The Chains of Habit:

Repeated Coordination in Joint Decision-Making Elicits a Sense of Commitment

[Dear Reader: Turns out that on closer inspection the results here are not significant, so we are going to re-do it as a within-design....before doing so, any thoughts on the hypotheses, the rationale, the design, etc would be much appreciated...]

Abstract: We tested the hypothesis that repeated coordination with a partner can elicit a sense of commitment, leading people to resist tempting alternatives and thereby sustaining cooperation through fluctuations in individuals' interests. In our paradigm, participants perform a repeated joint decision-making task either with the same partner (Partner Condition) for all 120 trials, or with a different partner on each trial (Stranger Condition). When both players coordinate on the same option, both are rewarded. On some trials, participants are offered outside options presenting varying degrees of temptation to defect. In *Experiment 1*, participants were informed that they were coordinating with their partner(s) via internet. The results of their choices, as well as the trajectories of their mouse movements, indicate that participants in the Partner Condition were more resistant to temptation, and that their threshold for defecting was higher in the Partner Condition. This was not the case in *Experiment 2*, in which participants were informed that their partner's responses had been pre-recorded, indicating that the effects observed in *Experiment 1* did not result from the higher level of familiarity with the partner in the Partner Condition. Taken together, these results support the hypothesis that repeated coordination is sufficient to boost cooperation by eliciting a sense of commitment to one's partner.

Keywords: coordination, decision-making, commitment, cooperation

Introduction

The prevalence and flexibility of human cooperation is unparalleled by any other species. We routinely work together to achieve ends that we could not achieve alone, even setting aside short-term interests to maximize the benefits to our interaction partners and larger social groups. In recent decades, a great deal of research in evolutionary theory, experimental economics and psychology has been devoted to investigating the evolutionary origins of human cooperation (Henrich & Henrich, 2007; Nowak, 2012; Tomasello, 2009; West, Griffin, & Gardner, 2007). This has led to significant progress in specifying ultimate (i.e. evolutionary) mechanisms that are likely to have supported the evolution of cooperation in humans – e.g. kin selection (Hamilton, 1963; Maynard Smith, 1964), direct (Trivers, 1971) and indirect (Nowak & Sigmund, 1998) reciprocity, and cultural group selection (Boyd & Richerson, 2008).

Moreover, this research has also informed and constrained research into the cognitive and motivational mechanisms that *proximally* support cooperation. For example, theorizing at the evolutionary level about the importance of indirect reciprocity has inspired research at the psychological level devoted to illuminating the mechanisms by which people manage their reputations (Nowak & Sigmund, 1998; Fehr et al., 2002). Thus, it has shown that people behave more pro-socially when they believe they are being observed, or when they believe that they will interact again with the same partner in the future (Andreoni & Bernheim, 2009; Rege & Telle, 2004). Moreover, it has been hypothesized that reputation management may be subserved by prosocial preferences, such as a preference for fairness (Andreoni, 1990) or an aversion to inequity (Fehr & Schmidt, 1999). Alternatively, Dana et al. (2007) and Heintz et al. (2015) have proposed that an aversion to disappointing others' expectations may play an important role.

Recently, researchers (Rusch & Luetge, 2016; Tomasello et al., 2012) have begun to investigate the psychological implications of a different theory about the evolutionary origins of human cooperation, namely Roberts' (2005) 'interdependence hypothesis'. According to this theory, humans' tendency to cooperate arose evolutionarily in a period in which our ancestors lived in small groups of individuals whose interests were largely interdependent, and for whom it was therefore not typically beneficial to act selfishly to the determinant of other group members. In other words, human cooperation is a byproduct of earlier selection for skills in coordinating. From this starting point, Rusch & Luetge (2016) reason that humans may be equipped with social decision-making processes which do 'not differentiate between instances of coordination and cooperation too sharply, at least initially, reflecting the hypothesized predominance and earlier evolutionary solution of coordination problems in our ancestral social ecology' (Rusch & Luetge, 2016: 292). If so, then successful coordination with a partner in a repeated coordination game may lead people to view their partner as being a reliable partner in general, and therefore also as someone who is likely to resist temptations to behave selfishly (e.g. to cooperate in a prisoners' dilemma). As a result, they themselves should be more likely to cooperate with a partner with whom they share a history of successful cooperation. In support of this, Rusch & Luetge (2016) found evidence of a 'spillover effect' from coordination to cooperation, i.e. cooperation rates in a prisoners' dilemma were boosted when rounds of the prisoners' dilemma were interspersed among rounds of a coordination game (i.e. the stag hunt) played together with a fixed partner.

But while Rusch & Luetge's hypothesis explains why successful coordination may lead participants to trust that their partner will not defect, it does not directly explain why they themselves would then choose to cooperate. Thus, it can only explain why cooperation rates would not fall below the level that corresponds with participants' preference; it does not provide any explanation of why coordination may directly boost cooperation rates. And indeed, since cooperation in a standard prisoners' dilemma depends not only on participants' trust that their partner will cooperate but also on their own willingness to cooperate, it is difficult to determine whether successful coordination in this paradigm boosted cooperation rates by affecting the former, the latter, or both.

One way to isolate the sense of commitment to one's partner – i.e. to specifically assess the effects of coordination upon the willingness to cooperate independently of trust – is to implement a *one-sided* social dilemma, such as a dictator game, in which only one player is faced with a temptation to defect. Since the decision of the dictator in a dictator game fully determines the outcome, she does not need to trust in the good will of her partner. This is the strategy employed by Guala & Mittone (2010). Their aim was to test the hypothesis that conventions take on a normative character over time. To this end, they measured cooperation rates in a sequential, one-sided prisoner's dilemma (effectively a dictator game) that followed several rounds of successful coordination in a pure coordination game (choosing one of two colors, 'red' or 'blue'), and compared this with cooperation rates in the same sequential, one-sided prisoner's dilemma played without any prior coordination game. Their results confirmed this prediction, corroborating the hypothesis that repeated coordination can give rise to social norms which, in turn, function to stabilize cooperation.

However, the results of this study are also consistent with an alternative explanation, namely that the coordination phase may have led participants to resist the temptation to defect by eliciting prosocial attitudes. This conjecture is motivated by research showing that coordination can enhance rapport (Bernieri, 1988) and trust (Launay et al., 2013; Mitkidis et al., 2015), and lead to cooperation in social dilemmas (Wiltermuth & Heath, 2009; Van Baaren et al., 2004) as well as pro-social helping behavior (Kokal et al., 2011; Valdesolo & Steno, 2011). If this conjecture is correct, then players may also have been more likely to cooperate if the choices presented in the test trials (the prisoner's dilemma) differed from the choices offered in the coordination phase, i.e. if the cooperative choice did not correspond to the convention that had been established. Moreover, since participants in both conditions played in fixed groups, it is not clear whether the coordination phase boosted their willingness to cooperate in general, or by eliciting a sense of commitment only to their specific partners.

The Current Research

Building upon the findings reported by Guala & Mittone (2010) and Rusch & Luetge (2016), the current study investigated the effects of repeated coordination with the same partner upon people's willingness to cooperate with that partner. Like Rusch & Luetge (2016), we reasoned that if Roberts' (2005) interdependence hypothesis is correct, then repeated coordination with the same partner should boost cooperation. Unlike Rusch & Luetge (2016), we reasoned that the interdependence hypothesis generates this prediction *independently of any effects of coordination upon trust.* This is because repeated coordination may serve as a cue to participants that their partner is interdependent with them, engendering a sense of commitment to that partner and thereby making them more resistant to tempting outside options (Michael, Sebanz & Knoblich, 2016).

In order to isolate the effects of repeated coordination on the willingness to cooperate with one's partner irrespective of trust, we followed Guala & Mittone's (2010) approach in opting for a sequential, one-sided social dilemma on test trials. We also modified their design in two key respects. First, unlike their paradigm, ours compared a condition in which participants played in fixed pairs with one in which they had a different partner on each trial. Specifically, one group of participants played a sequential coordination game with the same partner (Partner Condition) for 126 rounds, while a second group played the same game with a different partner on each trial (Stranger Condition). This enabled us to tease apart any general prosocial effect of coordination from the effect arising from a sense of commitment specifically to one's partner. Secondly, we aimed to ensure that any effects of coordination upon cooperation rates could not be explained as adherence to specific conventions that had arisen during the experiment. To do this, we designed the coordination game such that the values varied from one trial to the next, such that the cooperative option did not reflect any convention.

In *Experiment 1*, participants were informed that they were coordinating with their partner(s) via internet, and that their partner would not receive any feedback about any of their decisions until the end of the experiment. At the beginning of each round, an image of the partner's face was displayed, which was either the same (Partner Condition) or different (No Repetition) every round. Then, the partner chose one of two values. The participant did not see what these two values were, but was then herself presented with two values to choose between. One of these, indicated in green, was the same value that the partner had chosen (cooperative option); the other, indicated in orange, was an alternative value (alternative option). The value of the alternative option varied unpredictably across trials; the degree of temptation which it presented was a function of its value.

We predicted that participants would resist the tempting alternative option more frequently in the Partner Condition than in the Stranger Condition. We also reasoned that a greater sense of commitment in the Partner Condition would lead participants to experience a higher degree of cognitive conflict on those trials on which they did choose the alternative option, and a lower degree of cognitive conflict on those trials on which they did cooperate. To measure cognitive conflict, we analyzed the response dynamics using continuous tracking of mouse movements while participants chose between the two options, which were spatially separated on the screen (See **Fig. 1**) (Kieslich et al, 2014; Freeman, Dale and Farmer, 2010; Spivey & Dale, 2006; Spivey, Grosjean & Knoblich, 2005). Our prediction was that the mouse movements would reveal more hesitation when defecting in the Partner Condition and more hesitation when cooperating in the Stranger Condition.

In *Experiment 2*, we tested whether the mere exposure to a partner (i.e. to the picture of their face) would suffice to create a sense of commitment in the absence of a context of online coordination. To this end, participants were informed that their partner's responses had been pre-recorded one week earlier at the lab, and that their choices would be matched at the end of the experiment. If mere exposure to the partner's picture is sufficient to elicit a sense of commitment to performing the task cooperatively, then we should see the same pattern of results in experiment 2 as in experiment 1. If, on the other hand, mere exposure without successful online coordination is not sufficient, then we should see no significant differences between the two conditions for any of the relevant measures.

Experiment 1

Method

Participants

Using G*Power 3.1 (Faul et al., 2009) we determined that a sample size of 48 (i.e. a between design with 24 in each condition) would provide 80% statistical power for detecting a medium-sized effect equivalent to what we observed in a pilot study (*d*= .XX), assuming an unpaired t-test with an alpha level of .05. We therefore recruited 48 participants (X females; age range: X-X, *M* = X, *SD* = X) from student organizations in the Budapest area, all of whom received gift vouchers for their participation. All were naïve to the purpose of the study, reported normal or corrected to normal vision, and gave written informed consent prior to the experiment. One additional male participant was excluded prior to analysis because he did not finish the minimum number of trials, as explained below. Participants were paid 2000 Hungarian Forints in Tesco vouchers. The experiment was conducted in accordance with the Declaration of Helsinki and was approved by the (EPKEB) United Ethical Review Board for Research in Psychology.

Apparatus and Stimuli

The experiment was displayed on a 24-inch wide screen (16:9) computer monitor (resolution: 1920 x 1080 pixels, framerate = 60Hz.). The program for the experiment was written in Open Sesame (Mathôt, Schreij, & Theeuwes, 2012). The two choice options were presented as 7 cm x 5 cm rectangular fields, separated by 36 cm. The mouse start field was also 7 cm x 5 cm, and was positioned 18 cm lower at the midpoint between the two choice options.

Procedure

After participants had read the information sheets and signed the consent forms, they were informed that in addition to the 1500 HUF show-up fee, they would also be paid a bonus based on the number of points they earned during the experiment, and that the same was true for their partner(s). They were then seated at a desk in a quiet testing room with the computer in front of them. The experimenter then explained the structure of the experiment with the aid of a visual representation (see Fig. 2).

At the beginning of each round, an image of the partner's face was displayed, which was either the same (Partner Condition) or different (No Repetition) every round. Then, the partner first chose one of two values. The participant did not see what these two values were, but was then herself presented with two values to choose between. One of these, indicated in green, was the same value that the partner had chosen (cooperative option); the other, indicated in orange, was an alternative value (alternative option). The values for the cooperative options ranged from 200-500 points. The value of the alternative option ranged unpredictably, over intervals of 50, from 100 points less to 250 points more than the value for the cooperative option. Thus, the lowest value for the alternative option was 100 and the highest 750. If the participant chose the cooperative option, the participant and the partner would each receive the amount of points corresponding to the selected value. If the participant chose the alternative option, she received that many points, while her partner received 0. The alternative option was therefore only tempting when its value was greater than that of the cooperative option, and the degree of temptation which it presented was a function of the value of the alternative option. In the induction phase, there were 14 trials, 7 trials for which the alternative option was 100 less than the value for the cooperative options and 7 for which it was 50 less. In the test phase, there were 112 test trials, divided into two test blocks. For each of the 8 different levels of temptation, there were 14 trials. Participants were informed that at the end of the test, in addition to the basic payment they would receive a bonus payment based on how many points they gained during the experiment, and that the same was true for their partner(s).

Next, participants read the instructions on their own, which were displayed on the screen, and then had the opportunity to ask the experimenter clarificatory questions. The experimenter then demonstrated two trials, and asked participants to practice one trial themselves. Participants were then given one more chance to ask questions, after which the experimenter left the room and they started the test. The test lasted approximately 35 minutes, after which the participants were debriefed about the purpose of the study, and informed that the role of their partner(s) had in fact been played by an algorithm. They were then each paid a total 2000 HUF.

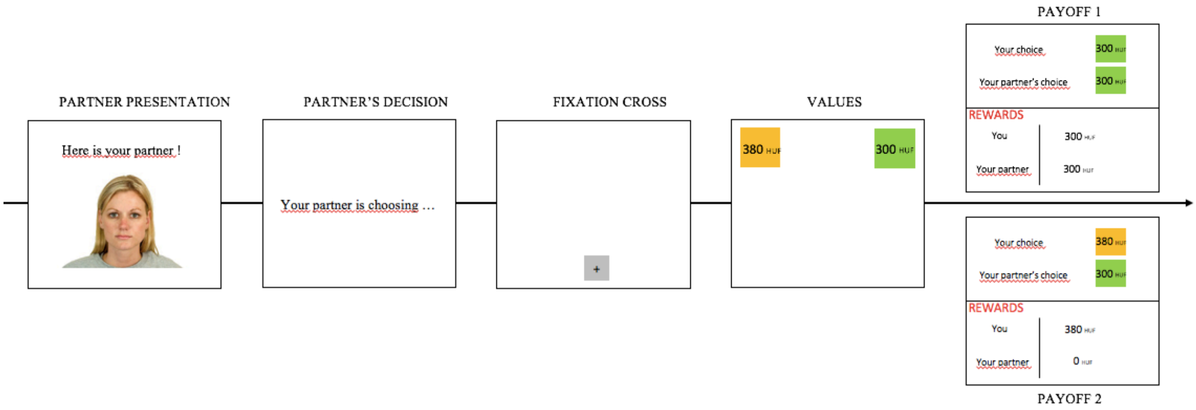

Figure 2: Trial Structure. First, a picture of the partner's face was displayed for 2000 milliseconds (a). Next (b), the participant waited as the partner selected one of two values, which were not displayed to the participant (b) The duration was determined randomly and ranged from 2000 to 3000 ms. Then, the two colored boxes appeared at the top of the screen. Only when the participant moved the cursor from the mouse start field did the value appear in the colored boxes (d). Each trial ended when the participant clicked on one of the two options or when 2999 milliseconds had elapsed. After the participant has made her or his selection, there is a 500 ms delay, and then the payoffs are displayed for 3000ms.

Results

For the analysis, we excluded one participant who had not completed the experiment. We then conducted an unpaired t-test, which revealed significantly higher cooperation rates in the Partner Condition (M=, SD=) than in the sign Stranger Condition (M=, SD=) *t(46)*=X, *p*=X, *Cohen's d*= X

The mouse tracking results revealed some interesting shit too, as Matt may hopefully be willing to explain…

Discussion

The results showed that cooperation rates were significantly higher in the Partner Condition than in the Stranger Condition. In line with this, the mouse tracking data revealed that participants were less hesitant when cooperating in the Partner Condition than in the Stranger Condition, and more hesitant when defecting in the Partner Condition than in the Stranger Condition. These findings are consistent with the hypothesis that repeated coordination with a partner on a joint decision-making task is sufficient to elicit a sense of commitment, making participants more resistant to tempting outside offers. However, it cannot be ruled out that the effects observed in Experiment 1 were due to the higher degree of familiarity arising from the repeated exposure to the picture of the same partner in the Partner Condition. Experiment 2 was designed to probe this alternative explanation.

Experiment 2

Experiment 2 was designed to test whether the differences observed between the Partner Condition and the Stranger Condition in Experiment 1 may have been due to the higher degree of familiarity arising from the repeated exposure to the picture of the same partner in the Partner Condition. To this end, we implemented the same design with one crucial difference: participants were informed that the responses of their partner(s) had been pre-recorded one week earlier at the lab, and that their choices would be matched at the end of the experiment. If mere exposure to the partner's picture is sufficient to elicit a sense of commitment to performing the task cooperatively, then we should see the same pattern of results in experiment 2 as in experiment 1. If, on the other hand, mere exposure without successful coordination is not sufficient, then we should see no significant differences between the two conditions.

Method

Participants

As in experiment 1, we recruited 48 participants (X females; age range: X-X, *M* = X, *SD* = X) from student organizations in the Budapest area, all of whom received gift vouchers for their participation. All were naïve to the purpose of the study, reported normal or corrected to normal vision, and signed informed consent prior to the experiment. The experiment was conducted in accordance with the Declaration of Helsinki and was approved by the (EPKEB) United Ethical Review Board for Research in Psychology.

Procedure

The only difference to Experiment 1 was the information which participants were given about their partner(s). Maybe put the exact wording from the instructions here?

Results

For the analysis, we excluded XXX. We then conducted an unpaired t-test, which revealed no significant difference in cooperation rates between the Partner Condition (M=, SD=) and the Stranger Condition (M=, SD=), $t(46)$=X, p=X, *Cohen's d*= X DETAILS HERE.

The mouse tracking results revealed some interesting shit too, as Matt may hopefully be willing to explain…

Discussion

The results showed that cooperation rates did not differ between the Partner Condition and the Stranger Condition. This indicates that mere exposure to the same partner in the Partner Condition was not sufficient to significantly affect decision outcomes. In line with this, the mouse tracking data revealed that participants were no less hesitant when cooperating in the Partner Condition than in the Stranger Condition. Interestingly, though, they were more hesitant when defecting in the Partner Condition than in the Stranger Condition, indicating that the higher level of exposure may indeed have elicited a sense of commitment, albeit not one sufficiently strong to influence decision outcomes.

General Discussion

In Experiment 1, participants in the Partner Condition exhibited higher cooperation rates, greater hesitation when defecting, and less hesitation when cooperating, than participants in the Stranger Condition. These results provide support for the hypothesis that repeated coordination with a partner is sufficient to elicit a sense of commitment, leading interaction partners to resist tempting alternatives and thereby contributing to sustaining cooperation through fluctuations in individuals' interests (Michael, Sebanz & Knoblich, 2016).

In *Experiment 2*, we removed the context of coordination by telling participants that their partner's responses had been pre-recorded, while maintaining the same degree of exposure to the partner in the Partner Condition as in *Experiment 1*. The results revealed that cooperation rates did not differ significantly between the Partner Condition and the Stranger Condition, and that participants were no less hesitant when cooperating in the Partner Condition than in the Stranger Condition. This indicates that the effects of coordination observed in Experiment 1 cannot be due to the familiarity arising from greater exposure to the partner in the Partner Condition. Interestingly, though, participants were more hesitant when defecting in the Partner Condition than in the Stranger Condition, indicating that the higher level of exposure may indeed have elicited a sense of commitment, albeit not one sufficiently strong to influence decision outcomes.

The present study contributes to research on the evolutionary origins of cooperation in humans insofar as it builds upon earlier findings reported by Rusch & Luetge (2016), who also predicted on the basis of the interdependence hypothesis that repeated coordination may boost cooperation. However, while we also took as our starting point Roberts' (2005) interdependence hypothesis, we differ by specifying a distinct (and compatible) mechanism by which repeated coordination may boost cooperation. Rusch & Luetge (2016) specify a mechanism whereby repeated coordination may lead participants to trust that their partner will not defect, but this mechanism does not directly explain why repeated coordination would then make them more likely to choose to cooperate.

Thus, their model only explains how repeated coordination can prevent cooperation rates from falling below the level corresponding to participants' baseline preference; it does not provide any explanation of how coordination may actually boost cooperation rates. In contrast to this, we reasoned that coordination may serve as a cue to participants that their partner is interdependent with them, leading them to weight their partner's interest more heavily. This may elicit a sense of commitment that leads interaction partners to resist tempting alternatives and thereby sustains cooperation through transient fluctuations in interests (Michael, Sebanz & Knoblich 2016). This line of reasoning gains support from our finding that repeated coordination is sufficient to boost cooperation rates even in a sequential decision-making task in which the dilemma is one-sided social dilemma (effectively a dictator game).

Our findings also build upon the results of an earlier study showing that repeated coordination can give rise to social norms which, in turn, can function to sustain cooperation (Guala & Mittone, 2010). The present study differs in two important ways from Guala & Mittone's (2010) study. First, we aimed to investigate whether coordination could boost cooperation independently of any social norms which it might generate. To this end, we designed the coordination game such that the two players coordinated on a value, which varied from one trial to the next, rather than on color. While the value chosen by the partner was always presented within a green field to the participant, participants were given no information about whether the values had also been presented to their partner in a colored field. As a result, successful coordination could not give rise to any convention. In addition, since the game was repeated for 120 trials, with alternative options constituting varying levels of temptation, participants could choose to resume cooperating after defecting on one or several trials – after any convention would have been violated and its normative force presumably diminished. The effects of coordination upon cooperation which we observed cannot be explained as adherence to specific conventions that had arisen during the experiment.

The second crucial difference between our study and that of Guala & Mittone (2010) is that we compared a condition in which participants played in fixed pairs (Partner Condition) with one in which they had a different partner on each trial (Stranger Condition). The differences which we observed between these two conditions in *Experiment 1* indicate that coordination can boost cooperation by eliciting a sense of commitment specifically to one's partner, and not by eliciting general prosocial attitudes.

Finally, it is also important to emphasize that our findings are not easily explained by appealing to other proximal mechanisms of cooperation which have been derived from other accounts of the ultimate evolutionary mechanisms that underpin cooperation in humans. For instance, since participants were clearly informed that they would always play the role of the second chooser and that their partner would never learn their identity, it is unlikely that our findings could be explained in terms of direct or indirect reciprocity. Needless to say, this does not cast doubt on direct or indirect reciprocity as important evolutionary mechanisms, nor on any hypotheses about the proximal mechanisms of cooperation which can be derived therefrom, since these theories are consistent with the possibility that *some* human cooperation may be traced back to the interdependence hypothesis. It will be important for future research to investigate what other forms of coordination may boost cooperation, as well as the contexts under which it does so.

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