Fabian Winter and Andreas Diekmann

13 Does Money Change Everything? Priming Experiments in Situations of Strategic Interaction

Abstract: Recent work by Kathleen D. Vohs and colleagues has argued that being primed with money-related stimuli brings about a self-sufficient orientation. People reminded of money are supposedly more willing to engage in solitary vs. social activities, donate less to social causes and help others less more generally. In the spirit of Raub's triangulation efforts to understand social phenomena, we first replicate two of the individual-choice experiments reported in Vohs et al (2006). We then extend their work to strategic situations, such as the Trust Game or the Volunteers Dilemma. Our replications partially support the findings of Vohs et al. but we find no effects of money priming in strategic interaction. The results suggest that strategic, and thus social interaction may be of a different quality than individual choices. The richer context may indeed mute subtle primes such as the ones used in previous experiments.

13.1 Introduction

Rational choice theorists and analytical sociologists alike focus on three elements of explanations: Preferences, beliefs, and constraints (Hedström 2005, Gintis 2007). Both beliefs and constraints are dependent on the social structure of interaction. Thus, the social structure of interaction, the rules of 'the game', the information condition, and the payoff matrix are at the core of parsimonious explanations of social phenomena. Many situations of social interaction are strategic and the tools of game theory proved to be very useful in describing the structure precisely. In contrast to other rational choice theorists, Raub introduced game theory to sociology very early and even before the 'gold rush' of behavioral economics (e.g. Raub 1982a, 1982b, 1984). In accordance with hypothetico-deductive reasoning and with the tools of game models at hand he is able to derive precise predictions which can be corroborated by experimental methods or survey data. Raub's pioneering work on social

Note: The title is adapted from Goetzmann (2016).

Fabian Winter, MPRG Mechanisms of Normative Change, Max Planck Institute for Research on Collective Goods, Bonn, Germany

Andreas Diekmann, Universität Leipzig and ETH Zurich, Zürich, Switzerland

dilemmas, on networks and social exchange, on repeated games in a sociological context, on trust and commitment and many other topics demonstrated the fruitful approach of the “Utrecht school” (e.g. Raub 2004; Raub and Weesie 1990; Raub and Buskens 2011). On the other hand, psychological game theory and framing models may extend the parsimonious models. By this approach, more or less salient motives are elicited by priming techniques. Also, the perception of the situation can be manipulated by presenting a certain type of “frame” (e.g. Esser 2010; Lindenberg 2006 for framing theories in sociology). A typical example is the “Wall Street Game experiment” (Liberman et al. 2004). A switch from a “Community” to a “Wall Street” frame strongly reduced the probands’ inclination to contribute to the common goal in a Prisoner’s Dilemma.

In a similar vein, Vohs et al. (2006, 2008) suggested a priming theory of money. They argue that a money prime (e.g. reading a text, a list of words referring to monetary transactions or observing images reminding of money, etc.) elicits cognitive processes and activities that may be described as more “self-sufficient”. The self-sufficiency hypothesis does not necessarily imply selfish behavior. The authors predict that “when reminded of money, people would want to be free from dependency and would also prefer that others not depend on them” (Vohs et al. 2006). On the other hand, money priming may enhance performance and an equity, exchange-based orientation (Vohs et al. 2008).

The effects of money priming are demonstrated by nine experiments (Vohs et al. 2006; further experiments are reported in Vohs et al. 2008). All experiments refer to non-strategic social interactions, i.e. the outcome of a decision is not dependent on other actors’ strategies. The question arises if money priming may also have self-sufficiency effects in situations of strategic interactions, as modelled by game theory. These are clearly predicted by the hypothesis because money-primed subjects should focus more on oneself and less on others. In the following we will try to replicate two experiments conducted by Vohs et al. (2006). In a second step we will extend this research by investigating money priming in four games of strategic interaction: The Ultimatum Game (UG), the Trust Game (TG), the Prisoner’s Dilemma (PD) and the Volunteer’s Dilemma (VOD).

13.2 The experiments by Vohs et al

In this section, we want to briefly summarize the relevant experiments and results presented in the work by Vohs et al. (2006). In total, the authors present nine experiments. We will later repeat two of them, although we follow different experimental protocols than the original authors. Our study is thus not a direct one-to-one replication but an independent test of their theory.

Here is the description of the design of the questionnaire study taken from the original publication:

In Experiment 8, we tested whether money-primed participants would place a premium on being alone even when choosing leisure activities that could be enjoyed with friends and family. Participants were randomly assigned to one of three priming conditions. Participants first sat at a desk, which faced one of three posters, to complete filler questionnaires. In the money condition, the desk faced a poster showing a photograph of various denominations of currency (fig. S3). In two control conditions, the desk faced a poster showing either a seascape or a flower garden (figs. S4 and S5). Subsequently, participants were presented with a nine-item questionnaire that asked them to choose between two activities. Within each item, one option was an experience that only one person could enjoy and the other option was for two people or more (e.g., an in-home catered dinner for four versus four personal cooking lessons). (Vohs et al. 2006)

The authors find that participants in the money-prime condition are more likely to choose solitary activities than those in the two control conditions.

The second replication in this chapter zeros in on the relation between money and altruism. Here is the description of the original experiment:

Experiment 6 tested for the psychological effects of money by operationalizing helpfulness as monetary donations. Upon arrival to the laboratory, participants were given \$2 in quarters in exchange for their participation. The quarters were said to have been used in an experiment that was now complete; in actuality, giving participants quarters ensured that they had money to donate. Participants were randomly assigned to one of two conditions, in which they de-scrambled phrases that primed money or neutral concepts. Then participants completed some filler questionnaires, after which the experimenter told them that the experiment was finished and gave them a false debriefing. [. . .] As the experimenter exited the room, she mentioned that the lab was taking donations for the University Student Fund and that there was a box by the door if the participant wished to donate. Amount of money donated was the measure of helping. (Vohs et al. 2006)

As predicted by their theory, the authors find that participants primed with money donate significantly less than those in the neutral frame.

Our replications deviate in several aspects from the original studies, which we further spell out in the next section. Importantly, we use the screen-saver priming from the donation experiment also in the questionnaire study instead of the posters used by Vohs et al. (2006).

13.3 Experimental Setup

Our experiments were conducted as computerized experiments with the zTree package (Fischbacher 2007) in the experimental lab of the ETH Zürich. Participants were students from the University of Zürich and the ETH Zürich who were invited via ORSEE, an internet-based recruitment system (Greiner, 2015) and had never participated in an economic experiment before. As it is standard in the experimental research

on social dilemmas and strategic interaction, all experiments were incentivized, however in a non-standard way. Instead of playing for money, our participants played for time in the lab (see for instance Berger et al. 2012 for a similar approach). Participants received a flat payment of 33 SFr. and played over the amount of simple mathematical calculations everybody had to perform. The more of these calculations someone was assigned to as the outcome of the games, the longer it took him or her to perform the task. Due to this design choice, we were able to induce an incentivized strategic situation without relating it to money, which could threaten the treatment effect.

All experiments involved the same priming mechanism adopted from Vohs et al. (2006), which worked as follows. First, participants did 100 calculations to familiarize with the “currency”. Thereafter, they were asked to fill out a questionnaire including the experimental questions for experiment 1 and to read the instructions for either experiment 2 or experiment 3, which took about 7–15 minutes. During that time, a screen-saver appeared, which either showed fish (neutral prime) or money bills (money prime) floating through water (see Supporting Online Material of Vohs et al. 2006). Every participant took part in experiment 1 and either in experiment 2 or experiment 3.

13.4 Findings

13.4.1 Experiment 1: Replication of the Vohs et al. questionnaire experiment

Our first experiment was designed to test the robustness of experiment 8 reported in of Vohs et al. (2006) and to confirm that our manipulation worked. We included the same experimental items in our questionnaire, asking participants to choose between nine social and solitary activities (e.g., an in-home catered dinner for four versus four personal cooking lessons). Confirming the results of Vohs et al. (2006), we find that participants primed on money ($N = 66$) choose significantly more solitude activities as compared to those with a non-money prime ($N = 66$) [$\mu_{money} = 2.97$ ($\sigma = 1.15$), $\mu_{neutral} = 2.53$ ($\sigma = 1.26$), $t(130) = 2.10$, $p = 0.038$, Cohen’s $d = 0.371$]. Note, however, that the effect size is much smaller than in the Vohs et al. study and at an overall lower level.¹ We are thus confident, that our priming worked.

¹ Vohs et al.: $\mu_{money} = 4.00$ ($\sigma = 1.20$), $\mu_{neutral1}/\mu_{neutral2} = 2.82/3.10$ ($\sigma_{neutral1} = 1.00/\sigma_{neutral2} = 1.80$), Cohen’s d money vs. neutral 1 = 0.59, Cohen’s d money vs. neutral 2 = 1.06.

13.4.2 Experiment 2: Does activating the concept of money affect fairness and trust?

Experiments 2 directly followed experiment 1 in two sessions with 30 participants each ($N = 60$). According to experiment 6 in Vohs et al. (2006), priming participants on money reduces their willingness to donate money to charitable organizations. With our second experiments, we aim to test the robustness of this finding in a more controlled environment. To get a robust measure of altruistic and fair behavior, we implemented the Ultimatum Game (UG, Güth et al. 1982), the Trust Game (TG, Dasgupta, 1988) and the Dictator Game (DG, Forsythe et al. 1994), played once by all participants in this order. If the results of Vohs et al. (2006) hold, we would expect less egalitarian behavior across games if participants are primed on money.

In UG, two players, *Proposer* and *Responder*, bargain over a divisible good (in our case 100 calculations). The Proposer makes an offer, stating how many of the 100 calculations the Responder has to solve. At the same time, the Responder states how many calculations he or she will solve *at most*, without knowing the Proposer's offer. If the Proposer's offer is at least as low as the Responder's threshold, the Responder will solve the offered calculations, and the Proposer will solve the remaining ones. This procedure is known as the strategy method (Selten 1967) and has been argued to elicit normative behavior (Rauhut and Winter 2010). If the offer is above the threshold, both players have to solve the full 100 calculations.² Under the canonical assumptions of game theory, the subgame perfect equilibrium of the game is such that the responder will accept any positive amount, and by backward induction the proposer offers exactly that. A higher threshold of the responder is often associated with a concern for equitable outcomes (cf. Fehr and Schmidt 1999; Winter et al. 2012). Money-induced self sufficiency should thus lead to lower thresholds, as the comparison with the Proposer is less important. Conversely, a self-sufficient Proposer should make lower offers, as fairness as well as the Responder's fairness concerns are less important. In both cases, however, we cannot reject the null hypothesis of different offers and thresholds, respectively [Offers: $\mu_{money} = 44.6$ ($\sigma = 16.8$), $\mu_{neutral} = 45.7$ ($\sigma = 11.0$), $t(130) = 0.29$, $p = 0.77$, Cohen's $d = .08$, Thresholds: $\mu_{money} = 51.7$ ($\sigma = 17.1$), $\mu_{neutral} = 54.1$ ($\sigma = 12.4$), $t(130) = 0.62$, $p = 0.53$, Cohen's $d = .16$].

In TG, there are again the two roles of Proposer and Responder. First, the Proposer decides between the two options *C* (for cooperate) and *D* (for defection). If the Proposer chooses *D*, both players have to solve 200 calculations. If the Proposer chooses *C*, the number of calculations depends on the Responder's decision: If the Responder chooses *C*, both players have to solve 150 calculations, which is less

² In this and the following two games, we used the *strategy vector method*, that is, we asked the participants to decide for both roles, Responder and Proposer, and only later assign them randomly to one of the roles. See Rauhut and Winter (2010) for a discussion of this method.

than the 200 they would have to solve if the Proposer chooses *D*. If the Responder chooses *D*, however, he or she would have to solve no calculations at all, while the Proposer has to solve 300. Thus, if the Proposer trusts in the Responder's fairness, he would choose *C*, but *D* otherwise. Again, via backward induction, we can show that the (subgame perfect) Nash equilibrium of the game leads the proposer to choose *D*, yielding (200, 200) because the responder would choose *D* herself, yielding (300, 0) which is worse than the 200 calculations the proposer would receive from opting out early.

Self sufficiency should lower the willingness to rely on the friendly behavior of others and should thus lower both player's probability of choosing *C*. Again, we are not able to reject the null hypothesis for either of the decisions [Proposer: $\chi^2(1, n = 30) = 0.07, p = 0.60$, Responder: $\chi^2(1, n = 30) = 0.27, p = 0.79$].

The DG mirrors the UG, however without the Responder's power to veto an unacceptable offer. Thus the Proposer's task is simply to decide how to allocate 100 calculations between himself/herself and the Responder. The DG can therefore be considered as a replication of experiment 6 in Vohs et al. (2006). But also in this case, we do not find significant differences between the two experimental conditions [Offers: $\mu_{money} = 67.2(\sigma = 24.7)$, $\mu_{neutral} = 65.6(\sigma = 24.5)$, $t(130) = 0.25, p = 0.80$, Cohen's $d = .07$].

In sum, we cannot find evidence that participants primed on money behave differently from those confronted with a neutral prime in strategic interactions.

13.4.3 Experiment 3: Does activating the concept of money affect cooperation?

Experiments 3 directly followed experiment 1 in four other sessions with 18–20 participants each ($N = 74$). As in experiment 2, participants were exposed to the priming and answered a set of control questions. The experimental task consisted of two other well-know experimental paradigms, the Prisoner's Dilemma (cf. Rapoport and Chammah 1965), and the Volunteer's Dilemma (Diekmann 1985) displayed in Table 13.1. Both games were played once in the above order by all the participants without giving feedback about the outcomes until the very end of the experiment.

Table 13.1: Prisoner's Dilemma (left) and Volunteer's Dilemma (right). The values in the cells denote the number of calculations to be performed associated with the choices.

Player 1 \ Player 2	Prisoner's Dilemma		Player 1 \ Player 2	Volunteer's Dilemma	
	Cooperation	Defection		Cooperation	Defection
Cooperation	200, 200	200, 0	Cooperation	100, 100	300, 0
Defection	0, 200	300, 300	Defection	0, 300	200, 200

In the Prisoner's Dilemma (PD), defection is always better on the individual level than cooperation (denoted by C), but worse on the collective level, which creates the social dilemma. Self sufficiency should thus lead to less cooperation, as people tend to focus on individual rather than collective aims. Our empirical results, however, show an unexpected effect in the opposite direction: Priming participants on money *increases* the likelihood of cooperation ($\chi^2(1, n = 74) = 4.34, p = 0.04$).

On the contrary, cooperation should be more pronounced in the Volunteer's Dilemma (VD). The game as played by our participants has three equilibria: two in pure strategies where either of the two cooperates while the respective other abstains, and a mixed strategy equilibrium where both players cooperate with the same probability $0 < p < 1$. From the decision maker's perspective, the most important thing is that *someone* (including the decision maker) volunteers to choose C, but it's better if someone else does it. In this case, money-induced self sufficiency would lower the willingness to rely on someone else, and consequently increase the likelihood of choosing the cooperative option. Our empirical results, however, do not allow us to reject the null-hypothesis of no differences between treatments: Participants primed on money are as cooperative as participants exposed to the neutral prime ($\chi^2(1, n = 74) = 0.05, p = 0.82$). In sum, we cannot confirm the hypothesized effects of money-priming on cooperation levels in incentivized social dilemmas.

13.5 Conclusions

We replicated the effect of a money screensaver on the choice of solitary activities (experiment 8 in Vohs et al. 2006). The effect size found in our replication was lower than in the original experiment. The diminished size of the effect is no surprise. Smaller effect sizes found in replications are very well in accordance with “the winner's curse” hypothesis (Young et al. 2008) as well as with results from the recent wave of replications in psychology (Klein et al. 2014; Open Science Collaboration 2012, 2015). As in commercial auctions, where of course the largest bid will win, large experimental effects found in scientific research have an increased chance of publication. Due to publication bias replication studies often report smaller effect sizes than the original study (if there is an effect at all). Moreover, we did not find a significant difference in fairness behavior with the Dictator Game. The replication of experiment 6 of Vohs et al. (2006) failed to provide evidence for the self-sufficiency hypothesis. Our results also mirror recent replication attempts of the Vohs et al. study by Klein et al. (2014), who also find no effects of the prime across many labs.

Our key questions target possible effects of money priming on the behavior in situations of strategic interaction. Here, our answer is clearly negative. In the Ultimatum Game neither the proposer's nor the responder's behavior was significantly influenced by the money screen saver. Also, there was no significant effect

in the Trust Game or in the Volunteer's Dilemma. For the Prisoner's Dilemma we even found a significant effect in the opposite direction of what was predicted. Here, money-primed subjects showed significantly more cooperation than subjects in the control group.

At least in situations of strategic interaction, the evidence for money-priming effects on actor's decisions is weak or non-existent. This is not to say that priming or framing has no impact on strategic interactions in general. For example, the Wall Street Game experiment provides evidence to the contrary. Framing the situation of a Prisoner's Dilemma had strongly affected the level of cooperation (Lieberman et al. 2004). However, we do not know under which conditions which type of priming or framing really has an impact on the various situations of strategic interaction.³

In contrast, game theory is much more systematic and elaborated. Given the structure of strategic interaction, game theory is a powerful tool to derive precise predictions on actors' decisions. The work of Raub and collaborators clearly demonstrates this. Enriching game models by social context, framing, and psychological hypotheses is an important step to enhance the explanatory power of a theory of social interaction. However, we are still far away from a general, unified theory and doubts remain that the social sciences will ever attain this goal.

References

- Berger, Roger, Heiko Rauhut, Sandra Prade and Dirk Helbing (2012). Bargaining over Waiting Time in Ultimatum Game Experiments. *Social Science Research*, 41(2), 372–379.
- Dasgupta, Partha (1988). Trust as a commodity. In Gambetta, Diego, editor, *Trust*, chapter 4, pages 49–72. Oxford: Blackwell Publishers.
- Diekmann, Andreas (1985). Volunteer's dilemma. *The Journal of Conflict Resolution*, 29(4):605–610.
- Dreber, Anna, Tore Ellingsen, Magnus Johannesson, David G. Rand (2013). Do People Care About Context? Framing Effects in Dictator Games. *Experimental Economics*, 16(3), 349–371.
- Esser, Hartmut, (2010). Das Modell der Frame-Selektion. Eine allgemeine Handlungstheorie für die Sozialwissenschaften? In G. Albert, S. Sigmund, Eds., *Soziologische Theorie kontrovers. Kölner Zeitschrift für Soziologie und Sozialpsychologie* 50:45–62.
- Fehr, Ernst and Klaus M. Schmidt (1999). A Theory of Fairness, Competition and Cooperation. *Quarterly Journal of Economics*, 114(3):817–868.
- Fischbacher, Urs (2007). z-Tree: Zurich Toolbox for Ready-Made Economic Experiments. *Experimental Economics*, 10(2):171–178.
- Forsythe, Richard, Joel Horowitz, N.E. Savin, and Martin Sefton (1994). Fairness in Simple Bargaining Experiments. *Games and Economic Behavior* 6(3):347–369.

³ An interesting question is whether the strong framing effect of the Wall Street Game might diminish or completely vanish when there are increasing stakes. Is “structure”, i.e. the structure of the game more important than priming or framing, particularly when stakes are high? Is a possible effect of framing due to a change of preferences or the beliefs or both? (Dreber et al. 2013).

- Gintis, Herbert (2007). A Framework for the Unification of the Behavioral Sciences. *Behavioral and Brain Sciences* 30:1–61.
- Goetzmann, William N. (2016). *Money Changes Everything. How Finance Made Civilization Possible*. Princeton & Oxford: Princeton University Press.
- Greiner, B. (2015). Subject pool recruitment procedures: organizing experiments with ORSEE. *Journal of the Economic Science Association*, 1(1), 114–125.
- Güth, Werner, Rolf Schmittberger, and Bernd Schwarz (1982). An Experimental Analysis of Ultimatum Bargaining. *Journal of Economic Behavior & Organization* 3(4):367–388.
- Hedström, Peter (2005). *Dissecting the Social. On the Principles of Analytical Sociology*. Cambridge: Cambridge University Press.
- Klein, Richard A., Kate A. Ratliff, Michelangelo Vianello, Reginald B. Adams, Štěpán Bahník, Michael J. Bernstein, . . . and Brian A. Nosek, (2014). Investigating variation in replicability. *Social Psychology* 45(3):142–152.
- Liberman, Varda, Steven M. Samuels, and Lee Ross (2004). The Name of the Game. Predictive Power of Reputations Versus Situational Labels in Determining Prisoner's Dilemma Game Moves. *Personal and Social Psychology Bulletin* 30:1175–1185.
- Lindenberg, Siegwart (2006). Prosocial Behavior, Solidarity, and Framing Processes. In Fetchenhauer, D., Flache, A., Buunk, B., Lindenberg, S., Eds., *Solidarity and Prosocial Behavior. An Integration of Sociological and Psychological Perspectives*, pages 23–44. New York: Springer.
- Open Science Collaboration. (2012). An open, large-scale, collaborative effort to estimate the reproducibility of psychological science. *Perspectives on Psychological Science* 7(6):657–660.
- Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, 349 (6251), aac4716.
- Rapoport, Anatol and Albert Chammah (1965). *Prisoner's Dilemma*. The University of Michigan Press, Ann Arbor.
- Raub, Werner (1982a). *Theoretical Models and Empirical Analyses. Contributions to the Explanation of Individual Actions and Collective Phenomena*. Utrecht: Explanatory Sociology Publications.
- Raub, Werner (1982b). The Structural-Individualist Approach: Towards an Explanatory Sociology, in Raub, Werner, editor, *Theoretical Models and Empirical Analyses* (Utrecht, E. S. Publications, pp. 3–40).
- Raub, Werner (1984). *Rationale Akteure, institutionelle Regelungen und Interdependenzen. Untersuchungen zu einer erklärenden Soziologie auf strukturell-individualistischer Grundlage*. Frankfurt am Main: Peter Lang.
- Raub, Werner and Jeroen Weesie (1990). Reputation and Efficiency in Social Interactions. *American Journal of Sociology* 96:626–654.
- Raub, Werner (2004). Hostage Posting as a Mechanism of Trust. Binding, Compensation, and Signaling. *Rationality and Society* 16:319–365.
- Raub, Werner and Vincent Buskens (2011). Micro-Macro Links and Microfoundations in Sociology. *Journal of Mathematical Sociology* 35:1–25.
- Rauhut, Heiko and Fabian Winter (2010). A sociological perspective on measuring social norms by means of strategy method experiments. *Social Science Research*, 39(6):1181–1194.
- Selten, Reinhard (1967). Die Strategiemethode zur Erforschung des eingeschränkt rationalen Verhaltens im Rahmen eines Oligopol-experiments. In Heinz Sauer mann, Ed., *Beiträge zur experimentellen Wirtschaftsforschung*, Vol. I, pages 136–168. Tübingen: J.C.B. Mohr – Siebeck.
- Vohs, Kathleen D., Nicole L. Mead, and Miranda R. Goode (2006). The psychological consequences of money. *Science*, 314:1154–1156.

- Vohs, Kathleen D., Nicole L. Mead, and Miranda R. Goode (2008). Merely Activating the Concept of Money Changes Personal and Interpersonal Behavior. *Current Directions in Psychological Science* 17:208–212.
- Winter, Fabian, Heiko Rauhut, and Dirk Helbing (2012). “How norms can generate conflict: An experiment on the failure of cooperative micro-motives on the macro-level”. *Social Forces*, 90: 919–948.
- Young, Njoo S., John P. A. Ioannidis, Omar Al-Ubaydli (2008). Why Current Publication Practices May Distort Science. *PLoS Medicine* 5:1418–1422.