3120986>, 2018.
30. Belloc, M., et al., *A Social Heuristics Hypothesis for the Stag Hunt: Fast- and Slow-Thinking Hunters in the Lab*. CESifo Working Paper Series No. 6824, 2018.
31. Rand, D.G., G.E. Newman, and O. Wurzbacher, *Social context and the dynamics of cooperative choice*. Journal of Behavioral Decision Making, 2015. **28**(2): p. 159-166.
32. Heilman, M.E. and J.J. Chen, *Same behavior, different consequences: reactions to men's and women's altruistic citizenship behavior*. Journal of Applied Psychology, 2005. **90**(3): p. 431.
33. Rand, D.G., et al., *Social heuristics and social roles: Intuition favors altruism for women but not for men*. Journal of experimental psychology. General, 2016. **145**(4): p. 389-396.

34. Rand, D.G., *Social dilemma cooperation (unlike Dictator Game giving) is intuitive for men as well as women*. Journal of experimental social psychology, 2017. **73**: p. 164-168.
 35. Stagnaro, M.N., A.A. Arechar, and D.G. Rand, *From good institutions to generous citizens: Top-down incentives to cooperate promote subsequent prosociality but not norm enforcement*. Cognition, 2017.
 36. Piovesan, M. and E. Wengström, *Fast or fair? A study of response times*. Economics Letters, 2009. **105**(2): p. 193-196.
 37. Rubinstein, A., *Instinctive and cognitive reasoning: A study of response times*. The Economic Journal, 2007. **117**(523): p. 1243-1259.
 38. Nielsen, U.H., J.-R. Tyran, and E. Wengstrom, *Second Thoughts on Free Riding*. Economics Letters, 2013. **122**: p. 136-139.
 39. Lotito, G., M. Migheli, and G. Ortona, *Is cooperation instinctive? Evidence from the response times in a public goods game*. Journal of Bioeconomics, 2013. **15**(2): p. 123-133.
 40. Nishi, A., et al., *Social environment shapes the speed of cooperation*. Scientific reports, 2016. **6**: p. 29622.
 41. Mischkowski, D. and A. Glöckner, *Spontaneous cooperation for prosocials, but not for proselves: Social value orientation moderates spontaneous cooperation behavior*. Scientific reports, 2016. **6**: p. 21555.
 42. Yamagishi, T., et al., *Response time in economic games reflects different types of decision conflict for prosocial and prosself individuals*. Proceedings of the National Academy of Sciences, 2017: p. 201608877.
- * This paper demonstrates that individual differences in altruistic preferences moderate the relationship between decision time and cooperation, and provides initial data on the specific cognitive systems involved in the relationship between decision time and cooperation.
43. Nishi, A., N.A. Christakis, and D.G. Rand, *Cooperation, decision time, and culture: Online experiments with American and Indian participants*. PloS one, 2017. **12**(2): p. e0171252.
 44. Pennycook, G., et al., *Commentary: Rethinking fast and slow based on a critique of reaction-time reverse inference*. Frontiers in psychology, 2016. **7**: p. 1174.
 45. Everett, J.A., D.A. Pizarro, and M. Crockett, *Inference of trustworthiness from intuitive moral judgments*. Journal of Experimental Psychology: General, 2016. **145**(6): p. 772.
 46. Critcher, C.R., Y. Inbar, and D.A. Pizarro, *How quick decisions illuminate moral character*. Social Psychological and Personality Science, 2013. **4**(3): p. 308-315.

47. Hoffman, M., E. Yoeli, and M.A. Nowak, *Cooperate without looking: Why we care what people think and not just what they do*. Proceedings of the National Academy of Sciences, 2015. **112**(6): p. 1727-1732.
48. Van de Calseyde, P.P., G. Keren, and M. Zeelenberg, *Decision time as information in judgment and choice*. Organizational Behavior and Human Decision Processes, 2014. **125**(2): p. 113-122.
49. Van Lange, P.A., et al., *The psychology of social dilemmas: A review*. Organizational Behavior and Human Decision Processes, 2013. **120**(2): p. 125-141.
50. Kraft-Todd, G., et al., *Promoting cooperation in the field*. Current Opinion in Behavioral Sciences, 2015. **3**: p. 96-101.