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Social setting, intuition and experience in laboratory experiments interact to shape cooperative decision-making

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Recent studies suggest that cooperative decision-making in one-shot interactions is a history-dependent dynamic process: promoting intuition versus deliberation typically has a positive effect on cooperation (dynamism) among people living in a cooperative setting and with no previous experience in economic games on cooperation (history dependence). Here, we report on a laboratory experiment exploring how these findings transfer to a non-cooperative setting. We find two major results: (i) promoting intuition versus deliberation has no effect on cooperative behaviour among inexperienced subjects living in a non-cooperative setting; (ii) experienced subjects cooperate more than inexperienced subjects, but only under time pressure. These results suggest that cooperation is a learning process, rather than an instinctive impulse or a self-controlled choice, and that experience operates primarily via the channel of intuition. Our findings shed further light on the cognitive basis of human cooperative decision-making and provide further support for the recently proposed social heuristics hypothesis.

1. Introduction

One of the factors of the enormous success of our societies is our ability to cooperate [1–15]. While, in most animal species, cooperation is observed only among kin or in very small groups, where future interactions are likely, cooperation among people goes far beyond the five rules of cooperation [16]: recent experiments have shown that people cooperate also in one-shot anonymous interactions [17–21] and even in large groups [22]. This poses an evolutionary puzzle: why are people willing to pay costs to help strangers when no future rewards seem to be at stake?

A growing body of experimental research suggests that cooperative decision-making in one-shot interactions is most likely to be a history-dependent dynamic process. It is *dynamic* because time pressure [23–27], cognitive load [28–30], conceptual priming of intuition [23,31] and disruption of the right lateral prefrontal cortex [32] have all been shown to promote cooperation, providing direct evidence that automatic actions are, on average, more cooperative than deliberate actions. It is *history-dependent* because it has been found that previous experience with economic games on cooperation and intuition interact such that experienced subjects are less cooperative than inexperienced subjects, but only under time pressure [24], and that intuition promotes cooperative behaviour only among inexperienced subjects with above median trust in the setting where they live [26]. While the latter paper also shows that promoting intuition versus reflection has no effect among experienced subjects, its results are inconclusive with regard to people with little trust in their environment, due to the limited number of observations. More generally, the limitation of previous studies is that they have all been conducted in developed countries and so they do not allow one to draw any conclusions about what happens among people from a societal background in which they are exposed to frequent non-cooperative acts.

Two fundamental questions therefore remain unsolved. What is the effect of promoting intuition versus deliberation among people living in a non-cooperative setting? How does this interact with previous experience with economic games on cooperative decision-making?

The first question is particularly intriguing since, based on existing theories, several alternatives are possible. The social heuristics hypothesis (SHH), introduced by Rand *et al*. [23,24] to explain the intuitive predisposition towards cooperation described above, 'posits that cooperative decision-making is guided by heuristic strategies that have generally been successful in one's previous social interactions and have, over time, become internalized and automatically applied to social interactions that resemble situations one has encountered in the past. When one encounters a new or atypical social situation that is unlike previous experience, one generally tends to rely on these heuristics as an intuitive default response. However, through additional deliberation about the details of the situation, one can override this heuristic response and arrive at a response that is more tailored to the current interaction' [25]. Hence, according to the SHH, inexperienced subjects living in a non-cooperative setting should bring their non-cooperative strategy (learned in the setting where they live) in the laboratory as a default strategy. These subjects are then predicted to act non-cooperatively both under time pressure (because they use their non-cooperative default strategy) and under time delay (because defection is optimal in one-shot interactions).

However, this is not the only possibility. Several studies have shown that patients who suffered ventromedial prefrontal cortex damage, which causes the loss of emotional responsiveness, are more likely to display anti-social behaviour [33–35]. These findings support the interpretation that intuitive emotions play an important role in pro-social behaviour and form the basis of Haidt's social intuition model (SIM), according to which moral judgement is caused by quick moral intuitions and is followed (when needed) by slow, *ex post facto* moral reasoning [36]. While the SIM does not make any prediction on what happens in the specific domain of cooperation, it would certainly be consistent with a general intuitive predisposition towards cooperation, mediated by positive emotions and independent of the social setting in which an individual is embedded.

A third alternative is yet possible. Motivated by work suggesting that people whose self-control resources have been taxed tend to cheat more [37,38] and be less altruistic [39–41], it has been argued that self-control plays an important role in overriding selfish impulses and bringing behaviour in line with moral standards. This is consistent with Kohlberg's rationalist approach [42], which assumes that moral choices are guided by reason and cognition: as their cognitive capabilities increase, people learn how to take the other's perspective, which is fundamental for pro-social behaviour. This rationalist approach makes the explicit prediction that promoting intuition always undermines cooperation.

In sum, the question of how promoting intuition versus reflection affects cooperative behaviour among people living in a non-cooperative setting is far from being trivial, and, based on existing theories, all three possibilities (positive effect, negative effect and no effect) are, *a priori*, possible.

Concerning previous experience on economic games, while the SIM and the rationalist approach do not make any prediction about its role on cooperative decision-making among people living in a non-cooperative setting, the SHH predicts that it has either a null or a positive effect driven by intuitive responses. This because experienced participants, despite their living in a non-cooperative setting, *might* have internalized a cooperative strategy to be used only in experiments. Of course, the SHH does not predict that a substantial proportion of subjects have *in fact* developed such a context-dependent cooperative intuition—and this is why the predicted effect is *either* positive *or* null. In the former case, however, the SHH predicts that the positive effect should be driven by intuitive responses, as the SHH assumes that experience operates primarily through the channel of intuition.

Here, we report on an experiment aimed at clarifying these points. We provide evidence of two major results: (i) promoting intuition versus reflection has no effect on cooperation among subjects living in a non-cooperative setting and with no previous experience with economic games on cooperation; (ii) experienced subjects are more cooperative than inexperienced subjects, but only when acting under time pressure.

Taken together, these results suggest that cooperation is a learning process, rather than an instinctive impulse or a self-controlled choice, and that experience operates primarily via the channel of intuition. In doing so, they shed further light on human cooperative decision-making and provide further support for the SHH.

2. Material and methods

We have conducted an experiment using the online labour market Amazon Mechanical Turk (AMT) [43–45], recruiting participants only from India. India is a particularly suitable country to hire people from for our purpose: if, as many studies have confirmed [46–57], good institutions are crucial for the evolution of cooperation, and if, as many scholars have argued [58–61], corruption and cronyism are endemic in Indian society, then residents in India are likely to have very little trust in strangers and so they are likely to have internalized non-cooperative strategies in their everyday life. One study confirms this hypothesis, by showing that spiteful preferences are widespread in the state of Uttar Pradesh, and this ultimately implies residents' inability to cooperate [62]. At the same time, according to demographic studies on AMT population [63], India is the second most active country on AMT after the US, which facilitates the procedure of collecting data.

Participants were randomly assigned to either of two conditions: in the *time pressure* condition, we measured intuitive cooperation; in the *time delay* condition, we measured deliberate cooperation. As a measure of cooperation, we adopted a standard two-person prisoner's dilemma (PD) with a continuous set of strategies. Specifically, participants were given an endowment of $0.20 and asked to decide how much, if any, to transfer to the other participant. The amount transferred would be multiplied by 2 and earned by the other participant; the remainder would be earned by themselves, but without being multiplied by any factor. Each participant was informed that the other participant was facing the same decision problem. Participants in the time pressure condition were asked to make a decision within 10 s and those in the time delay condition were asked to wait for at least 30 s before making their choice. After making their decision, participants had to answer four comprehension questions, after which they entered the demographic questionnaire, where, along with the usual questions, we also asked 'To what extent have you previously participated in other studies like this one (e.g. exchanging money with strangers)?' using a five-point Likert-scale from 'never' to 'several times'. As in previous

studies [23,24,26], we used the answer to this question as a measure of the participant's previous experience with economic games on cooperative decision-making. As in these studies, we say that a subject is *inexperienced* if he or she answered 'never' to the above question. In the electronic supplementary material, we also report the results of a pilot, in which we measured the participants' level of experience by asking them to report the extent to which they had participated in *exactly* the same task before. Although the use of the word 'exactly' may lead to confusion, with some minor differences in the details, our main results are robust to the use of this measure (see electronic supplementary material for more details).

After collecting the results, bonuses were computed and paid on top of the participation fee ($0.50). No deception was used.

3. Results

A total of 949 subjects participated in our experiment. Taken globally, results contain a lot of noise, as only 449 subjects passed the comprehension questions. Here, we restrict our analysis to subjects who passed all comprehension questions and we refer the reader to the electronic supplementary material for the analysis of those subjects who failed the attention check. We include in our analysis also subjects who did not obey the time constraint in order to avoid selection problems that impair causal inference [64].

First, we ascertain that our time manipulation effectively worked. Analysing participants' decision times, we find that those in the time delay condition ($n = 246$) took, on average, 45.64 s to make their decision, whereas those under time pressure took, on average, only 20.04 s. Thus, although many subjects under time pressure did not obey the time constraint, the time manipulation still had a substantial effect.

Participants under time pressure transferred, on average, 27.93% of their endowment, and those under time delay transferred, on average, 28.57% of their endowment. Linear regression using time manipulation as a dummy variable confirms that the difference is not statistically significant (coeff. = 0.00646201, $p = 0.8572$), even after controlling for age, sex and level of education (coeff. = 0.0108648, $p = 0.7265$). We note that restricting the analysis to subjects who obeyed the time constraint leads to qualitatively equivalent results (26.11% under time pressure versus 29.02% under time delay, coeff. = 0.310051, $p = 0.4868$). Thus, promoting intuition versus reflection does not have any effect on cooperative decision-making. We note that these percentages are far below those observed among US residents in a very similar experiment [19]. More precisely, in this latter paper, US residents started out with a $0.10 endowment and were asked to decide how much, if any, to give to the other person. As in this study, the amount transferred would be multiplied by 2 and earned by the other player. Strictly speaking, these two experiments are not comparable for three reasons. First, in [19], there was no time manipulation; second, the initial endowments were different; third, stakes used in the experiment in the US did not correspond to the same stakes in Indian currency. According to previous research, these differences are minor. Indeed, recent studies have argued that stakes do not matter as long as they are not too high [44,65], and that neutrally framed PDs give rise to a percentage of cooperation sitting between that obtained in the time pressure condition and that obtained in the time delay condition [23]. Thus, comparing the percentage of cooperation in this study

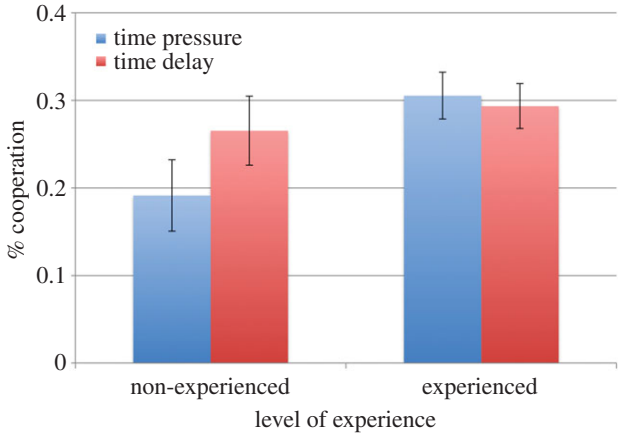

Figure 1. Average amount transferred per condition (time pressure versus time delay) divided by level of experience in economic games on cooperation (naive versus non-naive). Error bars represent the standard error of the mean. Inexperienced subjects under time delay transferred slightly more than inexperienced subjects under time pressure, but the difference is not statistically significative ($p = 0.2306$). Previous experience with economic games on cooperation has a positive effect on cooperation, but only among participants in the time pressure condition ($p = 0.04464$). (Online version in colour.)

(28%) with that reported by Capraro *et al.* [19] (52%) supports our assumption that the average Indian sample is particularly non-cooperative (or, at least, less cooperative than the average US sample).

Next, we investigate our main research questions. Figure 1 summarizes our results, providing visual evidence that (i) promoting intuition versus reflection has no significant effect on cooperation among inexperienced subjects, and that (ii) experienced subjects cooperate more than inexperienced subjects, but only when acting under time pressure.

More specifically, we find that inexperienced subjects under time pressure ($n = 47$) transferred, on average, 19.78% of their endowment, whereas those under time delay ($n = 73$) transferred, on average, 26.98% of their endowment. The difference is not significant (coeff. = 0.0719907, $p = 0.2306$), even after controlling for all socio-demographic variables (coeff. = 0.0711474, $p = 0.2337$). Thus, promoting intuition versus reflection has no effect on cooperation among inexperienced subjects living in a non-cooperative setting. This finding is robust to controlling for people who did not obey the time constraint (coeff. = 0.156951, $p = 0.5560$) and to controlling for people who obeyed the time constraint (coeff. = 0.0371963, $p = 0.8082$).

To explore the interaction between experience and cooperative behaviour, as in previous studies [23,24,26], we separate subjects into experienced and inexperienced. This procedure comes from the observation that, although the level of experience is a categorical variable, the association between participant's objective level of experience and their answer to our question is objective only in the case of inexperienced subjects. Linear regression predicting cooperation using experience as a dummy variable confirms that experience with economic games on cooperation favours the emergence of cooperative choices, but only among people in the time pressure condition (time pressure: coeff. = 1.05974, $p = 0.04464$; time delay: coeff. = 0.217945, $p = 0.63930$). These results are robust to including control on the socio-demographic variables (time pressure: coeff. = 1.05054, $p = 0.04641$; time delay: coeff. = 0.215053, $p = 0.64603$). Our main

results are also robust to using non-parametric tests, such as Wilcoxon rank-sum: the rate of cooperation of inexperienced subjects is not statistically distinguishable from the rate of cooperation of inexperienced subjects acting under time delay both when they act under time pressure ($p = 0.3271$) and under time delay ($p = 0.5619$); and the rate of cooperation of inexperienced subjects is significantly smaller than that of experienced subjects, but only among those acting under time pressure (time pressure: $p = 0.0251$; time delay: $p = 0.4715$). For completeness, we also report the results of linear regression predicting cooperation using level of experience as independent variable. We find that level of experience has a marginally significant positive effect on cooperation among subjects acting under time pressure (coeff. = 0.327449, $p = 0.06343$) and has no effect on cooperation among subjects acting under time delay (coeff. = 0.210234, $p = 0.20062$). Also, these results are robust to including control on all the socio-demographic variables (time pressure: coeff. = 0.305278, $p = 0.08438$; time delay: coeff. = 0.19119, $p = 0.25112$).

The increase of cooperation from inexperienced subjects to experienced subjects seems to be driven by participants under time pressure who did *not* obey the time constraint. Specifically, linear regression predicting cooperation using experience as a dummy variable yields non-significant results in the case of participants who obeyed the time pressure condition (without control: coeff. = 0.137931, $p = 0.8864$; with control: coeff. = 0.0760645, $p = 0.9390$) and significant results in case of participants who did not obey it (without control: coeff. = 0.151793, $p = 0.0166$; with control: coeff. = 0.150522, $p = 0.0180$). This is not surprising, and it is most probably due to noise generated by a combination of two factors: the set of people who obeyed the time pressure constraint is very small (for instance, only 14 inexperienced people obeyed the time constraint) and it is more likely to contain people who did not understand the decision problem but passed the comprehension questions by chance (which we estimated to be 5% of the total; see the electronic supplementary material).

4. Discussion

We have shown that (i) promoting intuition via time pressure versus promoting deliberation via time delay has no effect on cooperative behaviour among subjects residents in India with no previous experience with economic games on cooperation, and that (ii) experience has a positive effect on cooperation, but this effect is significant only among subjects acting under time pressure.

Our results have several major implications, the first of which is providing further support for the SHH [23,24]. Introduced in order to organize the growing body of literature providing direct [23–32] and indirect [66–69] evidence that, on average, intuitive responses are more cooperative than reflective responses, the SHH contends that people internalize strategies that are successful in their everyday social interactions and then apply them to social interactions that resemble situations they have encountered in the past. Thus, when they encounter a new or atypical situation, people tend to rely on these heuristics and use them as intuitive responses. Deliberation can override these heuristics and adjust the behaviour towards one that is more tailored to the current interaction.

As such, the SHH makes a prediction that has not been tested so far: inexperienced subjects living in a non-cooperative setting should act non-cooperatively both under time pressure, because they use their non-cooperative default strategy (learned in the setting where they live), and under time delay, because defection is optimal in one-shot interactions. Our results support this prediction.

Besides this prediction, the SHH is also consistent with an interaction between level of previous experience with economic games on cooperation, time pressure and cooperation in one-shot interactions: experienced people, despite their living in a non-cooperative setting, *might* have internalized a cooperative strategy, to be used only in AMT. The SHH does not predict that a substantial proportion of experienced people have *in fact* developed this context-dependent intuition for cooperation, but it is certainly consistent with a positive effect of experience on cooperation driven by intuitive responses. Our results provide evidence for this phenomenon.

As mentioned in the Introduction, Kohlberg's rationalist approach makes the explicit prediction that promoting intuition should always undermine cooperation [42]. Thus, our results support the SHH versus Kohlberg's rationalistic approach. Of course, this does *not* imply that the rationalist approach should be completely rejected: it is indeed supported by many experimental studies involving pro-social behaviours other than cooperation. If anything, our results point out that different pro-social behaviours may emerge from different cognitive processes. Classifying pro-social behaviours in terms of the processes involved is an important direction for future research, towards which, to the best of our knowledge, only one recent study has attempted a first step [70].

Supporting the SHH, our results suggest that economic models of human cooperation should start taking dual processes and individual history into account. Indeed, virtually all major models of human cooperation are static and decontextualized, and only a handful of papers have recently attempted a first step in the direction of taking dual processes into account [71–74]. We believe that extending these approaches to incorporate individual history could be a promising direction for future research.

Our findings go beyond mere support of the SHH. Our cross-cultural analysis, although it is formally not correct, shows that residents in India are, on average, less cooperative than US residents. The difference is so large (28% versus 52%) that it is hard to explain it by appealing to minor differences in the experimental designs, and so it deserves comment.

One possibility, supported by the experimental evidence that good institutions are crucial in promoting cooperation [46–57], and the evidence that India struggles on a daily basis to fight corruption in politics at both the national and local levels [58–61], is that residents in India may have internalized non-cooperative behaviour in their everyday life (because cooperation is not promoted by their institutions) and they tend to apply it also to the new situation of a laboratory experiment. One far-reaching consequence of this interpretation is that the role of local institutions may go far beyond regularizing behaviour. If institutions do not support cooperative behaviour, selfishness may even get internalized and applied to atypical situations where people rely on heuristics. While this interpretation is supported by a recent study [75] showing that norms of cooperation learned in one experiment spill over to subsequent experiments where there are

no norms, we recommend caution on our interpretation, as our results do *not* show directly that inexperienced residents in India are less cooperative than US residents *because* they are embedded in a society whose institutions do not promote cooperative behaviour. However, we believe that this is a fundamental point that deserves to be rigorously addressed in further research.

Interestingly, we have shown that experienced residents in India are significantly more cooperative than inexperienced ones. This correlation appears to be even more surprising if seen in light of recent studies reporting that experience has a *negative* effect on cooperation among residents in the US [19,27]. Although the sign of these effects is different, they share the property that they are driven by intuitive responses. Thus, they are in line with the SHH, which assumes that experience operates mainly through the channel of intuition, but it does not make any prediction about the sign of the effect of experience, which may ultimately depend on a number of factors. While it is relatively easy to explain a negative effect of experience with economic games on cooperation, by appealing to learning of the pay-off maximizing strategy, explaining a positive effect is harder. One possibility is that experienced subjects have learned cooperation in iterated games, where it might be strategically advantageous, and tend to apply it also in one-shot games. Another possibility is that Turkers are developing a feeling of community that may favour the emergence of pro-social preferences. Understanding what mechanisms can promote the emergence of cooperation from a non-cooperative setting is certainly a fundamental topic for further research.

Ethics. All subjects provided written informed consent prior to participating. According to the Dutch legislation, this is a non-NWO study, that is (i) it does not involve medical research and (ii) participants are not asked to follow rules of behaviour. See http://www.ccmo.nl/attachments/files/wmo-engelse-vertaling-29-7-2013-afkomstig-van-vws.pdf, §1, Article 1b, for an English translation of the Medical Research Act. Thus (see http://www.ccmo.nl/en/non-wmo-research) the only legislations which apply are the Agreement on Medical Treatment Act, from the Dutch Civil Code (Book 7, title 7, §5), and the Personal Data Protection Act (a link to which can be found in the previous webpage). The current study conforms to both.

Data accessibility. Data can be accessed at http://datadryad.org/review?doi=doi:10.5061/dryad.jk2jm.

Authors' contributions. V.C. and G.C. designed the experiment, conducted the experiment, analysed the data and wrote the manuscript.

Competing interests. The authors declare that they have no competing interests.

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