Social closeness and latent commitment impact decisions to keep promises

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Abstract Making a promise involves a fairly fast yet complicated assessment of potential outcomes. Outside of the immediate consideration of the benefit of keeping the promise versus the cost of breaking it, one also needs to assess whether to pay a cost for keeping it or obtaining a gain for breaking it. Often this decision is compounded with the interpersonal relations and social closeness of the interaction. However, the impact of social closeness on our decisions in the context of keeping promises has not been explored. As our interactions occur with people with whom we share differing degrees of social closeness, it is fundamental to understand how these different social contexts can impact our decisions. We investigated whether the decision to keep or break a promise can be modulated by the degree of social closeness between the promisor and promisee. The participants in the experiment played a trust game with three partners: a computer, a stranger, or a friend. The game consisted of making a promise to their partners and subsequently deciding between paying a cost to keep it or obtaining a benefit for breaking it. The experiment allowed us to independently evaluate the effect that promises and social closeness have on the decision to cooperate. Using Bayesian Hierarchical Modeling, we found that, in accordance to our prediction, as social closeness increases, the probability of breaking the promise decreases. We also found that participants could not be assigned into honest or dishonest categories, as the decision to keep promises was modulated by latent commitment. Our findings suggest that the benefits

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of breaking a promise are evaluated depending on the familiarity of the affected person and that high social closeness might add more utility to follow through on a promise.

Keywords Social closeness · Deception · Bayesian Modeling ·

1 Introduction

Social interaction requires us to navigate through a set of social dilemmas, such as keeping or breaking promises as part of our daily routine. To successfully solve this dilemma, one needs to assess several scenarios: what is the benefit or cost of keeping the promise, as well as whether there is a benefit in breaking it, as well as considering the consequences for the other people involved in the interaction. Frequently, when we break our promises we can receive benefits at the expense of those who keep them (Henrich and Henrich 2007). Examples can be found in everyday situations, such as the teenager who fails to reach home at the promised time (gaining leisure time at the expense of the parents' concern). Or there can be situations with very serious social implications, such as the tax evaders who benefit from the resources that governments allocate to the society with the money of those who pay. Despite some of the incentives to break promises, everyday life is full of examples of individuals who keep their promises even if they pay a cost to do so (Bicchieri 2002). Researchers have proposed that people keep promises to foster reciprocity in the future (Fehr and Camerer 2007; Fehr and Schurtenberger 2018; Henrich and Henrich 2007) or to reduce negative emotions such as guilt (Chang et al. 2011; Stillwell et al. 1994). These mechanisms can hardly explain when people keep promises to strangers (Charness and Dufwenberg 2006; Vanberg 2008) or even non-human partners such as a computer (Kiesler, Sproull, and Waters 1996). Despite the fact that many of our interactions occur with people with whom we share differing degrees of social closeness, little is known about the role that social closeness plays in decisions to break or keep promises. This is essential because fulfilling agreements with colleagues of different levels of social closeness – such as work colleagues or friends – can have an impact on the consolidation of interpersonal relationships (Henrich and Henrich 2007), and breaking the promises can also destroy relationships and damage one's reputation (DePaulo et al. 2004).

In our study, we set out to explore the effects of social closeness on decisions to keep or break promises. Participants in the experiment played a trust game in which they had incentives to betray three partners of different levels of social closeness: a computer, a stranger, or a close friend. Our pre-registered hypothesis was that subjects would keep promises more frequently depending on the level of social closeness with their partners despite paying a cost for doing so (<https://osf.io/u97fd>). According to other experiments in which participants show prosocial decisions (Fehr and Camerer 2007), we expect subjects to keep their promises more often to their friends compared

to the stranger and the computer. In line with these hypothesized results, and according to experiments in which participants obtain a more subjective reward from cooperating with a close friend in contrast to a stranger matched by sex (Fareri, Chang, and Delgado 2015; Fareri et al. 2012; Sip et al. 2015), we hypothesized that regardless of the effect that promises may have, the subjects will decide to cooperate on more occasions with their friends compared to the stranger or the computer.

Finally, related to previous classifications, we explored whether subjects who pay more frequently to their partners can be classified as “honest” and those who pay less as “dishonest” (Baumgartner et al. 2009; Baumgartner, Gnanotti, and Knoch 2013). Using a Bayesian cumulative model (Bürkner 2017; Liddell and Kruschke 2018) we measured the latent commitment that subjects express through their promises, and we explained it depending on their group they belonged (“honest” vs. “dishonest”). We hypothesized that the “dishonest” subjects would not differ in the degree of latent commitment in contrast to the “honest.” This would imply that “dishonest” subjects express higher commitment in their promises so they could exploit partners’ trust (Bicchieri 2002). Plus, we considered the alternative for the subjects to be consistent with the latent commitment they express through their promises, which would grant evidence against the previously used classification.

2 Methods

2.1 Subjects

45 subjects (15 male) were recruited from the National Autonomous University of Mexico; their ages ranged from 19 to 33 years and their minimum educational level was high school diploma. Subjects were asked to come to the laboratory with a “close” friend, who fulfilled the following criteria: he/she 1) of the same gender, 2) was not a blood relative, and 3) was not a romantic or sexual partner. From this sample, 15 subjects performed the task in a room and 30 subjects (15 men) in a magnetic resonance imaging (MRI) scanner, however, the image data for the latter group was not analyzed for the present work.

2.2 Task

All subjects performed an adaptation of a trust game with promises, using hypothetical monetary rewards (Baumgartner et al. 2009). The variation of our experiment with respect to the original task was that three partners with three levels of social closeness were presented in the role of the investor: computer (no closeness), stranger (low closeness) and friend (high closeness), while the participant acted as the trustee. The task was programmed in PsychoPy2 version 1.84.2 (Peirce et al. 2019; Peirce 2008) with 24 trials between two

Fig. 1 Trust game with promises, each box from left to right represents a screen that was shown to the subjects sequentially. Section A1 corresponds to an example of trials without promises and section A2 to trials with promises.

players: trustee and investor. The trustee originally had 0 Mexican pesos and the investor had 2 pesos, the investor had the opportunity to give his/her money to the trustee or keep it. If the investor gave his/her money, it was multiplied by 5 pesos, so that the trustee had 10 pesos. Finally, the trustee had to decide if he/she wanted to pay half to the investor or keep the 10 pesos. The structure described was repeated in 24 trials; however, in 4 of the trials the trustee could send a promise to the investor. The promises were that he/she would always, mostly, sometimes, or never pay back. Each promise was valid for three trials, so that 12 of the trials had the effect of the promise and the other 12 did not. Each partner performed the role of investor in 8 of 24 total trials, however, both the promises and social closeness conditions were presented to the trustee in pseudorandom order.

Since our main interest was the trustee's behavior, to avoid unbalanced responses from investors, the investor was always the computer although the trustee was shown to have 3 types of investors, and the investors' decisions were programmed a priori to randomly give their amount in 6 trials and withhold the amount in 2 trials. The covert story for all our subjects was that they would be playing in real-time with their friend (whom they brought to the study), the stranger (another same-sex unknown person), or the computer. A diagram of the experimental task is shown in Figure 1.

The promise phase in part A1 indicated that in the following three trials the subject could decide without the effect of the promise. In A2, the subject was asked to decide between 1) always, 2) mostly, 3) sometimes or 4) never pay back. This pattern was repeated. In the anticipation/assignment phase, subjects were told who their partner was for that trial (computer, stranger or friend) and was given the message that their partner was making his/her decision. Later in the decision phase, the subject was informed if the partner invested his/her \$2 or not, he/she was reminded of his promise level (if they were trials with promises) and, in case the partner had invested, he/she was

asked to decide whether to pay back or not. Finally, payments for each trial were shown in the feedback phase and the sequence was repeated until the task finished.

2.3 Procedure

Subjects came to the lab with a same-sex friend considered close to him or her. It was emphasized that they must not have a romantic or family relationship with their friends, to try to exclude the effect on cooperation due to a consanguineous relationship or sexual attraction. Also, to ensure that the subjects and their companions had a similar degree of social closeness to each other, both responded to the “Inclusion of the Other in Self” IOS scale (Aron et al. 1997) without observing the responses of their partner. Subjects were trained in the main task by two researchers; the game was first explained verbally, and then the computer interface was presented on a portable computer. They were told that they would make their decisions with four buttons on the computer keyboard, which corresponded to the levels of promises and with only two of these to make their decision to pay back or not. Friends heard the explanation, then they were told that they would make their decisions in a separate room on another computer. Although this was a deception, as they were not participating at all in order for us to control and balance the behavior of the “friend” and the “stranger” during the tasks. Subjects performed between 3 and 6 practice tests together with the researcher who demonstrated the course of the game when the investor gave his/her budget. When the subjects were ready, we proceeded to take them without their companions to another room (or MRI scanner if that was the case) where they would perform the task. The subjects began the task believing that they would play with the three partners of different social closeness. In the other room, we informed the companion about the deception. When the subjects finished the task, they were debriefed. Both subjects and their friends were told that they could withdraw their participation and informed consent if they disagreed with any of the manipulations made by the researchers.

2.4 Hierarchical Bayesian Modeling

All models presented below were programmed in R via the *brms* package (Bürkner 2017; R Core Team 2017) which performs the inference using sampling by Hamiltonian Markov chain Monte Carlo through Stan (Carpenter et al. 2017). For each model, the posterior distributions of all parameters were approximated with four chains of 2000 iterations each; the first 1000 iterations of each chain were discarded (burning period), for a total of 4000 post burning samples. Model convergence was evaluated through visual inspection of the chains and calculation of the $\hat{R}$ statistic, which for all parameters was

1, that can be interpreted as convergence (all data and R scripts are available at <https://github.com/saidejp/motivations-promises>). Vaguely informative prior distributions were used for the parameters of interest in the models, which allows the data to dominate the inference, also assumes as little as possible regarding the nature of the phenomenon, which could be adequate for the current state of evidence in the problem we studied (McElreath 2018).

2.4.1 Effect of social closeness on breaking promises

To evaluate the hypothesis that subjects would keep the promise more to their friends than to the stranger and computer, we filtered all trials in which subjects promised that they would always pay back and then decided not to pay. Subsequently, Bayesian inference was used to assess the effect of partners on the decision to break the promise at an individual and a population level. For this purpose, a Hierarchical Bayesian Model was carried out that assumes that the uncertainty in partners effect on the decision to break the promise varies depending on each individual, however, it also assumes that these variations belong to common population distributions (Gelman and Hill 2006).

$$y_i \sim \text{Bernoulli}(\theta_i)$$

$$\text{logit}(\theta_i) = \mathbf{X}\beta + \mathbf{Z}u$$

In the previous model, the decision to break the promise y_i comes from a Bernoulli distribution with probability θ_i . The goal of the Hierarchical Model is to predict each decision through the linear combination of the effects of each partner, transformed by its inverse link function logit (Bürkner 2017). In this model, β and u are coefficients at the population level and individual level respectively, while $\mathbf{X}$, $\mathbf{Z}$ are their corresponding design matrices. In this case, the population coefficients correspond to the presence of partners with null social closeness β^{computer} , low β^{stranger} and high β^{friend} . We compared through evidence ratio the hypothesis that $\beta^{\text{stranger}} < \beta^{\text{computer}}$, and $\beta^{\text{friend}} < \beta^{\text{stranger}}$.

2.4.2 Effects of promises and social closeness on cooperation

To evaluate the effect of the experimental conditions on the decision to pay back, we used all trials when partners invested. Again, a Hierarchical Bayesian Model was fitted. It assumed that the promises and partners have an effect that varies for each individual and each trial; however, it also assumed that these variations belong to common population distributions. The model estimates that the probability θ_i of the decision to pay back is based on the effect of the presence of promises β^{promise} , as well as partners with low β^{stranger} and high β^{friend} social closeness; we compared through evidence ratio the hypothesis that $\beta^{\text{friend}} > \beta^{\text{stranger}}$. Furthermore, in order to determine if the model captured the data generating process closely enough, we obtained the posterior predictive distribution at the individual level, which simulated observations of

the posterior distribution and compared them with the observed data. We strengthened the confidence in the model if the observations and predictions were very close (Lee and Wagenmakers 2014; Schad, Betancourt, and Vasishth 2019).

2.4.3 Effects of social closeness on cooperation varying by promises

In this model, it is assumed that social closeness had an effect that varied for each level of promise, which implies that there were levels of promise that were more sensitive than others to the effects of the partner's on the decision to pay back. Again, a Hierarchical Bayesian Model was made to estimate the effect of partners at the population level and variations depending on the promise level. We also obtained the posterior predictive distribution at the promise level to check model performance.

2.4.4 Commitment expressed in promises

We performed the hierarchical clustering technique through the Ward method, in order to divide our sample into two subsets depending on their payment rate. The subset that had the highest payment rate was labeled "high" and the other set as "low." Subsequently, we modeled the levels of promises selected depending on the group of membership through a cumulative Bayesian model. This tool was a model for ordinal dependent variables, which assumed that the selected promises (never, sometimes, mostly, and always) were an observed ordinal variable Y , which originated from the categorization of a continuous latent variable $\tilde{Y}$. In this case, we assumed that the selected promises gave us information on the level of commitment expressed that characterizes the high and low group; so that we could compare groups according to their z-score in the latent variable. We evaluated through evidence ratio the hypothesis that the groups differed or not in the level of commitment expressed through their promises.

2.4.5 Social closeness between partners

To assess social closeness, 30 (15 men) of our subjects and their friends responded to the IOS scale (Aron et al. 1997; Fareri and Delgado 2014; Sip et al. 2015), which consists of seven pairs of circles that vary in the degree of overlap and represent the social closeness that an individual perceives with respect to the other. We performed a hierarchical and cumulative Bayesian model to support the hypothesis that there were no differences in subjective social closeness between subjects and their friends, with a posterior evidence ratio of 2.74 in its favor.

Fig. 2 Pay-back proportion by partners and promises levels, the x-axis represents 100 percent decisions made to each partner, the different shades of blue shows the proportions in which the subjects paid back or not. The y-axis presents how these proportions vary according to the promises made.

3 Results

3.1 Descriptive Statistics

In total, we analyzed 18 decisions and 4 promises per subject (810 decisions and 180 promises). From the decisions, 69% were paid back, whereas the proportion of the promises selected were never = 5.4%, sometimes = 16.2%, mostly = 43.8% and always = 40.2%. Figure 2 shows the payment proportion depending on the levels of promises and partners. Breaking promises, meaning the subject had promised always and subsequently decided not to pay back, occurred only in 12.4% of trials (19 times they did not pay back of 153 when promised always), of which 68.4% (13/19) were trials with a computer, 31.6% (6/19) with a stranger and 0% (0/19) with a friend. It is essential to note that breaking the promise was not the most frequent decision; when they promised always and had the computer as a partner, they decided to pay back in 91.5% of trials.

3.2 Social closeness decreases the probability of breaking promises

In general, the posterior probability of breaking the promises are low ($p < 0.38$), however social closeness has a clear effect on decreasing the probability of breaking the promise, null social closeness (computer) has the highest probability of breaking of promises, and this probability monotonically decreases until it is practically zero when social closeness is high (friend) (See Figure 3). In line with our first hypothesis that subjects would keep promises more de-

Fig. 3 Posterior probability of breaking the promise depending on the partner. The x-axis shows the posterior probability of breaking the promise, and the y-axis indicates the three partners. The dotted line shows the probability that breaking the promise would be zero, circles correspond to the medians of the distributions of the posterior estimated effects, the thick bar, and the thin bar correspond to the interval of 0.5 and 0.95 posterior probability, respectively.

pending on social closeness, we calculated the evidence ratio for the following hypothesis:

- There is a higher probability to break the promise to the computer than the stranger.
- It is more likely to break the promise to the stranger compared to a friend.

The evidence ratio, which is the ratio between the posterior probability of the mentioned hypotheses and their corresponding alternative hypotheses, was 7.47 and 8.64 respectively in favor of the previous hypotheses. As seen in Figure 3 in the estimate for computer, we had a 95% posterior probability that the parameter for promise-breaking was between 4-38%, although it was a small proportion, it clearly excludes the probability that promises are not broken.

3.3 Social closeness increases cooperation regardless of promises

More than 95% of the posterior probability of the population coefficients is greater than 0, which showed strong evidence of the effect of experimental conditions on the decision to cooperate, although the presence of promises and the stranger clearly increased the probability of paying, the presence of a friend was the condition that had the greatest effect on this behavior controlling for the promise condition (See Figure 4). In line with our second hypothesis that subjects would cooperate more with friends than with other partners,

Fig. 4 Posterior estimates in logit scale. We show posteriors distributions of the hierarchical Bayesian model coefficients for the effect of experimental conditions on the decision to cooperate. The x-axis shows the magnitude of the logit scale coefficients, and the y-axis shows the experimental conditions associated with that effect. The centerline represents the median of the distribution and the shaded area corresponds to the interval of 0.5 posterior probability.

posterior distributions clearly showed that the probability of cooperation with friends was greater than the probability of cooperation with a stranger, with an evidence ratio of 72. The hierarchical model allowed us to capture the individual response at the same time as the population response. In Figure 5, there is a great correspondence between the subject's responses and predictions of the model. Even in cases where the model was "wrong" (for example, subject 1), the observed response was in the range of a predicted standard deviation, which gives credibility to population estimates.

3.4 Effects of social closeness vary by promise level

For this analysis, a particular hypothesis was not proposed. We explored whether the effect of social closeness on cooperation could vary regarding the level of promises. If the social closeness effect on cooperation were the same in all promise levels, it would suggest that promises were equivalent. However, subjects responded in a consistent manner with the level of promises selected; although the social closeness effect was maintained, the probability of paying back increased as the strength of the commitment expressed in the promise did, particularly for the computer and the stranger (See Figure 6).

Fig. 5 Posterior predictive distribution in contrast to the proportion of decisions to each partner during the promises phase, each panel corresponds to one of the first twelve subjects. The responses on the dotted line indicate that the subject paid back random to that partner. The x-axis pointed the three playmates when the subjects had made a promise, while the y-axis indicates the proportion of decisions in which subjects paid back.

Fig. 6 Posterior predictive over pay back rate, social closeness varying effects by promise levels. Correspondence between payment proportions and model predictions depending on the game partner at the group level. The x-axis pointed the three partners when the subjects had made a promise, while the y-axis indicates the proportion of decisions in which subjects paid back.

Fig. 7 Probability of promise choices by group. We show the probability of selecting a certain level of promise depending on the group of belonging. The x-axis shows the two groups derived from the hierarchical grouping technique, the low group ($n = 25$) with a payment rate of 58 percent and the high group ($n = 20$) with a payment rate of 83 percent. The y-axis shows the probability of selecting a given promise, and we show the commitment strength in shades of blue. It is observed that the low group is more likely to choose mostly, and the high group to choose always.

3.5 The two groups differed in the commitment expressed by promises

The hierarchical grouping technique found a solution for two groups with similar n but different payment rate. The group “Low” had 25 subjects and a payment rate of 58%, while the group “High” was conformed by 20 subjects and they had a payment rate of 83%. The 95% frequentist confident interval of the difference was between 20-32% in favor of the High group. The Bayesian cumulative model showed that the degree to which the subjects of the High group differ from the Low group, in normal standard deviations (z -values), on the latent scale of $\tilde{Y}$, had a point estimate of 0.95, which implies that the High group had 0.95 z -values greater commitment to pay back than the Low group. The 95% Bayesian Credibility Interval indicates that the High group was between 0.40 to 1.51 z -values of difference from Low. To conclude with at least a 95% probability that people belonged to the High group expressed in their promises a greater commitment to pay back than the subjects of the Low group. Looking at Figure 7, the probability of choosing the different levels of promises varied depending on the group, the one who had the highest percentage of decisions to pay back is more likely to choose always (High group), while the group that had the lowest percentage of decisions to pay back were more likely to choose mostly (Low group). According to our data people were quite consistent with keeping what they promised to pay.

4 Discussion

Social closeness provides us with a source of information that can help us to solve the social dilemma of keeping or breaking a promise. Our results suggest that the benefits and cost of such a decision can be evaluated depending on the familiarity of the affected person. The current study had three goals: 1) to assess whether social closeness affects the decision to keep a promise despite paying a cost for doing so, 2) to evaluate the effect of social closeness on cooperation regardless of the impact of make a promise, and 3) to compare the latent commitment between two groups that differ in their payment rates.

The most novel finding was regarding our third goal. We found that the subjects divided into two subsets, formed depending on their payment rate, actually differed in the strength of the latent commitment expressed in the promise. Our results contrast with the assumption that subjects can be classified depending on their payment rate as “honest” or “dishonest” (Baumgartner et al. 2009; Baumgartner, Gianotti, and Knoch 2013). In our study there was consistency between the membership group and the commitment expressed, meaning that those of the low group promised less firmly than those of the high group. Thus, our results suggest that there are not necessarily “honest” or “dishonest” people, but the same individual, modulated by commitment or familiarity with their peers (among other variables), might make both honest and dishonest decisions. Moreover, the implementation of the cumulative Bayesian model could illustrate the usefulness of incorporating novel tools in the analysis of ordinal variables that have received other types of management in previous work (Bürkner and Vuorre 2019; Liddell and Kruschke 2018).

Regarding the first goal, we found that social closeness impacts the decision to keep a promise. Our subjects fulfilled all promises only with a close friend, despite paying a cost. When social closeness was low or absent, the probability of keeping all promises was null; however, people were more likely to keep promises to a stranger than to a computer. Our results are consistent with the proposal that making a promise can activate social norms of cooperation; specifically, people tend to follow the rule of keeping one’s word (Bicchieri 2002; Fehr and Schurtenberger 2018). However, familiarity seems to be an important driver of our final decision on promises. Although the monetary consequences of breaking a promise were identical for the three levels of social closeness, our subjects preferred not to break a promise when social closeness was high compared to low or absent.

Researchers have proposed some potential reasons why people do not break their promises to friends. One is that social closeness might impact the way those involved perceive a transgression, and breaking a promise given to a friend can be emotionally devastating for him/her. The transgressing subject may experience serious negative emotional consequences (e.g., guilt or shame), and other people could respond to the violation with disapproval, punishment or revenge (Linke 2012; Shinada, Yamagishi, and Ohmura 2004). The fact that our subjects broke the promise to a computer more often than to a stranger, is in line with other similar studies (Andreoni and Miller 1993; Kiesler, Sproull,

and Waters 1996). Since breaking a promise given to a computer is not perceived as having negative social consequences, and the group of membership has no retaliation against the subject, both the individual and group likely perceive that this might not imply a transgression.

On the other hand, in congruence with our second goal, the effect of high social closeness on the decision to cooperate was superior to the impact of promises and low social closeness. It has been proposed that decision-makers pay a cost for acting against the rules of cooperation because partners might not reciprocate in the future (Hruschka and Henrich 2006). It is thought that decision-makers may receive altruistic punishment (Shinada, Yamagishi, and Ohmura 2004), or feel guilty (Vanberg 2008). However, the fact that playing with a friend had more effect on decisions to cooperate could indicate that the subjects obtained more utility because of their social closeness, rather than behaving according to the norm. This finding agrees with a study where subjects rated the experience of sharing with a friend more positively, than with other low social closeness peers (Fareri et al. 2012). In other words, the decision to cooperate with a friend might not only imply minimizing costs (e.g., avoiding the guilt) but also maximizing utilities (e.g., experiencing more pleasure).

A limitation of our study was the use of hypothetical rewards compared to real rewards. A relatively recent study on decision-making reported that there is more loss aversion when subjects have real monetary rewards compared to hypothetical in a risk task (Xu et al. 2016). However, other studies did not report differences between the use of both types of rewards in self-control, temporal and social discount tasks (Johnson and Bickel 2006; Locey, Jones, and Rachlin 2011; Rachlin and Jones 2006). Our results have theoretical congruence (Fehr and Schurtenberger 2018) and are in the same direction as other works that use real money (Croson, Boles, and Murnighan 2003; Glaeser et al. 2000). Thus, there are only few reasons to expect that other types of rewards would modify our results.

In conclusion, our findings suggest that people make “honest” or “dishonest” decisions based on their latent commitment or social closeness, and not specifically based on a trait. Although people can obtain benefits from breaking promises, these benefits are evaluated depending on the social closeness of the person who could be affected. People preferred to pay a cost rather than breaking a promise to a close friend, which may suggest that cooperating with peers of high social closeness could derive more utility than acting according to the norm. Together, our findings could potentially help to delimit the social preferences that explain compliance with standards and human cooperation.

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