



Intergenerational Cooperation

Promoting pro social behavior in selfish times

Master thesis
Economics and Consumer Psychology

In collaboration with Roel van Vugt

Master thesis proposal
Psychology, Economics, and Consumer Psychology
Faculty of Social and Behavioural Sciences – Leiden University

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Abstract

In order to reach a sustainable development for future generations, intergenerational cooperation is needed. Critical issues that are associated with environmental degradation are often related to social dilemmas. Within a network structure (in)direct reciprocity functions as a mechanism that promotes pro-social behavior in a social dilemma. In a hierarchy structure, like generations, however, direct enforcement or punishment resulting from (in)direct reciprocity are not applicable because generations have foregone. In order to find a way to promote pro-social behavior in intergenerational social dilemmas we experimentally examined whether a self-imposed binding rule emerges and could function as a mechanism that promotes a fair resource allocation across a chain of participants. In groups of four, participants had to sequentially transfer monetary units from a common pool to their private account with or without the additional option to implement a self-imposed binding rule for the following participant. We expected that the option to implement a binding rule would lead to a fair distribution of units. We found that, contrary to the expectations, a self-emerging and self-imposed binding rule did not lead to a fair resource allocation across a chain of participants. A surprising finding was that participants in the rule condition who implemented a rule, contrary to the expectations, increased an unfair allocation. Why a binding rule did not work as a mechanism that led to a fair resource allocation could be explained by the asymmetrical power allocation seen in intergenerational social dilemmas and the theory of psychological reactance.

Introduction

Thinking about the future

Thinking about our future generations, we would like to pass on the same welfare and living standards we are used to now, to our children and grandchildren. The earth we know now offers fossil fuels, enough fish in the sea to feed us, and beautiful rainforests. By not handling underlying systems that ensure these living standards with care, it is uncertain if these living standards will still be there in the years to come and can be passed on to the next generations. Critical issues that are associated with environmental degradation are climate change, overpopulation, pollution and resource depletion. These issues interfere in sustaining nowadays living standards. The problem of man-made environmental degradation lets us think about intergenerational justice, what do we owe to our future generation? In order to maintain natural resources and environmental services that the earth offers now, sustainable development is necessary. Sustainability has become an important subject since the World Commission on Environment and Development was asked to take a look at the long-term environmental issues and their aspirational goals (Vojnovik, 1995). In their book *Our Common Future*, they launched the concept of sustainable development and describe this as a “development that meets the needs of the present without compromising the needs of the future” (Brundtland, Gro Harlem and Khalid, 1987, pp. 29). Ensuring a sustainable future is necessary for passing the earth on to our next generation and goes beyond international commitments. But, how do we reach such a sustainable future?

Tragedy of the commons

Sustaining the environment goes hand in hand with a fair and careful approach to the environmental services and natural resources that are still available. But, critical issues that are associated with environmental degradation are often related to situations whereby the collective interest and a personal interest are at odds. In such a ‘social dilemma’ each individual is better off by acting self-interested but each self-interested choice is also followed by a negative outcome for all other individuals involved (Wade-Benzoni, Tenbrunsel & Bazerman, 1996). A social dilemma can be defined by three properties: 1) choosing not to cooperate is always more profitable than choosing to cooperate, regardless what other individuals choose to do; 2) choosing not to cooperate is always harmful to other individuals compared to cooperating; 3) the amount of harm others receive by not cooperating is always bigger than the profit the non-cooperator will receive (Wade-Benzoni, Tenbrunsel & Bazerman, 1996).

A resource dilemma is a specific type of social dilemma. Public natural resources are resources that everybody can harvest (e.g. fish in the sea, energy, water, forest) but there is only a finite amount available, which makes the resource prone to overexploitation. This dilemma is also known as the “Tragedy of the Commons” (Milinski, Sommerfeld, Krambeck, Reed & Marotske, 2008). The Tragedy of the Commons, first described by Hardin (1968), predicts the overexploitation or degradation of all resources that are used in a common. The common dilemma is a social dilemma in which the short-term self-interested acts of individuals are conflicting with the long-term group interests of the group. The purpose of the group interest lies within moderate harvest but personal interest may cause individual overharvesting (Wade-Benzoni, Tenbrunsel & Bazerman, 1996). When individuals act self-interested, the resource upon a group depends on will deplete (Hardin, 1968). Environmental degradation like climate change, overpopulation, pollution, and resource depletion are examples of Tragedy of the commons in real life. Environmental degradation is a problem that occurs on a global level wherefore international cooperation is necessary to make collective changes. These changes do not just happen overnight and need binding agreements that ensure aspirational goals for the next, let's say, 30 to 50 years to make a significant difference. An example of such a binding contract is the Paris Agreement whereby 195 countries approved to roll back global warming. A current example of a self-interested behavior is the behavior of Donald Trump. Although the previous president of the United States, Barack Obama, made a commitment by signing the Paris Agreement, the current president Donald Trump eliminated restrictions on fossil fuel productions, thereby retreating from the action on climate change. These restrictions benefit the United States of America now, but not the long-term group goal of rolling back global warming. In the Tragedy of the Commons, self-interested behavior makes it hard to protect common resources because it counteracts a sustainable consumption of public resources. Defecting will give economic benefits to the defecting individual and the cost will be divided among all the other individuals in the group (Fehr, Fischbacher & Gächter, 2002). This behavior is also known as the free-riders problem that implies that “unless the number of individuals in a group is quite small, rational self-interested individuals will not act to achieve their common or group interests” (Weismuller, 2012, pp. 1). Free riders avoid paying any cost of engaging in collective actions and take benefit of other individual’s costly contributions/cooperation (Weismuller, 2012).

Scratching each other's back

In order to reach sustainability, cooperation that will lead to a fair allocation of resources and prevention of free riding is necessary. Cooperation happens when one individual pays a cost for another to receive a benefit. Promoting pro-social behavior is an important issue when it comes to preventing free riding. Relying on internalized social norms such as the norm of fairness (e.g. treating each other in a fair way) is often not enough. The expectation that others will also follow the norm and act pro-socially does not ensure conformation because the desired behavior may be in conflict with the individual's self-interest (Bicchieri & Xiao, 2009). Hence, another mechanism is necessary. Cooperation driven by reciprocity is a mechanism that could ensure pro-social behavior. Reciprocal cooperation promotes pro-social behavior with positive (in)direct reciprocity and punishes defection or free-riding with negative (in)direct reciprocity. With direct reciprocal cooperation, an individual returns the help (positive reciprocity) or harm (negative reciprocity) to the individual who helped or harmed them initially (Trivers, 1971; Axelrod, 1980) and is also known as the principle "if I scratch your back you'll scratch mine" (Stanca, 2007, pp.2; Nowak & Sigmung, 2005). Cooperation thus rewards cooperating but when an individual defects he or she gets a taste of his or her own medicine. Direct reciprocity can sustain cooperation when individuals interact repeatedly (Nowak, 2006). When individuals interact only once, there is no possibility of reciprocation. Selfishness in these situations outperforms cooperation, and hence should be favored by natural selection (Delton, Krasnow, Cosmides & Tooby, 2011). Only when two individuals interact repeatedly reciprocal cooperation can be strategically beneficial and outperform mutual selfishness in the long-run (Stanca, 2007). Another form of reciprocity is indirect reciprocity and can be seen as the principle "if I scratch your back someone else will scratch mine" (Stanca, 2007, pp. 2; Nowak & Sigmung, 2005). Indirect reciprocity occurs when individual A does someone else a favour (individual B) and does not expect to receive a favour back from this recipient. But, at the same time, individual A may receive a favour back from someone else (individual C) who may be a recipient of a favour by another individual and has seen the good deed done by person A. Indirect reciprocity is thus based on reputation. It assumes that people may gain a positive reputation if they cooperate and gain a negative reputation when they defect. It will pay off if you have a positive reputation because people will select those to cooperate with, who are known to be cooperative (Van Dijk, 2015). People are well aware of this positive effect and are more willing to cooperate when they know that their reputation will be seen by others (Milinski, Semmann & Krambeck, 2002; Semmann, Krambeck & Milinski, 2004).

In both direct and indirect reciprocity, individuals base their behavior on knowledge about the previous behavior of a partner towards themselves (direct reciprocity) or towards others (indirect reciprocity, Rutte & Taborsky, 2007). These types of reciprocity are thus based on mutual cooperation. The last form of reciprocity differs hereof. Generalized reciprocity is not based on mutual cooperation and can be described by the principle “if I scratch your back you’ll scratch someone else’s” (Stanca, 2007, pp. 2). When an individual received a favor from any other individual (individual A) there is a higher likelihood that the receiving individual (individual B) will give a favor to another (unfamiliar) individual (individual C). Generalized cooperation is thus based on previous experience with any other individual (Rutte & Taborsky, 2007). Generalized reciprocity can “pay off”, in the sense that A might get a return of his/her investment. Not by B, but by someone else in the society.

When an individual is the first one to cooperate, there is always a possibility he or she gets exploited by non-cooperative and thus self interested others. When an individual expects someone else to behave self-interested, they will reciprocate by being self-interested as well. From this perspective, people avoid doing good without any benefit for themselves. Doing good in this way becomes an exchange: when you receive something, there is a reason to give something in return (Holmes, Miller & Lerner, 2002).

Intergenerational dilemma

Direct and indirect reciprocity are based on a cooperation that takes place within a network structure (e.g. a web or circle). Herein, a fair cooperation can be established by using negative and positive (in)direct reciprocal behavior that functions as a social contract. However, to develop a sustainable future and ensure next generations with the same living standards, intergenerational cooperation is needed. Cooperation between generations is based on a chain- or hierarchical structure that offers no place for a social contract based on (in)direct reciprocity. The direct enforcement or punishment resulting from (in)direct reciprocity is impossible to implement and determination about how the benefits and burdens of their cooperation should be allocated is difficult. To find a way to promote cooperation between generations, we first take a better look at intergenerational social dilemmas and research hereof.

Trade-offs among different generations is an important social dilemma in our society. It affects long time horizons and has implications for our future generations, such as sustainability. In these intergenerational social dilemmas, the interests of the present and future generations are not always aligned (Wade-Benzoni & Plunkett Tost, 2009). When there

is a difference in preference between different generations about how resources should be allocated or how decisions should be made, an intergenerational dilemma occurs. Compared to the social dilemmas discussed above, intergenerational social problems are characterized by an asymmetric allocation of power. The older generation has control on how resources are allocated while the future generation has little or no power and control about the allocation (Wade-Benzoni, 2002). This means that future generations do not participate in important decisions that will later affect them (Padilla, 2002). Future generations do not have the chance to reciprocate the behaviour of previous generations because these generations have passed. The living cannot cooperate with the dead or in this case the unborn. Generation A will never benefit from their pro-social behavior to generation B (direct reciprocity) but will also never benefit from the positive reputation generation A would have received for their pro-social behavior to generation B seen by generation C (indirect reciprocity). Because there is no opportunity to give benefits back, generations face a high incentive to act self-interested and free ride. The benefits then will be allocated to the present generation while the later generations receive the burdens (Wade-Benzoni, 2002). Life opportunities for future generations will be unabated when the following generation will inherit the same amount of resources and contribute to the collective pool as the previous generation (Padilla, 2002). Since the present generation does not typically benefit from the sacrifices they make for the future generations, why would one generation cooperate on the behalf of future generations? This kind of behavior can be seen in generalized reciprocal cooperation. Without the expectation to receive a favor back, individuals cooperate due to prior experiences. Wade-Benzoni (2002) introduced the concept of intergenerational reciprocity whereby the behavior of previous generations influences the behavior of present generations towards future generations. With a study based on the real-life fisheries crisis and federal gasoline taxation, which is related to greenhouse gasses and global warming, Wade-Benzoni (2002) concludes that generations pass on the benefits and burdens to future generation retroactively. Therefore, it is very important for the present generation to set a good example for the next generation so cooperation has a higher likelihood to be sustained (Wade-Benzoni, 2002). Just like with generalized reciprocity, generations may base their cooperation on previous experience.

Present study

Since future generations are not able to reciprocate directly or punish the over-usage of the finite resource by previous generations we here examine if and how a fair allocation of public resources across different generations can be achieved. Earlier research concluded that a tax

on resource extraction could ensure a fair distribution of finite resources. But, this was not enough to reach sustainable resource use in a study by Klepper (1995). Fehr, Fischbacher, and Gächter (2002) explain that free riding exists in our cooperative infrastructure nowadays because not all obligations of cooperation can be subjected to a binding contract. But on the contrary, a fair intergenerational allocation may be something that can be subjected to a binding contract.

In this study, we will examine if a binding contract between generations will promote pro-social behavior. Since we cannot examine real generations we approach this topic experimentally, which will give us more control, and more insights into the underlying mechanism of intergenerational cooperation. We will mimic the incentive structure of real-world social dilemma situations whereby intergenerational problems can be represented as a hierarchy structure. We will examine if a binding contract may function as a mechanism that leads to a fair resource allocation and imposes restrictions on free riding in a hierarchy structure. Binding contracts have to self-emerge without the incentive to do so. We, therefore, test if a self-imposed binding rule emerges and helps to achieve a fair resource allocation across a chain of participants. The sequential order of the chain represents a hierarchy structure.

Since selfishness outperforms cooperation when just interacting once, we expect that individuals who do not have the possibility to implement a binding rule to act rather selfish. When the first person acts self-interested, there is a higher likelihood that others will also act selfishly as well (Bicchieri & Xiao, 2009; Wade-Benzoni, 2002). In the experimental group, where individuals have the possibility to implement a binding rule, we expect that a fair resource allocation depends on how many people implement a binding rule. When the implementation of the binding rule is stable and starts with the first person, there is a higher likelihood that others will also implement the rule (Bicchieri & Xiao, 2009; Wade-Benzoni, 2002). Concluding, our first hypothesis is that a binding contract will function as a mechanism that leads to a fair resource allocation compared to no binding contract. Our second hypothesis is that the fairness of the resource allocation depends on the number of binding rules implemented. To my knowledge, there is no previous literature on the impact of a binding rule on the allocation of resources in a hierarchy structure and the fairness thereof.

Method

Recruitment

In the period between February and May 2017, 184 students of Leiden University between the age of 17 and 58 ($M = 21,76$, $SD = 3.83$) participated in the experiment. Different recruitment strategies have been used to gather participants for the experiment. An advertisement was placed on the participants recruitment website of Leiden University in order to gather students in need of course credit. In the period of the 1st of March and 22nd of March, students were able to register themselves via this website for the experiment. Next to this, flyers distributed at Leiden University. The experiment was advertised with information concerning time and rewards. The experiment lasted for a maximum of 15 minutes and participants could earn 1 credit or €3,00. In addition, they could earn up to €10,- extra, depending on their decisions in the experiment (see below).

Measurement procedure

The experiment was conducted in a lab setting at Leiden University. A computer was used for the experiment containing the complete experiment, including the instructions, comprehension questions and a demographic questionnaire. At the beginning of the experiment, participants were assigned a group number (1-46) and a group member number within that group (1-4). Participants were randomly allocated to either condition 1: the no rule condition, or to condition 2: the rule condition. In both conditions, participants started with reading the instructions on the computer screen (see Appendix A.1), detailing the rules and procedure of the experiment. To ensure proper understanding, participants had to answer comprehension questions (see Appendix A.2). The participants could only proceed to the experiment when all answers were filled in correctly. After finishing the experiment, participants ended with a questionnaire that contained demographic and motivational questions (like “what was your main reason to participate in this experiment?”).

Design

In the control condition, participants formed groups of four and sequentially took part in the experiment. The first participant was in the role of group member one and the second participant in the role of group member two and so on. At the start of the experiment, there was a common pool of 100 monetary units. The first participant had to decide how many units he or she wanted to transfer to his or her private pool leaving what was left for the following participant. The second mover learned how many monetary units there were left in the pool

and had to decide how many he or she would transfer to his or her private pool and so on. Starting the experiment, each participant was informed about (i) in which position they were (from first to fourth), (ii) how many units the pool contained at the beginning, (iii) how many units there were in the pool starting their experiment, (iv) and how many participants would follow after their decision. The participants also learned that his or her taking decision would affect the earning of the following participants. Each unit had a value of 0.10 euro cents. The units that the participants transferred to their private pool were exchanged to euros and paid out accordingly after the experiment was over.

In the experimental condition, participants went through the same procedure, with one exception. After the participant had to fill in a number of units he or she wanted to transfer to his or her own private pool, the participants had the option to impose a rule that was binding for the following participant. This binding rule contained an upper limit on how much the next group member could transfer from the pool to his or her private pool. In this way, participants could restrict the selfishness of the next participant. For example group member 1 decides, after transferring 20 of the 100 units to his or her private pool to impose a binding rule for group member 2 limiting his or her transfer amount to 25 units. Group member 2 could thereby transfer a maximum of 25 units to his or her private pool and impose the same or a new binding rule for the next group member if he or she wanted to and so on.

Data analysis

The data was analysed with SPSS (Statistical Package for the Social Sciences, version 23). For each group (e.g. group 1, participants 1 to 4) of the experimental (rule condition) and control condition (no rule condition), the transfer amount means and standard deviations as a measure of inequality were calculated. Next to this, the relative transfer amount means (percentage of units participants transferred to his or her private pool based on a number of units left in the common pool by the previous participants) and equality deviations were calculated (measure of how much a transfer amount deviates from an equal split based on the units left in the common pool by previous participants). A linear regression was performed to predict transfer amount based on group members and to predict equality deviation based on the number of rules implemented. A Mann Whitney U test was performed to measure inequality between the two conditions, to measure relative deviation from fairness between group members across conditions, to measure deviation from fairness between the two conditions and to measure deviation from fairness between the rule and no rule implementers

in the rule condition. A paired sample t-test was performed to compare the means of the rule- and transfer amount.

Results

Transfer rate

Figure 1 shows the mean transfer amounts per group member. Together they represent the distribution of all the 100 units. The reference line set in figure 1 shows the theoretical distribution based on an equal split of the pool across all group members. As can be seen in figure 1, in both conditions the first mover took more than he or she should to ensure the possibility of an equal distribution. In the rule condition, group member two, three and four had an equal distribution of the units that were left in the pool compared to the no rule condition.

A linear regression was performed to predict the transfer amount based on condition and mover position. The transfer amount can be calculated with the following equation:

$$\text{Transfer amount} = -.12 \times \text{condition} - 7.81 \times \text{group member} + 44.20.$$

Although condition is a bad predictor ($t(181) = -.049, p = .961$) of the transfer amount, mover position is a good predictor ($t(181) = -7.101, p < .00$). These results show that when the mover position increases with one, the transfer amount decreases with 7.101 and that in condition 1 (no rule condition) the transfer amount decreases with 0.12.

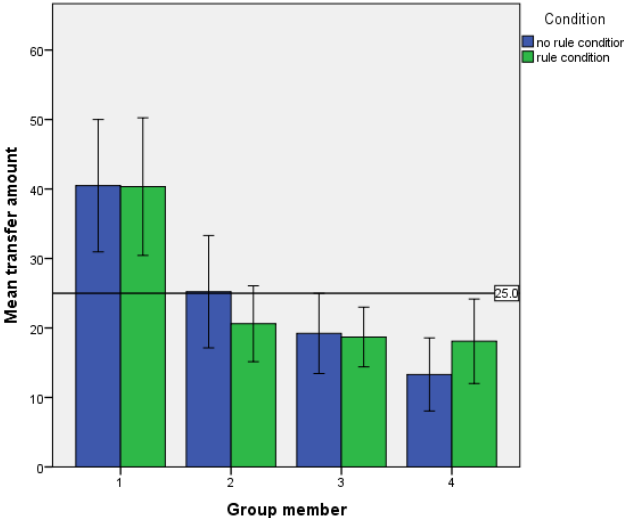


Figure 1. Mean transfer amount per group member in the rule and no rule condition (reference line shows theoretical distribution based on equal split; error bars show the 95% confidence interval).

To measure (in)equality of the distribution within groups across the two conditions, the standard deviation of the transfer amount per group per treatment was calculated. The decision of the last mover was ignored in this analysis and from the further analysis, since being selfish as the last mover is not in conflict with fairness concerns since there was no group member after him or her. Figure 2 shows the average inequality per condition. As can be seen, inequality was slightly higher for the rule ($M = 17.93$) compared to the no rule ($M = 14.69$) condition, suggesting that participants in the rule condition were able to distribute the pool more fairly than the rule condition. However, the observed trend in the data was statistically not significant (Mann-Whitney U-test, $U = 211, p = .234$).

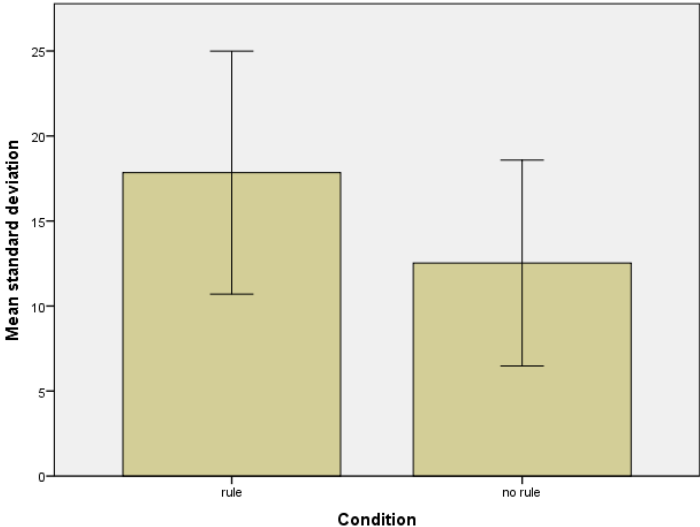


Figure 2. Mean standard deviation of transfer amount per group ($N = 23$ per condition) as a measure of inequality, per treatment (error bars show the 95% confidence interval).

Fairness violation

The previous analysis showed that inequality was? not significant between and within the conditions. However, this measure did not capture the relative fairness violation per group member across conditions. Therefore we looked at the relative transfer amount per group member. The relative transfer amount is the percentage units a participant took from what was left in the common pool starting their experiment. An equal and thus fair split of the units would mean that the first mover would take 25% (1/4) of the 100 units since he or she is the first mover out of four. The second mover would take 33% of all the units that were left for him or her and the following two participants, and the third mover would take 50% that was left for him or her and the last participant. Figure 3 shows the mean relative transfer amounts per group member per treatment and the deviation from an equal split. As can be seen in the graph, the mean of group member 2 ($M = 33.54\%$) and group member 3 ($M = 49.29\%$) in the

rule condition are very close to an equal split compared to group member 2 ($M= 44.95\%$) and group member 3 ($M= 55.97\%$) in the no rule condition. Contrary, group member one took more than what an equal split would demand in both conditions (no rule condition $M= 40.48\%$, rule condition $M=40.35\%$).

However, none of these differences were statistically significant (Mann-Whitney U test: group member 1 $U = 257, p = .864$, group member 2 $U = 201.500, p = .459$, group member 3 $U = 167.500, p = .253$).

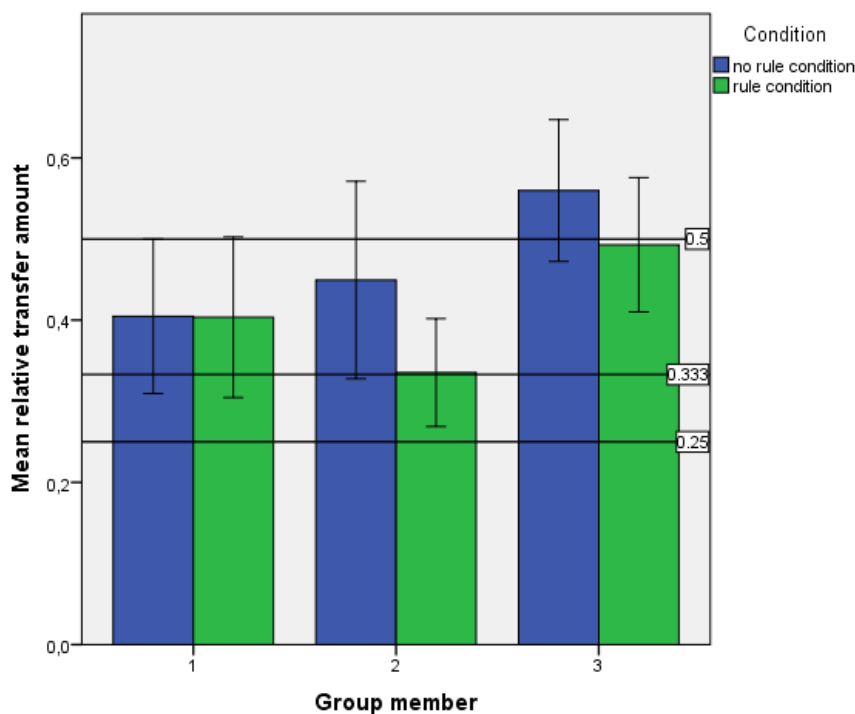


Figure 3. Mean relative transfer amount per group member per condition (reference lines show theoretical relative transfer amounts based on an equal split per group member: 0.25 = relative fair transfer for the first group member, 0.33 = relative fair transfer for the second group member, 0.50 = relative fair transfer for the third group member; error bars show the 95% confidence interval).

Previous analysis showed the relative fairness violation per group member across conditions. Since we did not find a statistically significant difference between group members, we looked at the overall fairness violation per condition. Figure 4 shows the equality deviation means per condition. Inequality was measured as the deviation from an equal split. For example, when group member two was left with a common pool of 45 units, an equal split would mean that he or she took 15, leaving 30 for the following two group members. The number of units that he or she took more (or less) than what an equal split would have been, represents the deviation from equality. Perfect equality thus means zero deviation and would give a relative transfer difference of zero. In the no rule condition participants deviated more from an equal split ($M = 5.28$) compared to participants in the rule

condition ($M = 3.25$). However, this difference was not significant (Mann-Whitney U test $U = 2126$, $p = .259$). Hence there was no difference in deviation from fairness across and within conditions.

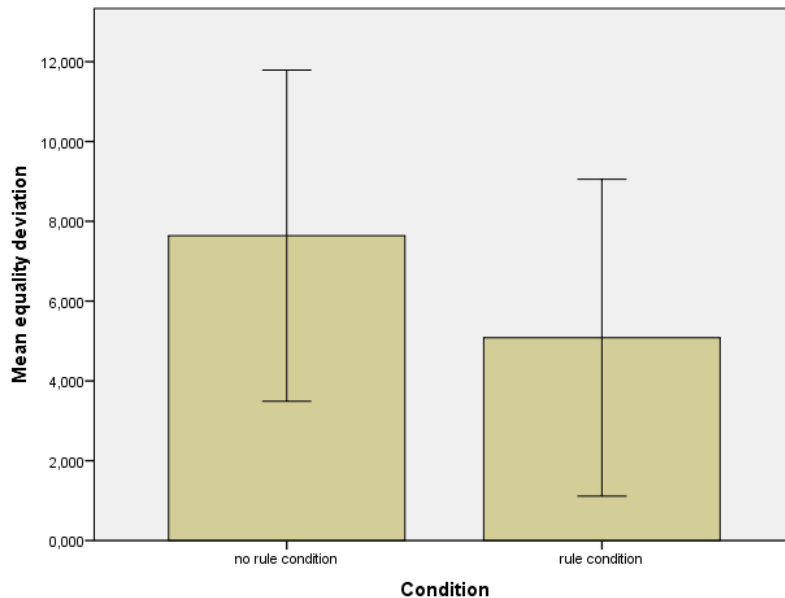


Figure 4. Mean equality deviation per treatment (error bars show the 95% confidence interval).

Rule implemented vs. no rule implemented condition

We did not find a significant difference in the transfer amount spread (distribution of the units between and within groups) nor in the deviation from fairness. This could be due to a reluctance of implementing rules of the participants in the rule condition. We, therefore, looked at how many participants implemented a rule. Only 29 (42.02 %) of the 69 participants who had a choice to implement a rule did so. This indicates that rule implementation did emerge, but only for a minority of the participants.

Figure 5 shows the means of the equality deviation of the participants who did or did not implement a rule in the rule condition. To make the comparison to participants who did not have the chance at all to implement a rule, the mean of the control condition is displayed in the graph with a line ($M = 7.64$). Participants who did not implement a rule deviated more from equality compared to the participants who did implement a rule. On average they took more than what an equal split would be compared to rule implementers in the rule condition. Rule implementers were thus slightly closer to fair taking decisions than no rule implementers. The difference between the equality deviation for the rule implemented condition and the no rule implemented condition was however statistically not significant (Mann-Whitney U test $U = 546$, $p = .664$).

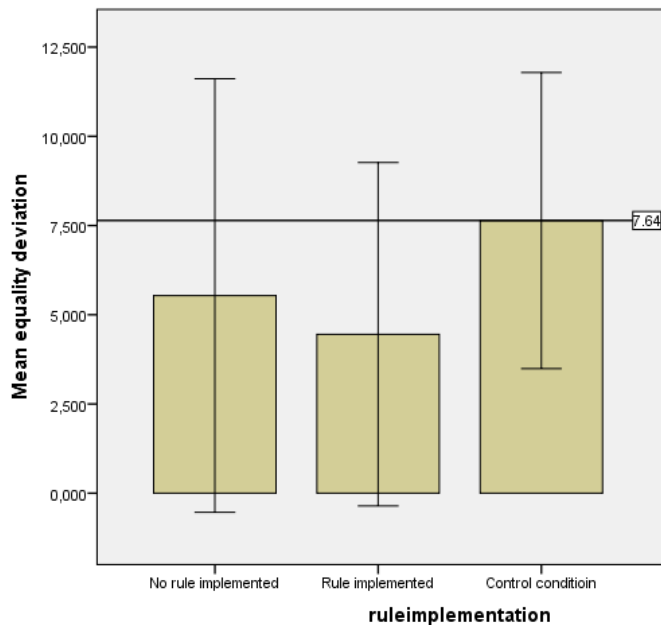


Figure 5. Mean equality deviation of participants who did or did not implement a rule and the control condition (error bars show the 95% confidence interval).

To check whether the equality in a group increased with an increased number of rules implemented, we looked at the equality deviation based on the number of rules implemented per group (see figure 6). As can be seen, the equality deviation for groups where no participants implemented a rule ($M = 9.53$) is higher compared to groups where one participant ($M = 3.54$) or two participants ($M = 3.49$) implemented a rule but not as high as the equality deviation of the control condition ($M = 10.58$). There were no group that implemented three rules.

A linear regression was performed to predict equality deviation based on the number of rules implemented per group. The result was not significant ($t(21) = -1.206, p = .241$). This means that the number of rules implemented was not a good predictor of equality deviation.

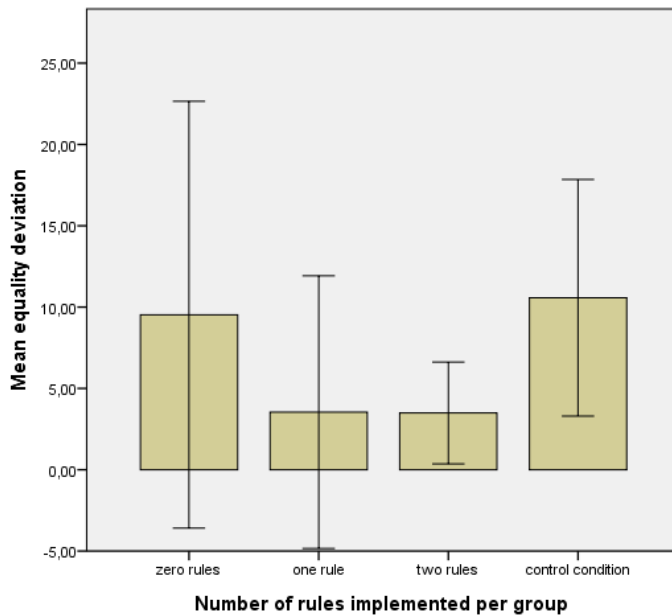


Figure 6. Mean equality deviation based on the number of rules that are implemented per group (error bars show the 95% confidence interval).

Rule implementers

So far, we did not find a difference concerning fairness within and across conditions although participant did implement some rules. To examine how the implementation of rules could not have affected the distribution of units, we took a better look at the behavior of rule implementers. Therefore, we examined the distribution of units by looking at the difference between the amount of units they transferred to their private pool (transfer amount) and the limit they imposed for the following participant (rule amount). The mean transfer amount ($M = 27.41$) was higher than the mean rule amount ($M = 19.93$). A paired sample t-test indicated that the difference between these two amounts was significant ($t(28) = 2.59, p = .015$). The transfer amount was higher than the rule amount; hence participants who implemented a rule transferred more units to their private pool than that they allowed the following participants to transfer to their private pool.

Discussion

In order to reach a sustainable future for the generations to come, intergenerational cooperation is needed. Within intergenerational social dilemmas it is hard to apply direct enforcement or punishment that could establish/sustain cooperation based on (in)direct reciprocity since future generations will neither be able to reciprocate or punish the over-usage of finite resources (like fossil fuel, sustainable climate damage) by previous generations. In order to find a way to promote pro-social behavior in intergenerational social dilemmas, we examined if a self-imposed binding rule emerges and could function as a mechanism that promotes pro-social behavior across a chain of participants. We expected that a binding rule would promote a fair resource allocation across a chain of participants and that the fairness of the distribution would depend on the number of rules that were implemented.

Study findings

By using a binding rule across a chain of participants who had to distribute a common pool of 100 units, we showed that a binding rule did not promote a fair resource allocation. The results showed, contrary to our expectations, a general deviation from fairness in the distribution of the common pool. Neither in the control condition nor experimental condition participants were able to achieve a fair distribution of units. Also, the number of rules implemented did not affect the fairness of resource allocation. Specifically, the results show that participants who implemented a rule, distributed significantly more units to themselves than they allowed following participants to do so, hence rule implementation led to an unequal distribution of resources.

Why a binding rule did not function as a mechanism that led to a fair resource allocation in a hierarchy structure could be due to the asymmetrical allocation of power seen in hierarchy structures/intergenerational dilemmas explained in the theoretical literature (Wade-Benzoni, 2002). Participants, who implemented a rule, had the power and control on how resources are allocated to the next participant whereby the next participant had little to no control or power about the allocation. The study of Lammers, Stapel and Galinsky (2010) indicates that power increases hypocrisy and describe hypocrites as “people who publicly uphold strict moral norms, expecting and demanding others to follow them, but who privately violate these espoused standards in their own behaviour” (Lammers, Stapel & Galinsky, 2010, pp. 237). Powerful people impose more normative restraints on others but believe that they can act in a less restrained way themselves. This means that powerful people take what they want since there are no punishments holding them back but also because they feel entitled to

it (Lammers, Stapel & Galinsky, 2010). Participants who implemented a rule showed this hypocritical behavior by taking more units themselves than they allowed their following group member to take. How to restrain hypocritical behavior in intergenerational dilemmas could be an interesting topic for future research.

Next, to this, only a minority of the participants implemented a rule. Non-emerging rule implementation could be due to a reluctance to rules. Rule reluctance can be explained by the psychological reactance theory of Brehm (1989). With this theory, Brehm (1989) indicates that a threat to one's freedom elicits psychological reactance: a motivational state that aims to restore the freedom that is threatened. Since individuals don't want their own freedom to be limited, they could be reluctant to limit the freedom of others. Also, when someone is encouraged to do something, psychological reactance can let individuals "dig in" and do the opposite of what is asked and refuse to comply, or in this case not implement a binding rule (Fogarty, 1997). Future research could examine if psychological reactance indeed withheld participants from implementing a binding rule for following participants.

Further, a lot of participants indicated in our demographical questionnaire that they participated in our experiment for money (81%) instead of science (19%). Participants knew that they would receive an extra amount of money on top of the three euros for participating, depending on how many units they had transferred to their private pool in euros after the experiment. This could have triggered selfish behavior.

Strong points and limitations

A strong point of our study is the number of participants that conducted our experiment. In a short period of time, we reached a lot of participants (N=184). In this way, we were able to collect a valuable set of data.

Though, our experimental design makes it hard to generalize our results due to less external validity. Also, the situation was controlled and did not represent real life; reactions of participants may not be real indicators of participant's behavior in non-experimental settings. In addition, mainly students participated in our experiment. In order to generalize the results, an equal distribution of age would be required. According to Sze, Gyurak, Goodkind, and Levenson (2013) people show greater pro-social behavior in late life. This means that the age of our participants could have influenced the overall lack of pro-social behavior seen in our experiment. Future research could examine if age influences the distribution of a common pool of resources in a hierarchy structure.

Practical implications

From an applied perspective, the present findings suggest that imposing a binding rule within a hierarchy structure would lead to an unequal distribution of resources. This means that within generations finite resources like fossil fuel or the amount of fish in the sea would not be sustained. Imposing a binding rule is thus not a suitable solution in order to promote pro-social behavior and prevent free riding in time structured problems like intergenerational dilemmas, which we need for a sustainable development. Therefore, more research is necessary.

Conclusion

Reaching a fair intergenerational cooperation is important for a sustainable development as a basis to pass on our living standards to the next generations. In order to reach a fair intergenerational cooperation, promotion of pro-social behavior is needed. We found that a self-imposed binding rule does not increase pro-social behavior within a hierarchy structure and therefore more research is necessary to find a mechanism that does, as a solution for time-structured problems as intergenerational dilemmas.

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Appendix A.1

INSTRUCTIONS

PAGE 1

Dear participant,

In this part of the experiment, you are paired with three other participants who are also taking part in this study.

Each participant will make a decision that will determine their payoff for this part of the study, as well as influence the payoff of the other participants.

The decisions are made sequentially.

Each of you is assigned an individual number from 1 to 4 by chance.

This number will determine which participant will make the first, the second, the third, and the fourth decision.

For example, if you are number 3, two participants before you already made a decision and after you make your decision, there will be one more participant, participant number 4, who will make the decision after yours.

What the decision entails is explained on the next page.

PAGE 2

In this part of the experiment, there is a limited pool of units.

This pool will be distributed among all four participants you are paired with, according to the individual decisions of each of you.

As explained, participant number 1 will go first.

He/she will learn about how many units are in the pool, and then decide how many units to take for him/herself.

Whatever participant number 1 decides to leave in the pool will be passed on to participant number 2.

Participant number 2 will then learn about how many units are left in the pool, and decide how many units to take for him/herself.

Whatever participant number 2 decides to leave in the pool will be passed on to participant number 3.

Participant number 3 will then learn about how many units are left in the pool, and decide how many units to take for him/herself.

Whatever participant number 3 decides to leave in the pool will be passed on to participant number 4.

Participant number 4 will then learn about how many units are left in the pool, and decide how many units to take for him/herself.

The experiment ends with the decision of participant number 4.

PAGE 3

At the start of the experiment, you, therefore, will learn:

- in which position you are (from first to fourth)
- how many units are in the pool
- how many participants will follow after your decision

You will then decide how many units to take for yourself.

You will also see how many units will be left in the pool.

PAGE 4 (EXPERIMENTAL)

While deciding how much units to take from the pool, each participant, except for participant number 4, will make one additional decision.

This decision is about implementing a binding rule for the next participant in the form of: “The next person shall maximally take up to X units”.

Thus, participant number 1 can decide how much participant number 2 shall maximally take from the pool. Participant number 2 can do the same for number 3, and number 3 for number 4.

If a participant decides to implement the rule, he/she will also decide on X .

The next participant is then restricted to maximally take X from the pool.

PAGE 5

The amount of units you have at the end of the experiment will be transformed into money and paid to you accordingly (the same is true for the other participants). Each unit will be worth 10 euro cents.

This is the end of the instructions for this part of the experiment.

Press the button below if you understand the instructions and want to proceed.

Appendix A.2

COMPREHENSION QUESTIONS

For this example, assume there are 60 units left in the pool. Participant number 3 decides to take 50 units. How many units are left in the pool for participant number 4?

- 50
- 10
- 60

For this example, assume there are 40 units left in the pool. Participant number 2 decides to take 12 units. Participant number 3 decides to take 10. How many units are left in the pool for participant number 4?

- 18
- 12
- 50

If you are participant number 2, how many participants *before* you already made a decision?

- 0
- 1
- 2
- 3

If you are participant number 2, how many participants *after* you still have to make a decision?

- 0
- 1
- 2
- 3

For experimental condition:

For this example, assume there are 50 units left in the pool after Participant number 2 decided how much to take for him/herself. Then, participant number 2 decides to implement a rule in the form: "The next person shall maximally take up to 20 units". How many units can participant number 3 *maximally* take?

- 0

- 10

- 20

- 50

For this example, assume there are 50 units left in the pool after Participant number 2 decided how much to take for him/herself. Then, participant number 2 decides to implement a rule in the form: "The next person shall maximally take up to 30 units". How many units can participant number 3 *minimally* take?

- 0

- 10

- 20

- 50