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COOPERATION IN SOCIAL DILEMMAS

THE NECESSITY OF SEEING SELF-CONTROL CONFLICT

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Abstract

Cooperation in social dilemmas: The necessity of seeing self-control conflict[+]

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Individuals in a social dilemma may experience a self-control conflict between urges to act selfishly and their better judgment to cooperate. Pairing a public goods game with a subtle framing technique, we test whether perception of self-control conflict strengthens the association between self-control and cooperation. Consistent with our hypothesis, cooperative behavior is positively associated with self-control for individuals in the treatment that raised the relative likelihood of perceiving conflict, but not associated with self-control in the treatment that lowered the likelihood. These results help advance our understanding of the role of self-control in social interaction.

Keywords: self-control, pro-social behavior, public good experiment, conditional cooperation

JEL Classification: D01, D03, D64, D70

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1. Introduction

The social dilemma involves a tension between the individual rationality of self-interest and the collective well-being. However, it might also represent an internal tension, a conflict of preferences within the individual. We explore the social dilemma by conceptualizing the decision to cooperate as a conflict of preferences—between the impulse of greed and the better judgment to act pro-socially. As such, the question of acting selfishly or cooperatively becomes one of self-control, and the 'stronger' the individual, the more cooperation we would expect to observe. However, self-control matters only to the extent that the individual recognized the decision at hand as a self-control conflict (Myrseth & Fishbach, 2009). Following these ideas, Kocher *et al.* (2012) theorized about, and found evidence of, a positive correlation between the capacity for self-control and cooperation among participants who reported feeling conflicted during the contribution decision—but not among participants who reported no conflict. In this paper, we directly test the causality of conflict identification in the public good game, and we do so by importing the experimental treatment applied by Martinsson *et al.* (2010) in a dictator game.

We present a model of rational self-control in the public good game (for surveys on public goods experiments, see, e.g., Ledyard, 1995; Zelmer, 2003; Gächter, 2007; Chaudhuri, 2011). This model captures the conflict between cooperative (pro-social) and selfish behavior. Specifically, we model the internal conflict between free-riding and contribution to the public good as a two-stage decision problem; first, there is an identification stage and, second, a contribution stage; self-control[1] determines the cost of cooperative behavior. Our framework for understanding cooperation is complementary to a range of other interpretations and findings. These include altruism, warm-glow, inequity aversion, efficiency preferences, reciprocity, and the sheer confusion of individuals (see, for instance, Andreoni, 1990; 1995; Palfrey & Prisbrey, 1997; Anderson *et al.*, 1998; Fehr & Schmidt, 1999; Houser & Kurzban, 2002).

We test this model in a public good game, with experimental treatments to influence identification of self-control conflict, and with a psychometric measure of trait self-control (Rosenbaum, 1980). In particular, we examine the causality of the identification stage in the self-control model, and we do so by adopting the framing technique used by Martinsson *et al.* (2012) to influence perceived conflict in the dictator game (see also Myrseth & Fishbach, 2010). Participants play a one-shot linear public goods game, of the Fischbacher *et al.* (2001)

[1] We use the terms "willpower" and "self-control (effort)" synonymously.

design, which elicits conditional contribution schedules through a variant of the strategy vector method (Selten, 1967), together with an unconditional contribution and an expectation of others' contributions. At the very end, participants complete measure of trait self-control, and they also report how conflicted they felt during the cooperation decision.

We find support for our main predictions. Identification of self-control conflict causes a stronger positive association between trait self-control and cooperation, both measured by unconditional and conditional contributions; participants in the framing treatment that prompted relatively higher likelihood of conflict identification exhibited a positive association between trait self-control and cooperation, but the participants in the treatment that prompted a lower likelihood of identification exhibited no correlation. Furthermore, an auxiliary test verified that our treatments influenced perceived conflict as intended; participants in the treatment intended to raise the relative likelihood of conflict identification reported that they felt more conflicted during the decision to cooperate than did participants in the treatment intended reduce the likelihood.

We organize the remainder of the paper as follows. Section 2 offers a review of the literature that speaks to the relation between pro-social behavior and self-control. Section 3 introduces our model, and Section 4 explains our experimental design. We present in Section 5 the experimental results. Section 6 discusses our findings and concludes the paper.

2. Self-control and pro-social behavior

2.1 *Self-control and social dilemmas*

Following common practice, we conceptualize self-control as a "cold' executive function that guides behavior in the face of "hot" impulses to act against better judgment (see e.g., Loewenstein, 1996; 2000; Metcalfe & Mischel, 1999; O'Donoghue & Loewenstein, 2007; Hofmann *et al.*, 2009). As such, willpower represents the resources that the executive function wields in a struggle against temptation (see e.g., Baumeister *et al.*, 1998). The resources may include cognitive strategies to divert attention away from temptation (Mischel, *et al.*, 1989), strategies of pre-commitment (Thaler & Shefrin, 1981, Schelling, 1984), or possibly the sheer strength of mind to hold back from the song of the sirens.[2]

[2] For details on a related formalization of self-control, see Myrseth and Wollbrant (2012).

The question of pro-social versus selfish behavior relates to that of self-control was broached by Loewenstein (1996; 2000), who suggests that selfish behavior may be motivated by visceral urges or drive-states, resembling cravings for relief from hunger, pain, and sexual deprivation. O'Donoghue and Loewenstein (2007) offer a conceptual framework for how selfish urges may conflict with the "colder," more abstract preferences for altruism. Recent empirical work offers results that one may interpret as indirect evidence for this idea.

Most pertinent to this paper are the studies that feature social dilemmas. Curry *et al.* (2008) find in a standard public goods game that individuals' discount rates are negatively associated with their contributions to the public good. In other words, more "impatient" individuals contributed less to the public good than did "patient" ones. Arriving at similar results, Fehr and Leibbrandt (2011) show that patient (vs. impatient) fishermen, whose time preferences were elicited in the lab, exhibited in a common resource problem more cooperative behavior and were in the field less likely to over-exploit the common pool resource. Moreover, Burks *et al.* (2009) report that "short-term" patience—the β in the β-δ model—is positively associated with cooperative behavior in a sequential prisoner's dilemma.[3,4]

More recently, Kocher *et al.* (2012) tested a model of the relation in a one-shot, linear public goods game between cooperation, self-control, risk-preferences, and the contributions of other players. Consistent with predictions from their model, cooperation was positively associated with a psychometric measure of trait self-control (Rosenbaum, 1980), and this association was moderated by an interaction with risk-preferences—higher risk aversion implied a weaker association. The result follows from conceptualizing as a costly gamble the use of self-control resources—or *effort*—in the struggle against temptation. The more risk averse an individual is, the less appealing is the gamble—and the less relevant self-control becomes in mustering efforts against the temptation to act selfishly. Moreover, from the conditional cooperation schedule elicited through the strategy method, they find that this interaction is moderated by the degree of cooperation of other players; individuals feel obliged to contribute, and to expend costly effort in this pursuit, to the extent that others are

[3] For more on self-control and time inconsistency in economics, see e.g. hyperbolic and quasi-hyperbolic discounting models by Strotz (1955) and Laibson (1997), the "planner-doer" model by Thaler and Shefrin (1981), and the dual-self model by Fudenberg and Levine (2006). For work on procrastination, see e.g. O'Donoghue and Rabin, (1999) and Burger *et al.* (2011).

[4] However, Duffy and Smith (2012) report no effect of cognitive load—a treatment intended to impair self-control by depleting cognitive resources—on outcomes across treatments in a repeated multi-player prisoner's dilemma.

also contributing to the public good. Finally, and also consistent with their model, the aforementioned patterns were obtained for individuals who reported feeling conflicted during the decision to cooperate—not for those who reported no conflict whatsoever. Notably, their study does not feature any experimental treatments—it is purely correlational. Our present paper seeks to further explore this latter pattern by manipulating and measuring experienced conflict during the decision to cooperate. As such, we test the causality of conflict identification.

2.2 *Self-control and dictator games*

A relatively consistent pattern of results emerges in related games that explore pure altruism. Piovesan and Wengström (2009) measure response times of participants in a repeated dictator game, lasting 24 periods.[5] They find both across and within participants that lower response times are associated with more selfish choices. One interpretation of their results is that the default behavior is to act selfishly and that pro-social behavior requires the successful resolution of a self-control conflict, which raises response time. Such successful resolution of conflict would require cognitive resources. While Hauge *et al.* (2009) report no effect of cognitive load on players in one-shot dictator games, Martinsson *et al*. (2012) show that donations to the Red Cross in a one-shot dictator game are positively correlated with participants' scores on the Rosenbaum (1980a) measure of trait self-control. Moreover, the correlation was found in the framing treatment that was expected to raise the relative likelihood of identification of self-control conflict—not in the framing treatment that was expected to reduce the likelihood. In our present paper, we adapt the framing treatment from Martinsson *et al*. (2012) to the public goods game, also for the purpose of manipulating identification of self-control conflict.

2.3 *Other evidence*

A growing literature on the "default" response in games of trust and reciprocity further supports the idea that altruistic responses require self-control. Achtziger *et al.* (2011) subjected players in an ultimatum game to cognitive resource depletion, and show that depleted proposers made lower offers—they became less altruistic. Moreover, depleted responders were more likely to reject offers that were unfair to themselves—they exhibited "altruistic punishment." Halali *et al.* (2011) report the same for responders, but with a

[5] For a general discussion of the utility and merit of response times in economics, see Rubinstein (2007).

different depletion task. Crockett *et al.* (2008) subjected responders to acute tryptophan depletion—a procedure that temporarily reduces serotonin levels in the brain and thereby impairs self-control (Schweighofer *et al.*, 2008); reduced serotonin levels raised rejection rates and this reduction is positively correlated with impulsive choice in a delay-discounting task (Crockett *et al.*, 2010).[6] In a trust game, Knoch *et al.* (2009) subjected receivers' right lateral prefrontal cortex—thought to be responsible for executive functioning (Miller & Cohen, 2001)—to transcranial magnetic stimulation, which reduces functioning in the targeted brain region. The authors show that receivers, though aware that returning a share of the amount received was both strategic and norm-compliant, were unable to do so under impaired executive functioning; self-control seems necessary to act on the better judgment to resist the temptation to keep the amount received entirely for oneself.

Finally, in a delay of gratification paradigm, Albrecht *et al.* (2011) show that individuals who choose between immediate and delayed rewards for themselves exhibit less patience and more affective involvement (activation in the dopaminergic reward system) than do individuals who make such choices for others—or for themselves in the future (for consistent results, see Pronin *et al.*, 2008).

3. Model

3.1 *Utility*

We assume an agent whose preferences are described by the utility function U_i, which consists of three components:

$$U_i = u_i(\pi_i) - s_i(\omega_i) - f_i\left(\bar{c} - c_i\right). \tag{1}$$

The first component, $u_i(\pi_i)$, is the utility from monetary payoffs For simplicity, we assume utility to be linear in payoffs, and so the utility from monetary payoffs is equivalent to the payoff itself, $u_i(\pi_i) = \pi_i$. Our empirical setting is a one-shot linear public goods game,

[6] Notably, Knoch *et al.* (2006), report results that conflict with these. Subjecting participants' right dorsolateral prefrontal cortex to low-frequency repetitive transcranial magnetic stimulation, they find that responders under impaired executive functioning exhibit substantially lower rejection rates—less altruistic punishment.

where π_i is the payoff, e_i the endowment, c_i the contribution level, and m the marginal return from the public good:

$$\pi_i = e_i - c_i + m \cdot \sum_1^n \frac{c_j}{n}. \tag{2}$$

If $0 < m, < 1$ and $m \cdot n > 1$, this payoff function has the required properties of a public good.

The second component, $s_i(\omega_i)$, specifies the cost of exercising self-control. This cost is "opportunity-based," as in Fudenberg and Levine (2006). The underlying idea is that temptation strength is proportional to the appeal of available alternatives. In this case, greed grows stronger when the difference between the highest possible available monetary payoff, c^*, and the expected monetary payoff, c', increases, $\pi_i(c^*) - \pi_i(c') = c_i - mc_i = (1 - m)c_i$. Assuming a linear functional form as in Fudenberg and Levine (2006), the cost of self-control thus becomes

$$s_i(\omega_i) = \frac{(1-m)c_i}{\omega_i}, \frac{1}{n} < m \leq 1, \tag{3}$$

where the self-control cost is moderated by a will-power parameter $\omega_i > 0$.

The third and final component, $f_i(\bar{c} - c_i)$, specifies a cost of deviating from the expected mean contribution, $\bar{c}$, of other group members in the public goods game. We assume a standard quadratic cost function as in (4)

$$f_i\left(\bar{c} - c_i\right) = \frac{\beta_i}{2}\left(\bar{c} - c_i\right)^2, \tag{4}$$

where $\beta_i > 0$ measures sensitivity to deviations from mean contributions.

The motivation behind our modeling approach is to describe an agent with altruistic motivations, but who nevertheless feels tempted to be selfish. That is, the agent experiences a self-control conflict between her better judgment to act pro-socially and the temptation to act selfishly. Moreover, to reflect observed patterns of conditional cooperation (see, e.g. Fischbacher et al., 2001; Fischbacher & Gächter, 2010), the agent experiences a cost from deviating from the average contribution of others—the greater the deviation, the larger the

cost experienced by the agent. Finally, to resolve this self-control conflict, the agent must expend costly effort. This effort is modeled with the approach by Fudenberg and Levine (2006), and implemented into the utility function accordingly.[7]

We can now state the utility function in full as

$$U_i = e_i + (m-1)c_i + m\bar{c} - \frac{(1-m)c_i}{\omega_i} - \frac{\beta_i}{2}\left(\bar{c} - c_i\right)^2 . \tag{5}$$

3.2 *The decision problem*

The agent's decision problem consists of two stages, as given in Figure 1. At the identification stage, agent either identifies conflict with probability p_i or does not identify conflict with probability $1 - p_i$. We denote identification $I = \{0,1\}$, where $I = 1$ indicates that the agent has identified conflict, and $I = 0$ that the agent has not. If the agent identifies self-control conflict, she perceives the full utility function, while if she does not, she perceives only the utility from monetary payoffs, as in (6)

$$U_i = \begin{cases} e_i + (m-1)c_i + m\bar{c} - \dfrac{(1-m)c_i}{\omega_i} - \dfrac{\beta_i}{2}\left(\bar{c} - c_i\right)^2 & \text{if } I = 1 \\ e_i + (m-1)c_i + m\bar{c} & \text{if } I = 0 \end{cases} . \tag{6}$$

Insert figure 1 here

This implies that if the agent does not identify self-control conflict, she is presumed entirely selfish, with a utility function that prescribes only profit maximization in the public goods game. Thus, when the agent does not identify conflict, the agent's utility function U_i becomes

$$U_{i|I=0} = e_i + (m-1)c_i + m\bar{c} . \tag{7}$$

[7] A similar modeling approach is also employed by Hauge (2010), for the dictator game.

LEMMA 1: *Given that the agent has not identified conflict* (I = 0)*, and m/n < 1, optimal contributions are given by*

$$c^{*}_{i|I=0} = 0 \quad . \tag{8}$$

Proof. All proofs are in Appendix A.

However, if the agent identifies conflict (I = 1), the agent perceives the complete utility function U_i (5) and thus maximizes

$$U_{i|I=1} = e_i + (m-1)c_i + m\bar{c} - \frac{(1-m)c_i}{\omega_i} - \frac{\beta_i}{2}\left(\bar{c} - c_i\right)^2 . \tag{9}$$

LEMMA 2: *Given that the agent has identified conflict* (I = 1)*, optimal contributions are given by*

$$c^{*}_{i|I=1} = \bar{c} - \frac{\left(1-m\right) + \left(\frac{1-m}{\omega_i}\right)}{\beta_i}. \tag{10}$$

We then have that the agent will contribute

$$c^{*}_i = \begin{cases} 0 & \text{with } 1\text{- } p_i \\ \bar{c} - \dfrac{\left(1-m\right) + \left(\dfrac{1-m}{\omega_i}\right)}{\beta_i} & \text{with } p_i \end{cases} . \tag{11}$$

Having solved the agent's decision problem, we can now relate this to our predictions for cooperation in the public goods game.

PROPOSITION 1: *Expected cooperation denoted* $\hat{c}_i$*, is a linear combination of optimal contribution given* identification (*I* = 1) *and optimal contributions given no identification* (*I* = 0)*, stated in*

$$\hat{c}_i = p_i \left[\bar{c} - \frac{(1-m) + \left(\frac{1-m}{\omega_i} \right)}{\beta_i} \right]. \tag{12}$$

PREDICTION 1: *Given* $\bar{c} > 0$, $\beta_i > 0$, *and* $p_i > 0$, *higher levels of willpower* ω_i *are associated with higher levels of observed cooperation, and this association increases in the probability of identifying conflict* p_i.

If the agent does not identify conflict, willpower is unrelated to cooperation, as the agent will only seek to maximize profit (6). However, if the agent has identified conflict *I* =1, she holds pro-social motivations, captured by a positive β_i, and would prefer to cooperate when she knows that other group members, on average, cooperate $(\bar{c} > 0)$. Because cooperation is costly also in terms of self-control, a higher level of will-power ω_i will allow the agent to cooperate more. Hence, we predict higher levels of cooperation $\hat{c}_i$ in the public goods game for higher levels of self-control. Furthermore, raising the likelihood of conflict identification p_i leads more agents to identify conflict, and for these individuals self-control will be positively associated with cooperation. On the group level, therefore, we expect to observe that cooperation weakly increases in likelihood of conflict identification p_i.

PREDICTION 2: *An increase in the average cooperation by other group members* $\bar{c}$ *, raises* $\hat{c}_i$ *if* $\beta_i > 0$ *and* $p_i > 0$.

Because deviating from the average cooperation of others is costly to an agent with $\beta_i > 0$ who has identified the self-control conflict, raising $\bar{c}$ will then lead to higher levels of cooperation $\hat{c}_i$.

We further define the self-serving bias *B* as the difference between the agent's optimal contribution in the case of identification and others expected contribution.[8] The self-serving bias can then be written as

$$B_i = \bar{c} - c^*_{i|I=1} = \frac{(1-m) + \left(\frac{1-m}{\omega_i}\right)}{\beta_i}. \tag{13}$$

PREDICTION 3. *Given* $\beta_i > 0$ *and* $p > 0$*, higher levels of willpower* ω_i *are associated with a smaller self-serving bias, and this effect increases in* p_i*, the probability of identifying conflict.*

Though the difference between other's cooperation $\bar{c}$ and the agent's observed cooperation $\hat{c}$ is costly to the agent who has identified self-control conflict, to reduce this difference requires costly effort. Therefore, we expect a small self-serving bias with higher levels of willpower.

4. Experimental design and procedure

4.1 *The public goods game*

The public goods game in our experiment relies on the following linear payoff function for individual *i*

$$\pi_i = 20 - c_i + 0.4\sum_j^4 c_j, \tag{14}$$

where c_i denotes the contribution of individual *i* to the public good. Each group consists of four randomly matched individuals, and each individual receives an endowment of 20 experimental points (the experimental currency unit). The marginal per capita return (MPCR) from investing in the public good is 0.4, fulfilling the conditions for a social dilemma.

[8] This is in line with existing literature on cooperation, which defines the self-serving bias as the difference between "perfect conditional cooperation" (exactly matching others average contribution) and one's own contribution. The latter is commonly referred to as "imperfect conditional contribution," as contributions tend to imperfectly match those of others (see e.g., Fischbacher et al., 2012).

Assuming that participants are rational and self-interested, it is clear that any MPCR < 1 implies a dominant strategy to free-ride. From the perspective of social welfare, it is optimal to contribute the whole endowment because MPCR·n > 1.

The preference elicitation and the incentive mechanism in our experiment follow that those from Fischbacher *et al.* (2001). Participants make two sets of decisions—first, an unconditional contribution to the public good and, thereafter, a conditional contribution schedule. The unconditional contribution is in the form of a single integer, satisfying $0 \leq c_i \leq 20$. For the conditional contribution, participants indicate how much they would contribute to the public good for any possible average contribution (rounded to integers) of the other three players within their group. For each of the 21 possible averages from 0 to 20, participants decide on a contribution between (and including) 0 and 20. This is a version of the strategy vector method (Selten, 1967).

To ensure incentive-compatibility, both the unconditional and the conditional contributions are potentially payoff-relevant. For one group member, randomly determined by the toss of a four-sided die,[9] the conditional contribution is relevant; their unconditional contributions are relevant for the other three group members. More specifically, the three unconditional contributions within a group, and the corresponding conditional contribution (for the specific average of the three unconditional contributions), determine the sum of contributions to the public good. One can then, according to equation (14), straightforwardly compute individual earnings.

4.2 *Treatments*

To test our hypothesis, we employed three between-subject treatments—the isolated, the standard, and the interrelated treatments—to influence perception of choice context and hence identification of self-control conflict. Each of the six sessions was assigned to one of the three treatments, and participants were randomly assigned to one of the six sessions.

The isolated and interrelated treatments were implemented with a subtle framing procedure designed by Myrseth and Fishbach (2010) to influence identification of self-control conflict, and adapted to the dictator game by Martinsson *et al.* (2012). Participants viewed a calendar showing the present month, and the calendar contained either a grid that separated

[9] Each group member is assigned a number from one to four. The die is rolled by a randomly selected participant in the session, and the roll of the die is monitored by the experimenter.

the dates or no such grid (see Figure 3). Moreover, in the gridded calendar, the date of the experiment was highlighted in grey; the date was not highlighted in the non-gridded calendar. Because we expected those who saw the gridded calendar to adopt a more isolated view of their subsequent choice opportunities, we refer to this treatment as the isolated treatment. Conversely, because we expected participants who saw the calendar with no grid to adopt a less isolated view—the choice opportunities perceived more related to each other—we refer to this as the interrelated treatment. We denote as the standard treatment that which features no calendar and otherwise resembles the typical presentation of the public good game.[10]

Insert Figure 2 about here

The purpose of this procedure was to manipulate participants' perception of the decision context, without actually changing the decision itself. As such it can be thought of as a framing treatment. Originally, Myrseth and Fishbach (2010) designed this framing technique to influence identification of self-control conflict in the face of "epsilon cost temptation." Epsilon cost temptations are tempting behaviors for which unit consumption cost is marginal—such as the calories gained from a single cookie—but for which long-run aggregated costs nevertheless may prove more severe—such as an expanding waistline. The authors argue that the gridded relative to the non-gridded calendar activated an isolated (versus interrelated) frame of the choice opportunity; participants were more likely to isolate the date in question and thus less likely to see the decision task in relation to similar future opportunities. Consequently, the gridded calendar reduced the relative likelihood that participants would identify a conflict between the temptation to have chips and the better judgment to maintain a fine figure and good health. And, as argued by Myrseth & Fishbach (2009), individuals will go for the temptation by default, if they never identify self-control conflict in the first-place. In other words, self-control resources—or willpower—are only relevant to the extent that the individual has identified self-control conflict.

Martinsson *et al*. (2012) adapted this argument to the context of the dictator game, making the case that greed in low-stake allocation decisions also might take the form of epsilon cost temptation. That is, the question of whether or not to be generous—to donate to a

[10] A priori, we could not be sure how the view of participants in the standard treatment would compare to those of participants in the other two treatments—this would depend on the "default" view they had coming into the experiment and on the framing of the standard treatment itself. However, a reasonable guess was that the participants in the standard treatment would fall somewhere between the narrow view in the isolated treatment and the wide view in the interrelated treatment, as was the case with donations in Martinsson *et al.* (2012).

charitable organization—may elicit self-control conflict if the decision is viewed in relation to future decisions, but not if the decision is viewed in isolation. If viewed in relation to future decisions, the question of how much to donate on a single occasion may have bearing on the decision maker's self-image; donating now—and in the future—indicates a generous character, whereas keeping the money for oneself does not. However, if viewed in isolation, the question of how much to donate has little bearing on self-image; the present decision of how much to donate is considered only in light of immediate consequences, leaving self-image out of the equation. Because a consistent self-image represents an important motivator for pro-social behavior (see e.g., Bénabou & Tirole, 2011; Gneezy *et al.*, 2012), they expected that individuals more likely would identify self-control conflict between selfish and pro-social behavior if the allocation decision was seen in relation to future opportunities than if it is seen in isolation. Using the treatment by Myrseth and Fishbach (2010), they found support for this idea. Participants in the interrelated treatment—that which presented a calendar without a grid—exhibited a positive correlation between the Rosenbaum (1980a) measure of trait self-control and donations. However, there was no correlation among participants in the isolated treatment—that which presented a calendar with a grid.

For the same reasons that the framing treatment may influence self-control conflict in the dictator game, it may also influence self-control conflict in the public good game.

4.3 *Measurement of conflict identification and of trait self-control*

As argued by Myrseth and Fishbach (2009), the capacity to exercise self-control is relevant to the decision to indulge only when the individual has identified self-control conflict. Therefore, one approach to investigating whether the problem of pro-social versus selfish behavior resembles one of self-control is to test whether capacity for self-control is positively associated with pro-social behavior when the individual has felt conflicted, but less so or not at all when the individual has not. This is the approach taken in this paper, and by Martinsson *et al*. (2012) in a dictator game and in a recent follow-up paper by Kocher *et al.* (2012) using a public good game. Martinsson *et al.* (2012) made the argument by subjecting participants to different treatments—those discussed in the treatment section above—intended to manipulate the relative likelihood of conflict identification. The authors found that capacity for self-control was positively associated with donations in the treatment intended to raise likelihood of conflict identification, but not in the treatment intended to reduce the likelihood. However, Kocher *et al.* (2012) did not subject participants to an experimental treatment.

Rather, their results rely on a measurement of experienced conflict. They found that capacity for self-control was positively related to cooperation among participants who reported feeling conflicted during the contribution decision, but not among participants who reported no conflict. Our present paper seeks to test the causality of conflict identification in the public good, unresolved in Kocher *et al.* (2012), by importing the experimental treatment from the dictator game by Martinsson *et al.* (2010). We also included the conflict measure from Kocher *et al.* (2012) to verify the treatment and to replicate the pattern originally obtained by them.

To capture subjectively experienced strength of conflict, we presented a question in the last part of the experiment similar to the one used in Aaker *et al.* (2008) and identical to that used in Kocher *et al.* (2012): "To what extent did you experience conflict when deciding how much to contribute?" Participants answered this question on a continuous scale ranging from 0 ("not at all") to 140 ("very much").

To capture capacity for self-control, we implemented a standard measure of trait self-control—the Rosenbaum Self-Control Schedule (Rosenbaum, 1980a), henceforth abbreviated Rosenbaum.[11] This measure has been validated against a number of relevant personality measures, and against behavioral tasks associated with self-control, such as resisting pain (Rosenbaum, 1980b), coping with stress (Rosenbaum & Smira, 1986; Rosenbaum, 1989), coping with mental disability (Rosenbaum & Palmon, 1984), coping with seasickness (Rosenbaum & Rolnick, 1983), quitting smoking (Katz & Singh, 1986), saving over spending (Romal & Kaplan, 1995), and curtailing procrastination (Milgram *et al.*, 1988). More recently, the measure has been found under certain conditions to correlate positively with pro-social behavior—specifically, donations in a dictator game (Martinsson *et al.*, 2012) and cooperation in a one-shot public good game (Kocher *et al.*, 2012).

An extensive literature from personality psychology documents that the tendency to apply self-control strategies represents a stable trait within the individual over time. For example, Mischel and colleagues found that a child's performance at age 4 on an instant gratification task (e.g., one marshmallow now, or two marshmallows later) predicted later in life their cognitive control (Eigsti *et al.*, 2006), ability to concentrate, self-control, interpersonal competence, SAT scores, and drug use (Mischel *et al.*, 1988; Mischel *et al.*, 1989; Shoda *et al.*, 1990; Ayduk *et al.*, 2000).

[11] The Rosenbaum Self-Control Schedule (1980a) is included in Appendix B.

4.4 *Overview of procedure*

We recruited participants from undergraduate classes at a technical university in Medellín, Colombia, in 2008. The head administrator sent to the respective universities' email lists invitations to participate in economic experiments, and she posted posters on campus, as well. In addition, the experimenter introduced himself in classes, where he repeated the information from the emails. We held six sessions—two sessions for each treatment—with 24 participants per session. Nobody participated in more than one experimental session, and none were students of mathematics, psychology, or economics. Participants entered a lecture hall, after which they were provided an experimental id-number to ensure anonymity, and assigned a seat. The experiment started with the experimenter distributing instructions for the public goods game (see appendix A). The experimenter read the instructions aloud to participants. When finished, all participants completed a set of control questions—to ensure comprehension. Participants were allowed to ask questions in private; when all had finished, the questions were solved in public on a black board. Thereafter, the experimenter distributed decision sheets for the public good game. The first page of the decision sheet was blank for all participants. The second page was either blank or contained a calendar, depending on treatment. The third page contained the answer sheet for the public good game; here the participant reported the amount she wished to contribute unconditionally. Once participants had indicated their decisions, the experimenter collected the decision sheets and distributed a second decision sheet. Here the participants were asked to provide an incentivized guess of how many tokens on average that the other participants in the same session had contributed. Once participants had indicated their guess, the experimenter collected the decision sheets and distributed a third decision sheet. Here the participant indicated how much they wished to contribute conditionally, by completing a contribution table, as in Fishbacher *et al.* (2001).

When participants had indicated their conditional contributions, the experimenter collected their decision sheets and distributed a questionnaire. The questionnaire first included a question that asked about the degree of conflict experienced during the allocation decisions. Second, it presented the Rosenbaum Self-Control Schedule (1980), and finally it posed some socioeconomic questions. Upon completing the questionnaire, participants exited the room, lined up, and re-entered the room one-by-one to claim their payment in private.

5. Experimental results

The summary statistics in Table 1 show that both conditional and unconditional contributions in our sample resemble those reported elsewhere (e.g., Fischbacher *et al.*, 2001; Fischbacher & Gächter, 2010). Moreover, the Rosenbaum scores are roughly similar to those found in other studies.[12]

Insert Table 1 about here

As expected, unconditional contributions are higher in the interrelated treatment (*Mean* = 8.71) than in the isolated treatment (*Mean* = 8.05), but this difference is not significant, p = 0.63 (Mann-Whitney *U*). Finally, there is no significant difference in Rosenbaum between the interrelated (*Mean* = 29.41) and isolated (*Mean* = 31.51) treatments, p = 0.64 (Mann-Whitney *U*).

5.1 *Conditional contributions*

Our experiment elicited both conditional and unconditional contributions to the public good. We start by analyzing conditional contributions.

With the vector strategy method, each participant indicated 21 contribution levels for all possible average contribution levels (rounded to integers) of the other group members. The elicitation schedule was fully incentivized. Testing Predictions 1 through 3, Table 2 presents an OLS analysis of the conditional contributions as a function of *Rosenbaum* scores and average contributions by others (denoted *Others*). For simplicity of exposition, we first break down our analysis by treatments.

Insert Table 2 about here

[12] The grand mean is slightly above the corresponding range of means from the original samples studied by Rosenbaum (1980a, b)—*Mean* = 29.7 vs. *Mean*s ranging from 23 to 27. It is above that (*Mean* = 16.7) obtained in Germany by Kocher *et al.* (2012), but close to that (*Mean* = 32.1) obtained in Colombia by Martinsson *et al.* (2012).

All specifications replicate a commonly found pattern—that the level of others' average contributions is strongly associated with own contributions (e.g., Gächter, 2007; Kocher *et al.*, 2008; Fischbacher & Gächter, 2010; Kocher *et al.*, 2012).[13]

Consistent with Prediction 1, specifications (7) and (8) reveal a positive and significant coefficient (p's < 0.05) on the *Rosenbaum* main effect; in the interrelated treatment, trait self-control is positively associated with cooperation. However, the corresponding main effects for the isolated and standard treatments—in specifications (1-2) and (4-5), respectively—are not significant (p's > 0.77). This latter result is also consistent with Prediction 1, which states that the positive association between self-control and cooperation increases in the probability of identifying self-control conflict.

In line with Prediction 2, specifications (2), (3), (5), (6), and (8) yield a positive and significant coefficient on the *Others* main effect. That is, contributions increase in the amount contributed by other players.

Specification (9) provides support for Prediction 3. The coefficient on the interaction between *Rosenbaum* and *Others* is positive and significant ($p < 0.01$). This means that the self-serving bias—the discrepancy between what others contribute and what the player contributes—diminishes with self-control in the interrelated treatment. Furthermore, the corresponding coefficients for the isolated and standard treatments—in specifications (3) and (6), respectively—are not significant, (p's > 0.37). This is also consistent with Prediction 3, which states that the self-serving bias should diminish with self-control more sharply with a higher likelihood of identifying self-control conflict.

Insert Table 3 about here

In the aforementioned analyses, we have broken the data down by treatments. To directly test the differences in the interaction effects found in Table 2 on specifications (3), (6) and (9), we provide the full specification in Table 3 (specification 10), which includes the treatments as variables. This also provides a direct test of Prediction 3, which states that the association between cooperation and the *Rosenbaum-Others* interaction is stronger in the interrelated than in the isolated treatment. Consistent with Prediction 3, the coefficient on the interaction between *Rosenbaum*, *Others*, and *Isolated*, in specification (10), is negative and

[13] In Kocher *et al*. (2012), the main effect of others' average contributions disappears in a regression analysis that includes risk preferences, but is otherwise similar.

significant ($p < 0.05$), while the interaction between *Rosenbaum* and *Others* positive and significant ($p < 0.01$) (recall that the *Interrelated* treatment represents the baseline in specification 10). This result verifies that the self-serving bias diminishes with self-control more sharply in the interrelated than in the isolated treatment.

We summarize our results below, according to Predictions 1-3, respectively:

RESULT 1a: *There is in the interrelated treatment a positive association between levels of trait self-control and conditional cooperation, but there is no discernable association in the isolated treatment.*

RESULT 2: *There is a positive association between conditional cooperation and the level of contributions by others.*

RESULT 3: *There is in the interrelated treatment a negative association between the degree of self-serving bias and levels of self-control, but there is no discernable association in the isolated treatment.*

Our results are of economic significance; the marginal effect in the interrelated treatment of *Others* is: $0.215 + 0.006 Rosenbaum\ score$;[14] The marginal effect evaluated at the mean of the Rosenbaum score (*Mean* = 29.99) approximates to 0.395. That is, if contribution by others to the public good increases by one unit, then a participant increases contribution to the public good by 0.395 units. The marginal effect evaluated at one standard deviation (*std. dev.* = 19.94) above the mean Rosenbaum score approximates to a marginal effect of 0.515, which corresponds to a 30% increase.

To better illustrate our results, we plot predictions from specification (10) for different levels of each independent variable. The predicted contributions are presented in Figures 3-5 for the isolated, standard and interrelated treatments, respectively. Figures 3 and 4 show that conditional contributions increase as *Others* increases. This corresponds to the standard observation in public goods experiments, and to Prediction 2. Notably, the figures show no association between conditional contributions and the *Rosenbaum*. Figure 5, reveals a similar

[14] The marginal effect of *Others* is below 1 for all possible values of the Rosenbaum score. This means that our estimated model implies imperfect conditional cooperators. A higher Rosenbaum score brings participants closer to perfect conditional cooperators.

sensitivity to *Others*. However, consistent with Prediction 3, the effect of increasing *Others* appears stronger for higher levels of self-control. Notably, the highest level of conditional cooperation in the Interrelated treatment, occurs when both the *Rosenbaum* and *Others* take high values, i.e., in the (High, High) cell.

Insert Figure 3 about here

Insert Figure 4 about here

Insert Figure 5 about here

We next to turn our conflict variable, denoted *Conflict*, which offers the opportunity for a treatment check. Participants reported mean *Conflict* levels of 47.11 (*std. dev.* = 32.98), 68.08 (*std. dev.* = 39.57), and 61.70 (*std. dev.* = 42.55), in the isolated, standard, and interrelated treatments, respectively. A Kruskal-Wallis test reveals no equality in distributions, $p = 0.026$. Of particular interest to us is the difference between the isolated and interrelate treatments, $p = 0.094$ (Mann-Whitney *U*).[15] This provides additional (though weak) evidence that our treatments successfully manipulated conflict identification.

Furthermore, because our experimental treatments were intended to manipulate conflict identification, we could run an alternative regression that substitutes the *Conflict* variable for our treatment variables—and thereby in effect replicate the correlational study reported by Kocher *et al.* (2012). Accordingly, specification (11) resembles specification (10) (see Table 3), with the exception that the former features *Conflict* rather than the treatment variables. And, as we expected, we obtain a negative and significant coefficient ($p < 0.05$) on the three-way interaction between *Rosenbaum*, *Others*, and *Conflict*. This pattern is consistent with that obtained by Kocher *et al.* (2012).

Our final analysis of conditional cooperation concerns the distribution of contributor types, classified according to the standard approach (see e.g., Fischbacher *et al.*, 2001; Fischbacher & Gächter, 2010). *Conditional cooperators* submitted a contribution schedule with a (weakly, with at least one strict step) monotonically increasing contribution for an

[15] A *t*-test yields significance at the 0.05-level for the difference between the isolated and the interrelated treatment. The difference between the isolated and standard treatment is significant ($p < .05$), but that between the standard and interrelated treatment is not (both Mann-Whitney *U*).

increasing average contribution by the other group members.[16] *Free-riders* indicated zero conditional contributions for every possible average contribution by the other members. *Hump-shape contributors* (also known as *Triangle contributors)* reported (weakly, with at least one strict step) monotonically increasing contributions up to a certain average level of others' contributions, above which their contributions schedule is (weakly, with at least one strict step) monotonically decreasing. The category referred to as *Residual* comprises the remaining participants.[17] Our data, across conditions, yields a distribution of types—shown in Table 4—within the range of those found in past studies (e.g., Fischbacher *et al.*, 2001; Kocher *et al.*, 2008; Herrman & Thöni, 2009; Thöni *et al.*, 2009; Fischbacher & Gächter, 2010).

Insert Table 4 about here

As in Kocher *et al.* (2012), our model makes a prediction about the likelihood that *Free-riders* relative to other types have identified self-control conflict. Specifically, given that *Free-riders*—who by definition have contributed less—possess similar levels of trait self-control, they should be less likely to have identified the conflict between keeping the money and contributing, and so less likely to have drawn on their self-control strategies to promote pro-social behavior. Indeed, consistent with this prediction, free-riders reported a significantly lower average level of conflict than did other types ($p < 0.01$; Mann-Whitney-*U*). As also found by Kocher *et al.* (2012), free-riders seem to have contributed less because they were less likely to see a self-control conflict and, therefore, less likely to draw on their self-control strategies to promote pro-social behavior.

5.2. *Unconditional contributions*

We next turn to our OLS analysis of unconditional contributions, given in Table 5.

Insert Table 5 about here

[16] We also included those without a weakly monotonically increasing contribution, but with a highly significant (*p*-value < 0.01) positive Spearman rank correlation coefficient between own and others' contributions (see Fischbacher *et al.*, 2001; Fischbacher & Gächter, 2010).

[17] This category is usually referred to in the literature as *Others*, but we choose a different label to avoid confusion with the regression variable, which bears the same name.

Consistent with Prediction 1, specification (14) reveals that the *Rosenbaum* exhibits a positive and marginally significant correlation ($p < 0.1$) with unconditional contributions for individuals in the interrelated treatment, who were relatively more likely to identify self-control conflict than were those in the isolated treatment.[18] However, among those in the isolated treatment—specification (12)—there is no significant correlation between *Rosenbaum* and unconditional contributions. The result is summarized below, in Result 1b, corresponding to Prediction 1:

RESULT 1b: *There is in the interrelated treatment a positive association between levels of trait self-control and unconditional cooperation, but there is no discernable association in the isolated treatment.*

Furthermore, we conducted an auxiliary test, reported in Table 6, to verify consistency with the corresponding pattern of correlations obtained in Kocher *et al.* (2012). The interaction in specification (16) between *Rosenbaum* and conflict intensity shows that the positive correlation between unconditional contributions and trait self-control is stronger ($p < 0.05$) among participants who reported stronger feelings of conflict—and who were presumably more likely to have identified self-control conflict.

Insert Table 6 about here

6. Discussion

We have tested the hypothesis that identification of self-control gives rise to a stronger positive correlation between self-control and cooperation. In a standard public good experiment, we find that trait self-control is positively associated with cooperation in the framing treatment that facilitates identification of self-control conflict, but we find no discernable association in the treatment that does not. Our results hold both for conditional and unconditional cooperation, and we find that the self-serving bias—the discrepancy between conditional contributions and the contributions by other players—is lower for higher levels of trait self-control. Furthermore, we find that free-riders are characterized not by

[18] In Table 6, specification (15), which includes dummy variables for treatments and the appropriate interaction terms, indicates significance at the 0.05-level. Although specification (15) is more powerful, we chose to present the results in Table in 4—broken down by treatments—for expositional purposes.

lacking trait self-control, but by not having perceived the self-control conflict in the first place. Overall, our results are consistent with the notion that identification of self-control conflict is necessary for cooperation.

Our results are also consistent with recent work by Martinsson *et al.* (2012), who employ an identical framing treatment in the dictator game; they find that trait-self control, captured on the same psychometric scale (Rosenbaum, 1980), is positively associated with donations in the treatment that facilitates identification—but that there is not association in the treatment that does not. Moreover, our results confirm the pattern of correlations obtained by Kocher *et al.* (2012), who test in the public good game a more elaborate model of self-control and pro-social behavior. Their empirical procedure includes not only the Rosenbaum measure of self-control, but also a risk elicitation procedure. However, they do not employ experimental treatments to influence perception of self-control conflict—instead they rely on individuals' self-reports of experienced conflict. As such, their findings leave open questions of causality, and it was our objective here to explore that of conflict identification. Not only do we find evidence for the causal story theorized by Kocher *et al.* (2012), we also replicate, across our treatments, their pattern of correlations with their measure of experienced conflict.

As such, this paper joins a line of research that attempts to understand how individuals in social interaction act on the basis of ostensibly conflicting preferences; it follows Martinsson *et al.* (2012) in exploring the idea that the question of pro-social versus selfish behavior may represent one of self-control. And the results are consistent with additional findings in the literature, most notably that contributions to the public good are negatively associated with discount rates (Curry *et al.*, 2008; Fehr & Leibbrandt, 2011).

Nevertheless, we should also echo a note of humility from Martinsson *et al.* (2012), on the question of generality. While our present results—like those of Kocher *et al.* (2012)—do suggest that individuals are tempted to be selfish and that self-control is necessary for cooperation, there is good reason to think that the results under other circumstances might reverse. In particular, when the beneficiaries of the public good are concrete, triggering feelings of empathy, the urge to cooperate might conflict with a better judgment to cooperate less. For example, the diligent student, who feels sorry for her poorly performing group-members, might feel compelled to do everything in a group project that awards the same grade to every group member. In our experiment, however, the beneficiaries are anonymous and hence highly abstract—as is standard in the public good game—and therefore unlikely to elicit feelings of empathy.

Evidence for the relationship between cooperation and self-control has implications for the study of strategic interaction more generally. If self-control determines cooperation, self-control may also determine players' strategic concerns in other interactions, where the choice of one player affects the welfare of others. An exploration into the role of self-control in strategic interaction might prove fruitful.

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Table 1: Summary statistics

Variable label	Description	Number of obs.	Mean	Std. Dev.	Min	Max
Unconditional contribution	Unconditional contribution to the public good	156	8.17	6.27	0	20
Conditional contribution*	Conditional contribution to the public good	3297	5.41	6.06	0	20
Others	A vector of integer numbers between and including 0 and 20, indicating all possible average contributions of the three other group members in the conditional contribution task	3297	10	6.06	0	20
Conflict	Response to "To what extent did you experience conflict when deciding how much to contribute?" ranging from 0 ("Not at all") and 140 ("Very much")	157	58.45	39.20	0	140
Rosenbaum	The Rosenbaum Self-Control Schedule Score	154	29.71	19.90	-16	77
Isolated	Isolated treatment presenting a calendar with a grid separating the dates prior to the contribution decision	157	0.36	0.48	0	1
Standard	Standard treatment presenting no calendar prior to the contribution decision	157	0.31	0.46	0	1
Interrelated	Interrelated treatment presenting a calendar without a grid separating the dates prior to the contribution decision	157	0.34	0.47	0	1

Note: * Denotes a variable constructed using the strategy method.

Table 2: OLS regressions of conditional contributions by treatment

Treatment:	Isolated			Standard			Interrelated		
Model specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. Var.	Cond.	Cond.	Cond.	Cond.	Cond.	Cond.	Cond.	Cond.	Cond.
Rosenbaum /100	-0.984	-0.984	0.196	-0.377	-0.377	-3.340	5.672**	5.672**	-2.678
	(-0.29)	(-0.29)	(0.05)	(-0.14)	(-0.14)	(-1.44)	(2.39)	(2.39)	(-1.54)
Others		0.334***	0.371***		0.421***	0.337***		0.403***	0.158*
		(5.56)	(3.02)		(7.00)	(3.41)		(6.61)	(1.97)
Rosenbaum × Others /100			-0.118			0.303			0.835***
			(-0.34)			(0.91)			(3.31)
Constant	6.390***	3.053**	2.682*	4.927***	0.713	1.559*	3.679***	-0.356	2.100***
	(5.29)	(2.35)	(1.71)	(4.95)	(0.76)	(1.90)	(3.90)	(-0.38)	(3.14)
n	1155	1155	1155	1008	1008	1008	1071	1071	1071
R^2	0.001	0.101	0.102	0.001	0.197	0.201	0.036	0.208	0.236

Note: *t*-statistics in parentheses; Standard errors are clustered on the individual level; * denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

Table 3: OLS regressions of conditional contributions: Full specification and conflict

Model specification:	(10)	(11)
Dep. Var.	Cond.	Cond.
Isolated	0.581	
	(0.34)	
Standard	-0.541	
	(-0.51)	
Rosenbaum × Isolated /100	2.870	
	(0.62)	
Rosenbaum × Standard /100	-0.725	
	(-0.25)	
Rosenbaum /100	-2.680	-0.971
	(-1.55)	(-0.42)
Others	0.158**	0.391***
	(1.98)	(3.64)
Others × Isolated	0.213	
	(1.46)	
Others × standard	0.179	
	(1.42)	
Rosenbaum × Others × Isolated /100	-0.953**	
	(-2.25)	
Rosenbaum × Others × Standard/ 100	-0.532	
	(-1.29)	
Rosenbaum × Others /100	0.835***	-0.142
	(3.33)	(-0.46)
Rosenbaum × Conflict /1000		-0.108
		(-0.48)
Conflict × Others /100		-0.178
		(-1.19)
Rosenbaum × Others × Conflict /10000		0.843**
		(2.02)
Constant	2.100***	2.072***
	(3.16)	(3.22)
n	3234	3234
R^2	0.179	0.169

Note: *t*-statistics in parentheses; Standard errors are clustered on the individual level; * denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

Table 4: Frequency of contributor types and variable means

Contributor type	Frequency	Unconditional contribution	Rosenbaum	Conflict
Free rider	17.31%	2.48 (6.05)	29.69 (19.54)	46.26 (38.55)
Conditional cooperator	50.96%	9.84 (5.42)	31.53 (20.56)	63.69 (39.45)
Hump-shape contributor	8.28%	8.08 (6.55)	33.15 (15.10)	63.46 (37.27)
Residual	22.93%	8.75 (5.87)	24.31(19.91)	53.97 (38.80)

Note. We classified a participant as a conditional cooperator either if the her own conditional contributions and expected contributions by others show a monotonic pattern with at least one increase or have a positive Spearman rank correlation at 1% significance level. Free-riders are those who conditionally contributed zero independently of the expected contributions by others. Hump-shaped contributors have the same conditional contribution pattern as conditional cooperator up to some maximum point and then negative correlation based on the same criterion as for conditionally cooperating behavior. Free riders contribute less unconditionally than do all other types (p-value $<$ 0.01; Mann-Whitney-U-test). Free riders also reports less conflict than all other types (p-values < 0.07; Mann-Whitney-U-test), although free riders' Rosenbaum score is not significantly lower than that of other types (p-value > 0.8; Mann-Whitney-U-tests); standard deviations in parentheses). There are no statistically significant differences in distributions of types between treatments ($p > .3$; Chi^2-test).

Table 5: Unconditional contributions by treatment: OLS regression results

Treatment	Isolated	Standard	Interrelated
Model specification	(12)	(13)	(14)
Dep. Var.	Uncond.	Uncond.	Uncond.
Rosenbaum	-0.045	-0.024	0.079*
	(-1.03)	(-0.57)	(1.98)
Constant	9.569***	8.334***	6.336***
	(6.38)	(6.00)	(4.52)
n	55	47	51
R^2	0.021	0.006	0.060

Note: *t*-statistics in parentheses; Robust standard errors; * denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

Table 6: Unconditional contributions, full specification and conflict: OLS regression results

Model specification	(15)	(16)
Dep. Var.	Uncond.	Uncond.
Isolated	3.233	
	(1.57)	
Standard	1.998	
	(1.01)	
Rosenbaum × Isolated	-0.124**	
	(-2.10)	
Rosenbaum × Standard	-0.103*	
	(-1.78)	
Rosenbaum	0.079**	-0.064
	(1.98)	(-1.35)
Conflict		-0.027
		(-1.17)
Rosenbaum × Conflict /100		0.129**
		(2.00)
Constant	6.336***	9.533***
	(4.52)	(5.37)
n	153	153
R^2	0.035	0.032

Note: *t*-statistics in parentheses; Robust standard errors; * denotes significance at the 10% level, ** denotes significance at the 5% level and *** denotes significance at the 1% level.

Figure 1. Identification of self-control conflict and agent utility

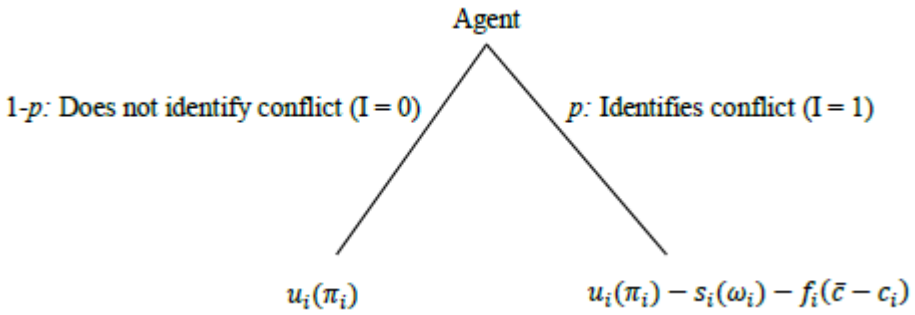


Figure 2. Calendar treatments

Before we continue with the experiment, please take a moment to consider this month's calendar:

The isolated treatment
(the highlighted date is the same as today's date).

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

*What is today's date?*_____

The interrelated treatment

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

*What is today's date?*_____

Figure 3. Conditional contribution by levels of self-control (Rosenbaum score) and expectation about others' average contribution (Others) in the Isolated treatment.

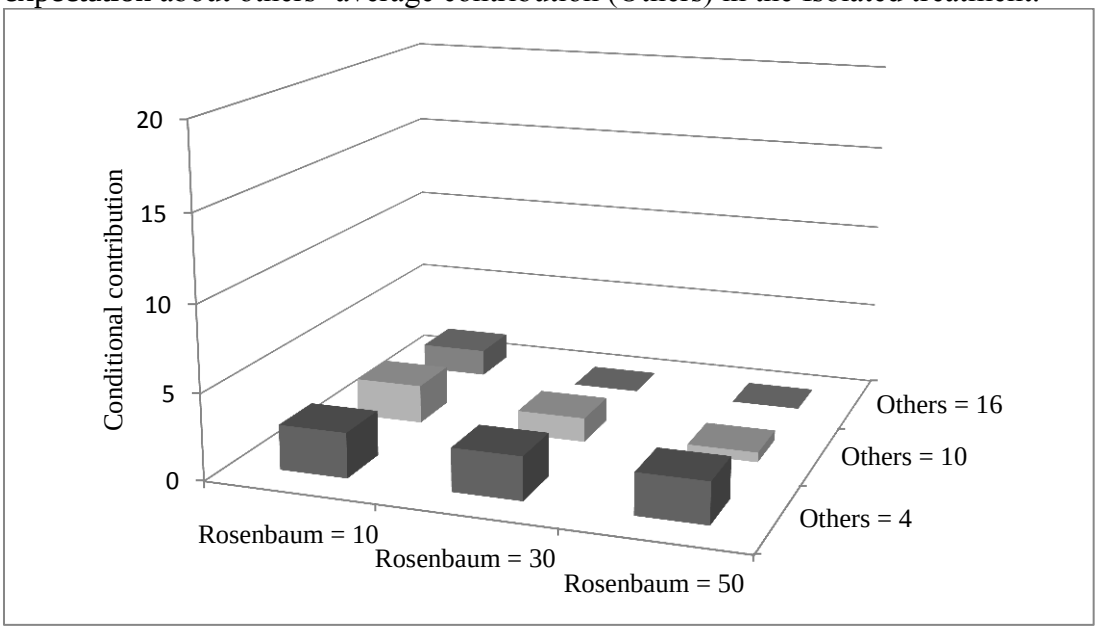


Figure 4. Conditional contribution by levels of self-control (Rosenbaum score) and expectation about others' average contribution (Others) in the Standard treatment.

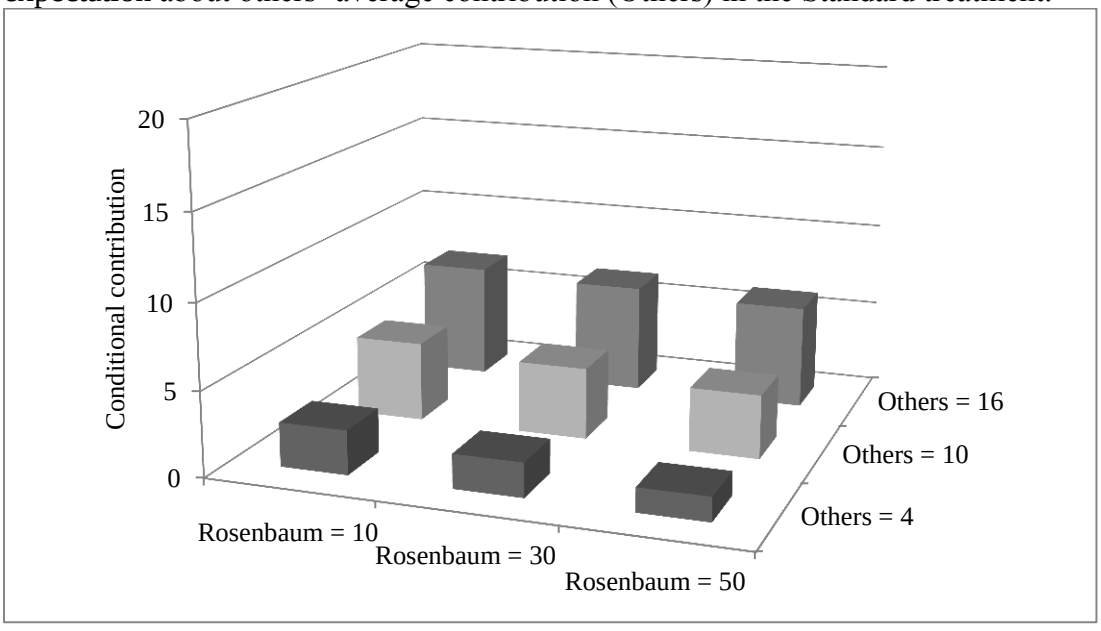
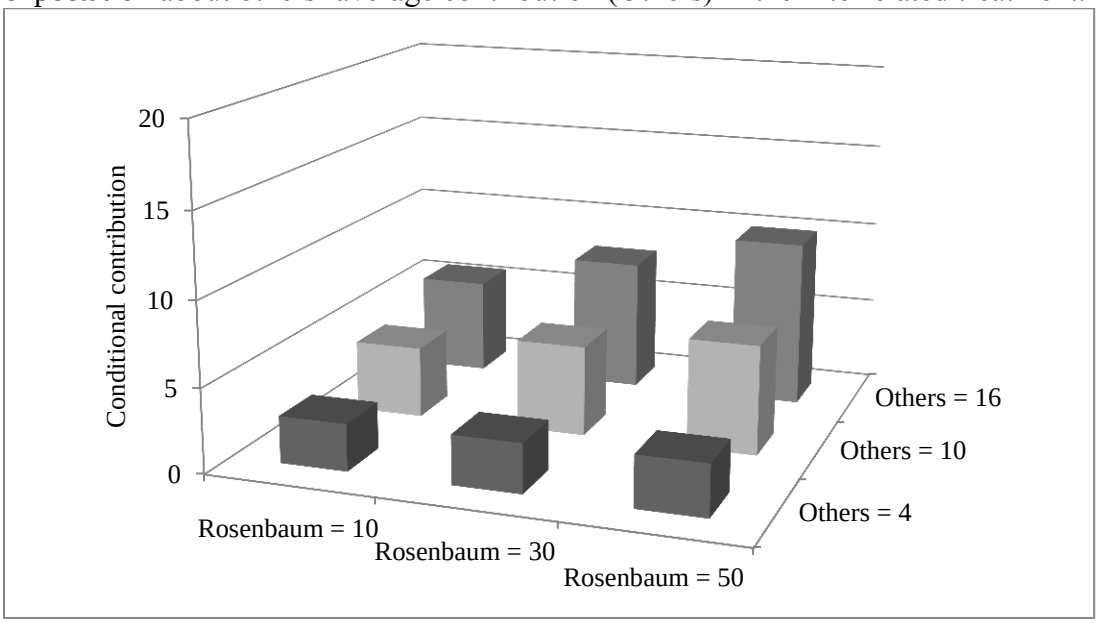


Figure 5. Conditional contribution by levels of self-control (Rosenbaum score) and expectation about others' average contribution (Others) in the Interrelated treatment.



Appendix A: Proofs

Proof Lemma 1

Recall that the agent's utility when not identifying conflict ($I = 0$) is given by

$$U_{i|I=0} = \pi_i ,$$

and

$$\pi_i = e_i - c_i + m \cdot \sum_1^n \frac{c_j}{n} .$$

Maximizing the payoff function with respect to c_i yields the first order condition

$$m/n = 1.$$

Since m/n, i.e., the marginal benefit of contributing, is by assumption less than 1, i.e., the marginal cost of contributing, the optimal contribution is zero, so we have,

$$c^*_{i|I=0} = 0$$

which proves the Lemma.

Proof Lemma 2

Recall that the agent's utility when identifying conflict (I =1) can be written as

$$U_{i|I=1} = e_i + (m-1)c_i + m\bar{c} - \frac{(1-m)c_i}{\omega_i} - \frac{\beta_i}{2}\left(\bar{c} - c_i\right)^2$$

Maximizing the utility function with respect to c_i yields the first order condition

$$(m-1) - \frac{(1-m)}{\omega_i} + \beta(\bar{c} - c_i) = 0$$

which rearranges to

$$c^{*}_{i|I=1} = \overline{c} - \frac{(1-m) + \left(\frac{1-m}{\omega_i}\right)}{\beta_i}$$

and thus proves the Lemma.

Proof Proposition 1

Recall from Figure 1 that the likelihood of identifying conflict is denoted *p*. A fraction of participants *p* is therefore expected to identify conflict, and a fraction 1 – *p* is expected not to. From Lemma 1, we have that optimal contribution in the case of no identification is zero (given by equation 7), and from Lemma 2 we have that optimal contribution in the case of identification is given by equation 10.

Expected group level behavior can therefore be written as

$$\hat{c}_i = (1-p_i)\cdot 0 + p_i \cdot \left[\overline{c} - \frac{(1-m) + \left(\frac{1-m}{\omega_i}\right)}{\beta_i} \right]$$

and this simplifies to

$$\hat{c}_i = p_i \cdot \left[\overline{c} - \frac{(1-m) + \left(\frac{1-m}{\omega_i}\right)}{\beta_i} \right]$$

which proves the proposition.

Proof Prediction 1

Recall the expression

$$\hat{c}_i = p_i \cdot \left[\bar{c} - \frac{(1-m) + \left(\frac{1-m}{\omega_i} \right)}{\beta_i} \right].$$

We see that increasing ω_i diminishes the numerator of the fraction involving β_i (the negative term) as long as β_i is positive (otherwise the negative term is equal to negative infinity). This in turn increases the size of the component,

$$\left[\bar{c} - \frac{(1-m) + \left(\frac{1-m}{\omega_i} \right)}{\beta_i} \right],$$

which itself is linearly increasing in p_i. This proves the prediction.

Proof Prediction 2

Again using $\hat{c}$, we see that raising $\bar{c}$ linearly increases $\hat{c}$ by $p \cdot \bar{c}$ as long as $\beta_i > 0$ (otherwise the negative term is equal to negative infinity). This proves the prediction.

Proof Prediction 3

Recall equation (13), reproduced below. Increasing ω_i leads to a fall in *B* if β_i is positive. Because a fraction *p* identifies conflict, this effect is valid for a fraction *p* of the participants and increases in p_i. This proves the prediction.

$$B = \bar{c} - c^*_{i|I=1} = \frac{(1-m) + \left(\frac{1-m}{\omega_i} \right)}{\beta_i}$$

.

Appendix B: Instructions for the public goods game*

You will be taking part in an experiment on decision-making. The experiment is designed so that your earnings will depend on both your own decisions and the decisions of others. Your earnings will be paid in cash at the end of the session.

Talking is not allowed throughout the entire session. Any violation of this rule will result in exclusion from the session and not receiving any payment. If you have any questions regarding these instructions, please raise your hand and a member of the experimenter team will attend to you.

Your earnings in this experiment will be in tokens. At the end of the experiment, the tokens will be converted into Colombian pesos (COP) at an exchange rate of:

2 tokens = 1500 COP.

Regardless of what decisions you make, you will receive a show-up fee of 5,000 COP.

During the experiment, you will have to answer a few questionnaires. Although some questions may appear strange to you, we ask you to still take them seriously. All your answers will be treated **confidentially and anonymously**. The identification number you received when entering the room will be used to identify you when paying you after the experiment. Before you leave the room, you should hand the identification number you received when entering the room to a member of the experimenter team. The experimenter will put this number in an envelope, seal it, and return it to you. When you go to collect your earnings, you should return the sealed envelope with your identification number still inside, the way it was handed to you before you left the room.

* Translated from Spanish

Along with these instructions, we will present you with a few examples. The numbers used are only for illustration purposes. The numbers you will encounter in the experiment could be different.

The basic decision

You will now learn how the experiment is conducted. First we will introduce the basic decision-making situation. Then we will ask you to answer control questions that will help you gain an understanding of the decision-making situation.

You will be a **member of a group of four people**. No one, except the experimenters, knows who belongs to what group. The groups are assembled randomly. At the beginning of the experiment, you will receive (on paper) **a number of tokens, called an "endowment."** Each of the four members of the group has to decide how to divide his or her endowment. You can put all, some, or none of your tokens into the project account. Each token you do not deposit in the project account will automatically be transferred to your **private account**.

Your income from the private account:

For each token you put into your private account, you will earn exactly one token. For example, if you have an endowment of 20 tokens and you put zero tokens into the project account (and therefore 20 tokens into the private account), then you will earn exactly 20 tokens **from the private account**. If instead you put 14 tokens into the project account (and therefore 6 tokens into the private account), then you will receive an income of 6 tokens from the private account. *Nobody except you earns tokens from your private account.*

Your income from the project account:

Everybody receives the same income from the project account, which is based on the total number of tokens the group puts into it. Your income from the project account will therefore be determined not only by the number of tokens you decide to put into the project account,

but also by the number of tokens the other group members invest in it. For each group member, the income from the project account will be determined as follows:

Income from the project account = the sum of all contributions to the project account x 0.4

For example, if the sum of all contributions to the group account is 60 tokens, you and the other group members will earn 60x0.4=24 tokens from the project account. If the four group members deposit a total of 10 tokens into the project account, then you and the others will earn 10x0.4=4 tokens from the project account.

Your total income:

Your total income is the sum of the income from your private account and the income from the project account:

Income from your private account (=your endowment – your contribution to the project account)
+ Income from the project account (=0.4 x the sum of all contributions to the project account)
Total income

Before we finish reading the instructions, please answer the following control questions. This will help you make sure you have understood everything correctly. If you have any questions or problems, please raise your hand. A member of the experimenter team will attend to you and answer your question in private.

Control questions

Please answer the following control questions. Their purpose is to make you familiar with calculating the various incomes in tokens that you might earn depending on the decisions you

will make about endowment allocation. Please answer all questions and write down all calculations.

1. Assume that you have an endowment of 20 tokens. Assume also that all group members (including yourself) put nothing into the project account.

   What is your total income? _____

   What are the incomes of the three other group members?_____,____ and ____

2. Assume that you and the other team members each have an endowment of 20 tokens. the same as the other three group members. Assume also that all group members (including yourself) put their entire endowments into the project account.

   What is your total income? _____

   What are the incomes of the three other group members?_____,____ and ____

3. Assume you have an endowment of 20 tokens. Assume also that the other group members collectively put a total of 30 tokens into the project account.

   a) What is your total income if you, in addition to the 30 tokens from the other three group members, put 0 tokens into the project account?

      i. Your total income is _____.

   b. What is your total income if you, in addition to the 30 tokens from the other three group members, put 8 tokens into the project account?

      i. Your total income is_____.

   c. What is your total income if you, in addition to the 30 tokens from the other three group members, put 15 tokens into the project account?

      i. Your total income is_____.

4. Assume that you have an endowment of 20 tokens and that you put 8 tokens into the project account.

a. What is your total income if the other three group members, in addition to your 8 tokens, put a total of 7 tokens into the project account?

    i. Your total income is _____.

b. What is your total income if the other three group members, in addition to your 8 tokens, put a total of 12 tokens into the project account?

    i. Your total income is_____.

c. What is your total income if the other three group members, in addition to your 8 tokens, put a total of 22 tokens into the project account?

    i. Your total income is_____.

If you finish these questions before the other participants, we advise you to think about additional examples to familiarize yourself further with these types of decision-making situations.

The Experimental Procedure

The experiment consists of decision-making situations similar to the one we just described. We will now explain the procedure in detail.

As you know, you have an endowment of 20 tokens. You can put these tokens into a project account. Any remaining tokens will automatically be deposited into your private account. Each person in the group will have the same endowment.

Each group member is asked to make two types of decisions. In the following instructions, we will refer to them as the **"unconditional contribution"** and the **"contribution table decision."**

- With the unconditional contribution, you decide how many tokens you want to put into the project account. Write this amount under *"Your unconditional contribution to the group account"* on the first page of your decision sheet. You must write down an **integer**

number that is neither smaller than zero nor larger than the total number of tokens you were given in your endowment (20). The difference between your endowment of 20 tokens and the amount you put into the project account is automatically transferred to your private account.

- Your second task is to fill out the **contribution table** on page 3 of the decision sheet. In the contribution table, please indicate how many tokens you would like to put into the project account for each possible average contribution of the other three group members (rounded up or down to the nearest integer number; for example, if the average is 17.5, then write 18). What you actually contribute will depend on what the other group members actually contribute. This will become clear to you if you take a look at the following contribution table example:

(Rounded) Average contribution of the other group members to the project account.	Your contribution to the project account is:
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

The numbers in the left column are the possible (rounded) average contributions of the other three group members. Assume for this example that the other three group members can contribute a maximum of 20 tokens each ((20+20+20)/3=20).

Using the column on the right, simply write down how many tokens you would like to contribute to the project account for each possible average contribution of the others. You must make an entry in each field of the right column. For example, write down how many

tokens you want to contribute to the group account if the others contribute an average of 0 tokens to the group account; how many you want to contribute if the others contribute an average of 0 tokens to the group account; how many you want to contribute if the others contribute an average 1 or 2 or 3 tokens, etc. In each field, you must write down an integer number that is neither smaller than zero nor larger than the total number of 20 tokens in your endowment. You can of course write down the same number in different fields.

After all participants have made their unconditional contribution decisions and have filled out their conditional contribution tables, one member of each group will be selected randomly. For the randomly selected group member, only the contribution table will be income relevant. For the three group members who are not selected, the unconditional contribution decision will be the income-relevant decision. When you make your unconditional contribution and when you fill out the contribution table, you do not know whether you will be selected randomly. You will therefore have to think carefully about both types of decisions since both could affect your earned amount. The following two examples should illustrate this:

Example 1. Assume that after you hand in your decisions, you are randomly selected. This implies that your income-relevant decision will be determined by your contribution table. For the other three group members, the unconditional contribution is the income-relevant decision. Assume they have made unconditional contributions of 0, 2, and 4 tokens. The rounded average contribution is therefore 2 ((0+2+4)/3=2).

If you have indicated in your contribution table that you will put 1 token into the project account if the others contribute 2 tokens on average, then the total contribution to the group account is 0+2+4+1=7. Thus, all group members earn an income of 0.4x7=2.8 from the project account plus the respective incomes from their private accounts.

If you have indicated instead that you will contribute 19 tokens to the project account if the others contribute 2 on average, then the total contribution to the project account is 0+2+4+19=25. All group members then earn an income of 0.4x25=10 tokens from the project account plus the respective incomes from their private accounts.

Example 2. Now assume that you are not selected randomly, which means that for you and two other group members, the unconditional contribution is the income-relevant decision. Assume further that your unconditional contribution to the project account is 16, and that

those of the other two group members are 18 and 20. The average unconditional contribution is then 18 ((16+18+20)/3).

If the randomly selected group member indicated in the contribution table that he or she contributes 1 token to the group account when the other three group members contribute 18 on average, then the total contribution of the group to the group account is 16+18+20+1=55 tokens. All group members will therefore earn 0.4x55=22 tokens from the group account in addition to the respective incomes from their private accounts.

If the randomly selected group member instead indicated in the contribution table that he or she will contribute 19 tokens to the group account if the other three group members contribute 18 on average, then the total contribution of the group to the group account is 16+18+20+19=73 tokens. Each group member will therefore earn 0.4x73=29.2 tokens from the group account in addition to the income from his or her private accounts.

The random selection is arranged in the following manner. Every person in each group is assigned a number from 1 to 4. This number is found on the last page of your decision sheet. A participant will randomly pick one of four cards **after** all participants have made their unconditional contributions and have completed the contribution table and the questionnaire. If the card that is picked corresponds to the number on your decision sheet, then the contribution table on the third page becomes income-relevant for you. If not, then the unconditional contribution on the first page is your income-relevant decision. Remember that you do not know which of the two decisions will be relevant for your earnings until you have handed in all your decisions. You should therefore complete both pages carefully.

The amount of tokens you earn will be converted into pesos and then paid in cash. Do you have any questions? Please raise your hand and a member of the experimenter team will attend to you and answer your question in private.

Appendix C: The Rosenbaum Self-Control Schedule

Note: * = item is reverse scored.

Directions - Indicate how characteristic or descriptive each of the following statements is of you by using the code given below

+3 very characteristic of me, extremely descriptive
+2 rather characteristic of me, quite descriptive
+1 somewhat characteristic of me, slightly descriptive
-1 somewhat uncharacteristic of me, slightly undescriptive
-2 rather uncharacteristic of me, quite undescriptive
-3 very uncharacteristic of me, extremely nondescriptive

l. When I do a boring job, I think about the less boring parts of the job and the reward that I will receive once I am finished.

-3	-2	-1	1	2	3

2. When I have to do something that is anxiety arousing for me, I try to visualize how I will overcome my anxieties while doing it.

-3	-2	-1	1	2	3

3. Often by changing my way of thinking I am able to change my feelings about almost everything.

-3	-2	-1	1	2	3

4. I often find it difficult to overcome my feelings of nervousness and tension without any outside help.*

-3	-2	-1	1	2	3

5. When I am feeling depressed I try to think about pleasant events.

-3	-2	-1	1	2	3

6. I cannot avoid thinking about mistakes I have made in the past.*

-3	-2	-1	1	2	3

7. When I am faced with a difficult problem, I try to approach its solution in a systematic way.

-3	-2	-1	1	2	3

8. I usually do my duties quicker when somebody is pressuring me.*

-3	-2	-1	1	2	3

9. When I am faced with a difficult decision, I prefer to postpone making a decision even if all the facts are at my disposal.*

-3	-2	-1	1	2	3

10. When I find that I have difficulties in concentrating on my reading, I look for ways to increase my concentration.

-3	-2	-1	1	2	3

11. When I plan to work, I remove all the things that are not relevant to my work.

-3	-2	-1	1	2	3

12. When I try to get rid of a bad habit, I first try to find out all the factors that maintain this habit.

-3	-2	-1	1	2	3

13. When an unpleasant thought is bothering me, I try to think about something pleasant.

-3	-2	-1	1	2	3

14. If I would smoke two packages of cigarettes a day, I probably would need outside help to stop smoking.*

-3	-2	-1	1	2	3

15. When I am in a low mood, I try to act cheerful so my mood will change.

-3	-2	-1	1	2	3

16. If I had the pills with me, I would take a tranquilizer whenever I felt tense and nervous.*

-3	-2	-1	1	2	3

17. When I am depressed, I try to keep myself busy with things that I like.

-3	-2	-1	1	2	3

18. I tend to postpone unpleasant duties even if I could perform them immediately.*

-3	-2	-1	1	2	3

19. I need outside help to get rid of some of my bad habits.*

-3	-2	-1	1	2	3

20. When I find it difficult to settle down and do a certain job, I look for ways to help me settle down.

-3	-2	-1	1	2	3

21. Although it makes me feel bad, I cannot avoid thinking about all kinds of possible catastrophes in the future.*

-3	-2	-1	1	2	3

22. First of all I prefer to finish a job that I have to do and then start doing the things I really like.

-3	-2	-1	1	2	3

23. When I feel pain in a certain part of my body, I try not to think about it.

-3	-2	-1	1	2	3

24. My self-esteem increases once I am able to overcome a bad habit.

-3	-2	-1	1	2	3

25. In order to overcome bad feelings that accompany failure, I often tell myself that it is not so catastrophic and that I can do something about it.

-3	-2	-1	1	2	3

26. When I feel that I am too impulsive, I tell myself "stop and think before you do anything."

-3	-2	-1	1	2	3

27. Even when I am terribly angry at somebody, I consider my actions very carefully.

-3	-2	-1	1	2	3

28. Facing the need to make a decision, I usually find out all the possible alternatives instead of deciding quickly and spontaneously.

-3	-2	-1	1	2	3

29. Usually I do first the things I really like to do even if there are more urgent things to do.*

-3	-2	-1	1	2	3

30. When I realize that I cannot help but be late for an important meeting, I tell myself to keep calm.

-3	-2	-1	1	2	3

31. When I feel pain in my body, I try to divert my thoughts from it.

-3	-2	-1	1	2	3

32. I usually plan my work when faced with a number of things to do.

-3	-2	-1	1	2	3

33. When I am short of money, I decide to record all my expenses in order to plan more carefully for the future.

-3	-2	-1	1	2	3

34. If I find it difficult to concentrate on a certain job, I divide the job into smaller segments.

-3	-2	-1	1	2	3

35. Quite often I cannot overcome unpleasant thoughts that bother me.*

-3	-2	-1	1	2	3

36. Once I am hungry and unable to eat, I try to divert my thoughts away from my stomach or try to imagine that I am satisfied.

-3	-2	-1	1	2	3

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