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

Valerio Capraro[1] & Giorgia Cococcioni[2]

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[1]Center for Mathematics and Computer Science (CWI), 1098 XG, Amsterdam, The Netherlands. [2]Department of Political Sciences, LUISS Guido Carli, 00197, Roma, Italy.

Abstract

Recent studies suggest that cooperative decision-making in one-shot interactions is a history-dependent dual process: promoting intuition versus deliberation has typically a positive effect on cooperation (duality) among people living in a cooperative setting and with no previous experience in economic games on cooperation (history-dependence). Here we report a large experiment exploring how these findings transfer to a non-cooperative setting. We find three major results: (i) promoting intuition versus deliberation has no effect on cooperative behavior among inexperienced subjects living in a non-cooperative setting; (ii) experienced subjects are much more cooperative than inexperienced subjects; and (iii) experience has a U-shaped effect on cooperation: subjects with little experience cooperate the least. We also find evidence that the behavioral transition between little experienced subjects and experienced subjects is primarily driven by intuitive responses. These results suggest that cooperation is a slow 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, 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.

Introduction

One of the secrets of the enormous success of our societies is our ability to cooperate [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14]. 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 [**?**]: recent experiments have shown that people cooperate also in one-shot anonymous interactions [16, 17, 18, 19, 20] and even in large groups [21]. 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 a history-dependent dual process. *Dual* because time pressure [22, 23, 24, 25, 26], cognitive load [27, 28, 29], conceptual priming of intuition [22, 30], and disruption of the right lateral prefrontal cortex [31] have all been shown to promote cooperation, providing direct evidence that automatic actions are, on average, more cooperative than deliberate actions. *History-dependent* because these results have all been found in developed countries, where people generally trust on others, and without controlling for the level of experience in economic experiments on cooperation. Indeed, it has recently been shown that experience and intuition interact such that experienced subjects are less cooperative than inexperienced subjects, but only under time pressure [26] and that intuition promotes cooperative behavior only among inexperienced subjects with above median trust in the setting where they live [25]. While this 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.

Two fundamental questions remain then unsolved. What is the effect of promoting intuition versus deliberation among people living in a non-cooperative setting? How does this interact with experience in 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 and colleagues [22, 23] 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" [24]. Then, 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 lab 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 behavior [32, 33, 34]. These findings support the interpretation that intuitive emotions may play an important role in pro-social behavior and form the basis of Haidt's Social Intuition Model (SIM) according to which moral judgment is caused by quick moral intuitions and is followed (when needed) by slow, ex post facto, moral reasoning [35]. If so, even among people living in a non-cooperative setting, promoting intuition should have a positive effect on cooperative behavior.

A third alternative is yet possible. Motivated by work suggesting that people whose self-control resources have been taxed tend to cheat more [36, 37] and be less altruistic [38, 39, 40], it has been argued that self-control plays an important role in overriding selfish impulses and bringing behavior in line with moral standards. This is consistent with Kohlberg's rationalist approach [41], 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 behavior. Taken literally, the rationalist approach predicts that promoting intuition should always undermine cooperation. While this is inconsistent with the aforementioned results, it is not difficult to imagine a scenario in which the rationalist approach interacts with the SHH: cooperation may have emerged after deliberation from a neutral or non-cooperative setting, giving rise to rational cooperative societies, whose members have internalized cooperation as a default strategy and use it when they encounter a new or atypical setting. Some of them, after deliberation, may switch to defection because they do not perceive a moral obligation in behaving cooperatively in one-shot anonymous interactions. Seen in this light, the SHH is not inconsistent with Kohlberg's rationalist approach. However, this tentative to reconcile the rationalist approach with the experimental data makes clear predictions on what should happen in a non-cooperative setting: whatever

the level of experience of a participant is, promoting intuition should always promote non-cooperative behavior.

In sum, the question of how promoting intuition versus reflection affects cooperative behavior 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, no effect) are, a priori, possible.

Moreover, while the SIM and the rationalist approach do not make any prediction about the role of experience, the SHH is consistent with level of experience having a positive effect on cooperation 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. Since overcoming heuristics formed outside the lab is likely to be a slow process, the SHH does not predict that experience has a linear effect on cooperation. On the contrary, a J-shaped or a U-shaped effect may be more symptomatic of an effect emerging slowly.

Here we report a large experiment aimed to clarify these points. We provide evidence of three major results: (i) promoting intuition versus reflection has no effect on cooperation among inexperienced subjects living in a non-cooperative setting; (ii) experienced subjects are extremely more cooperative than inexperienced subjects; (iii) experience has a U-shaped effect on cooperation, with little experienced subjects cooperating the least. Additionally, we find a nearly significant trend suggesting that experience changes intuitive responses more than reflective ones.

Taken together, these results suggest that cooperation is a slow 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 Social Heuristics Hypothesis.

Methods

We have conducted an experiment using the online labor market Amazon Mechanical Turk (AMT)[42, 43, 44] recruiting participants only from India. India is a particularly suited country to hire people from for our purpose: if, as many field studies have confirmed [45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56], good institutions are crucial for the evolution of cooperation, and if, as many scholars have argued [57, 58, 59, 60],

corruption and cronyism have engrossed the entire Indian society, then residents in India are likely to have very little trust on strangers and so they are likely to have internalized non-cooperative strategies in their every-day life. One study confirms this hypothesis, by showing that spiteful preferences are widespread in the village of Uttar Pradesh and this ultimately implies residents' inability to cooperate [61]. At the same time, according to demographic studies on AMT population [**?**], India is the second most active country on AMT after the US, which makes the procedure of collecting data particularly fast.

Our experiment was made of three single studies. In each study participants were randomly assigned to either the time pressure condition or the time delay condition. Inside each condition, they 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 k ($k = 2, 5, 10$ depending on the study) 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 seconds and those in the time delay condition were asked to wait for at least 30 seconds 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 participated in tasks like this before?" Participants could choose among 'Exactly the same task - several times', 'Exactly the same task - once or twice', and 'Never'. Full instructions are reported in the Supplementary Information.

After collecting the results, bonuses were computed and paid on top of the participation fee (\$0.50). No deception was used. 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 behavior. See http://www.ccmo.nl/attachments/files/wmo-engelse-vertaling-29-7-2013-afkomstig-van-vws.pdf, Section 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, section 5), and the Personal Data Protection Act (a link to which can be found in the previous webpage). The current study conforms to both.

Results

A total of 6.546 subjects participated in our three studies. Taken globally, results are completely at random, since only 1.558 subjects passed the comprehension questions. In all three studies, the percentage of people failing the comprehension questions in the time pressure condition was approximately the same as the percentage of people failing the comprehension questions in the time delay condition (74% vs 68%, for $k = 2$; 57% vs 54%, for $k = 5$; and 47% vs 43%, for $k = 10$). Said this, we restrict our analysis to subjects who passed all comprehension questions, without further comments. We include in our analysis also subjects who did not obey the time constraint in order to avoid selection problems that impair causal inference [63].

Figure 1 summarizes the relevant results. We start exploring the effect of promoting intuition versus reflection among inexperienced subjects. We find that inexperienced subjects under time pressure ($N = 253$) transferred, on average, 27.82% of their endowment while those under time delay ($N = 321$) transferred, on average, 28.47% of their endowment. The difference is certainly not significant. Thus, promoting intuition versus reflection has no effect on cooperation among inexperienced subjects leaving in a non-cooperative setting.

Then we explore the interaction between experience and cooperative behavior. Linear regression confirms that little experienced subjects are significantly less cooperative than inexperienced subjects both under time pressure (coeff $= -0.0844337$, $p = 0.00088$) and under time delay (coeff $= -0.085229$, $p = 0.00031$); and confirms that experienced subjects are significantly more cooperative than little experienced subjects both under time pressure (coeff $= 0.374666$, $p < .0001$) and under time delay (coeff $= 0.272971$, $p < .0001$). Moreover, experienced subjects are also significantly more cooperative than inexperienced subjects, both under time pressure (coeff $= 0.145116$, $p < .0001$) and under time delay (coeff $= 0.0938709$, $p < .0001$). Thus experience has a significant U-shaped effect on cooperation, where little experienced subjects cooperate the least and experienced subjects the most.

The coefficients of the previous regressions suggest that the motivations behind the initial decrease of cooperation, which affects subjects under time pressure and those under time delay to exactly the same extent, are different from the motivations behind the subsequent flourishing of cooperation, which seems to affect subjects under time pressure to a larger extent than those under time delay. To confirm this, we use linear regression to predict decision among experienced subjects using time pressure as a dummy variable.

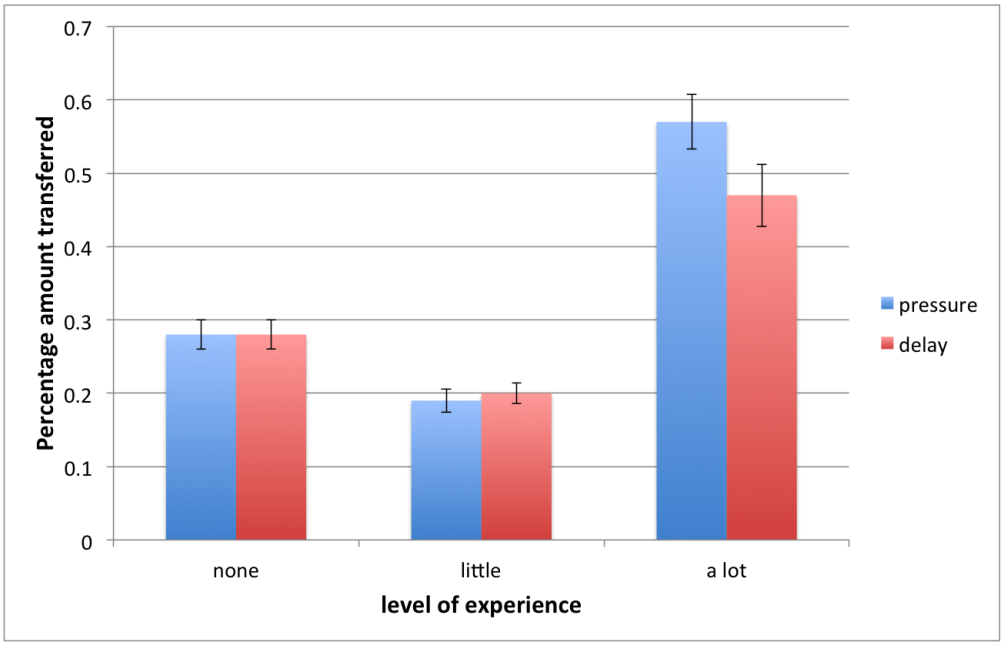

Figure 1: *The figure reports the percentage of the endowment transferred divided by experience level and condition (time pressure versus time delay). Error bars denote the standard error of the mean. Promoting intuition versus reflection does not have any effect among little or no experienced subjects. On the contrary, it seems to have a positive effect on cooperation among experienced subjects. Linear regression shows that this effect is nearly significant. Level of experience seems to have a U-shaped effect on cooperation. Linear regression confirms that little experienced subjects are significantly less cooperative than both inexperienced and experienced subjects, and that experienced subjects are significantly more cooperative than inexperienced subjects.*

We find that experienced subjects under time pressure are nearly significantly more cooperative than experienced subjects under time delay (coeff $= 0.0960161$, $p = 0.09165$). Taking into account that the total number of experienced participants is pretty small (146 in the time pressure condition and 109 in the time delay condition), such a small p-value may be symptomatic of a true effect suggesting that experience operates primarily through the channel of intuition.

Next, we check whether this relationship between time pressure and experience is affected by the multiplier k. Linear regression shows that there is no significant three-way interaction between time pressure, experience, and k (coeff $= 0.0139836$, $p = 0.117$) and thus confirms that our results are robust across multipliers.

Condition	% coop US	% coop India	% coop India (only experienced)
k=2	51.6	27.0	57.0
k=5	66.6	28.8	49.3
k=10	75.7	28.7	54.0

Table 1: *Cross cultural analysis. Essentially the same experiment (with minor differences in the design) gave stunningly different results in the US. US residents cooperated much more than residents in India. However, if we restrict the analysis only to experienced subjects resident in India, we find that their rate of cooperation is nearly the same as that of US residents.*

Finally, we compare the current results with those collected in a similar experiment conducted using US residents [18]. There, participants were given \$0.10 (instead of \$0.20 as in the current studies) and were asked to decide how much, if any, to transfer to the other participant. The amount transferred would be multiplied by k ($k = 2, 3, 4, 5, 10$) and earned by the other participant; the remainder would be earned by themselves, but without being multiplied by any factor. There was no time manipulation.

The two experiments are not, strictly speaking, comparable for three reasons. First, in [18] 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. At least two of these three differences are minor: recent studies have argued that stakes do not matter a lot as long as they are not too high [43, 64].

Thus we compare the two experiments, since the difference is so stunning that it cannot be easily explained by appealing to presumably minor differences in the experimental designs. Table 1 reports all relevant comparisons, showing that residents in India were far less cooperative than US residents, but this difference tends to disappear if we look only at experienced subjects.

Discussion

We have shown that promoting intuition via time pressure versus promoting deliberation via time delay has no effect on cooperative behavior among subjects residents in India with no or little experience in economic experiments on cooperation. These subjects are,

on average, much less cooperative than US residents. However, this difference almost disappears when we look at experienced subjects: these cooperate far more than little or no experienced subjects; they cooperate almost as much as US residents. Interestingly, the effect of experience on cooperation is not linear, but follows a U-shaped curve, according to which experience promotes an initial decay followed by a flourishing of cooperation. These two phases interact with the time conditions in different ways: the initial decay of cooperation regards subjects under time pressure and those under time delay to exactly the same extent; the subsequent flourishing of cooperation still regards both subjects under time pressure and those under time delay, but it is primarily driven by subjects under time pressure.

Our results have several major implications, the first of which is providing further support for the Social Heuristics Hypothesis (SHH) [22, 23]. Introduced in order to organize the growing body of literature providing direct [22, 23, 24, 25, 26, 27, 28, 29, 30, 31] and indirect [65, 66, 67, 68] 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 behavior 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 provide strong evidence for this prediction.

Besides this prediction, the SHH is also consistent with an interaction between level of experience, time pressure, and cooperation: 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.

The fact that our results support the SHH versus Haidt's Social Intuition Model and Kohlberg's rationalistic approach does *not* imply that these latter two theories should be completely rejected: both of them are indeed supported by many experimental stud-

ies involving pro-social behaviors other than cooperation. If anything, our results point out that different pro-social behaviors may emerge from different cognitive processes. We believe that classifying pro-social behaviors in terms of the processes involved is an important direction for future research and a necessary step to develop a general model of pro-social behavior that incorporates all those three models as particular instances.

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 [69, 70, 71, 72]. We believe that extending these approaches to incorporate also individual history could be a promising direction for future research.

Our findings go beyond the 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 that it is hard to explain it by appealing to minor differences in the experimental designs and so it deserves to be commented, also in light of the finding that this difference almost disappears when one restricts the analysis only to residents in India with experience in economic games on cooperation.

One possibility, supported by the experimental evidence that good institutions are crucial in promoting cooperation [45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56] and the evidence that India struggles on a daily basis to fight corruption in politics at both the national and local levels [57, 58, 59, 60], is that residents in India may have internalized non cooperative behavior 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 lab experiment. One far-reaching consequence of this interpretation is that the role of local institutions may go far beyond regularizing behavior. If institutions do not support cooperative behavior, selfishness may even get internalized and applied to atypical situations where people rely on heuristics. Of course we recommend extreme caution on this interpretation, since our results do *not* show directly that inexperienced residents in India are less cooperative than US residents *because* they are embedded into a society whose institutions do not promote cooperative behavior. 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 far more cooper-

ative than little or no experienced subjects. The shift is unexpectedly strong: inexperienced subjects transferred only roughly 25% of their endowment, while experienced subjects under time pressure transferred almost 60% of their endowment. 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 [18, 26].

Moreover, our results show that the effect of experience on cooperation is far from being linear and it seems to be best approximated by a U-shaped curve, according to which little experienced subjects cooperate the least. Explaining this particular shape is likely to be difficult, since drawing causal links between experience and cooperation within a subject through just one observation is nearly impossible. One possibility is that altruist residents in the US and selfish residents in India, for unclear reasons, do a few studies on AMT and then quit participating. However, such unwanted selection problems may explain essentially every effect. For instance, even if we had found a linear effect, one could have argued that maybe, for unclear reasons, selfish subjects gradually abandon AMT. Moreover, selection effects cannot readily explain the nearly significant positive effect of time pressure on cooperation among experienced subjects. On the contrary, the particular U-shaped curve suggests that two opposite forces are operating at different levels. Recall that little experienced subjects have participated only in one or two studies like ours and, thus, it is reasonable to assume that they have not yet accumulated enough experience to change their non-cooperative heuristics. Since these subjects are way more likely to have met a defector than a cooperator the first one or two times they played, it might be possible that they are just best replying to these previous interactions. This would turn initial cooperators into defectors, explaining the initial decay of cooperation. At a deeper level, the other force represents the true and slow effect of experience. Experienced participants may have accumulated enough experience to develop a context-dependent cooperative heuristics through at least two mechanisms: (i) some may have participated more in indefinitely iterated games, for which cooperating may be optimal, than in one-shot games; (ii) some may see a one-shot game as embedded into an indefinitely iterated game with random matching, for which cooperating might be optimal as well. Interestingly, since the SHH assumes that experience operates primarily through the channel of intuition, this explanation of the U-shape effect is consistent with the nearly significant effect of time pressure on cooperation among experienced participants. However, we are aware that this is only one among infinitely many alternative interpretations: the U-shaped effect of experience on cooperation is probably our most intriguing result and understanding its origins is certainly an interesting topic for future research.

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Full Instructions

Participants were randomly assigned to either the time pressure condition or the time delay condition. In both conditions, after entering their worker ID, participants were informed that they would be asked to make a choice in a decision problem to be presented later and that comprehension questions would be asked. Participants were also informed that the survey (which was made using the software Qualtrics) contained a skip logic which would automatically exclude all participants failing any of the comprehension questions. Specifically, this screen was as follows:

Welcome to this HIT.

This HIT will take about five minutes. For the participation to this HIT, you will earn 0.50 US dollars, that is, about 31 INR. You can also earn additional money depending on the decisions that you and the other participants will make.

You will be asked to make one decision. There is no incorrect answer. However:

IMPORTANT: after making the decision, to make sure you understood the decision problem, we will ask some simple questions, each of which has only one correct answer. If you fail to correctly answer any of those questions, the survey will automatically end and you will not receive any redemption code and consequently you will not get any payment.

With this in mind, do you wish to continue?

At this stage, they could either leave the study or continue. Those who decided to continue were redirected to an introductory screen where we gave them all the necessary information about the decision problem, but without telling exactly which one it is. This is important in order to have the time pressure and time delay conditions work properly in the next screen. This introductory screen for the participants in the time pressure condition was the following:

You have been paired with another participant. You can earn additional money depending on the decision you will make in the next screen. You will be asked to make a choice that can affect your and the other participant's outcome. The decision problem is symmetric: also the other participant is facing the same decision problem. After the survey is completed, you will be paid according to your and the other participant's choices.

You will have only 10 seconds to make the choice.

This is the only interaction you have with the other participant. He or she will not have the opportunity to influence your gain in later parts of the HIT. If you are ready, go to the next page.

The introductory screen for the participants in the time delay condition was identical, a part from the fact that the sentence 'You will have only 10 seconds to make the choice' was replaced by the sentence 'You will be asked to think for at least 30 seconds before making your choice. Use this time to think carefully about the decision problem'.

The decision screen was the same in both conditions:

You and the other participant are both given \$0.20 *US dollars. You and the other participant can transfer, independently, money to the each other. Every cent you transfer, will be multiplied by* 2 *and earned by the other participant. Every cent you do not transfer, will be earned by you.*

How much do you want to transfer?

By using appropriate buttons, participants could transfer any even amount of money from \$0 to \$0.20.

En passant, we observe that reading the decision screen takes about six seconds and thus participants under time pressure had only about four seconds to make their choice.

To assure that time pressure and time delay work properly, it is necessary that comprehension questions are asked after the decision has been made. Thus, right after the decision screen, participants faced the following four comprehension questions.

What is the choice by YOU that maximizes YOUR outcome?

What is the choice by YOU that maximizes the OTHER PARTICIPANT's outcome?

What is the choice by the OTHER PARTICIPANT that maximizes YOUR outcome?

What is the choice by the OTHER PARTICIPANT that maximizes the OTHER PARTICIPANT's outcome?

By using appropriate buttons, participants could select any even amount of money from \$0 to \$0.20. Participants who failed any of the comprehension questions were automatically excluded from the survey. Those who answered all questions correctly entered the demographic questionnaire, where we asked for their age, sex, reason for their choice, and, most importantly, level of experience in these games. Specifically, we asked the following question:

To what extent have you participated in tasks like this before?

Participants could choose among 'Exactly the same task - several times', 'Exactly the same task - once or twice', and 'Never'. After answering this question, participants got the completion code and could submit their work.