**Title: Does repetition affect altruism via ethical goods? Results from an economics experiment**

(preliminary version March 2012, submitted to the 6th Annual Meeting of the Portuguese Economic Journal, University of Porto, July 6-7, 2012)

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**Abstract**:

Ethical goods are increasingly available in markets for conventional goods giving pro-ethically motivated consumers a convenient option to contribute to public goods. In this experiment, we implement a between-subject design to test the how having the possibility to make several smaller repeated purchases of ethical goods and contributions to charitable causes affects aggregate pro-social behaviour.

From a theoretical perspective, assuming people demand private and public characteristics regardless of how they are provided, we would expect no behavioural relevance of fragmenting allocation decisions into smaller repeated purchases. The first effect of fragmentation is identified in the standard dictator game, namely that repetition decreases giving. This result adds to the literature on reluctant altruism, since it establishes that the decrease in donations observed over the game fragments causes lower generosity than in a one-shot dictator game. The second effect concerns the introduction of a selfish impure public good in that fragmented setting. Introducing the impure good has overall positive effects on contributions. A final issue involves having subjects make their decision in groups with observation of what others do. Even though the level of donations is not different from the game without group observability, subjects appear to adjust to a group benchmark level and donations converge within groups.

**Keywords**: Experimental Economics, impure public goods, ethical goods, pro-social behaviour, social norms, experimental dictator games

JEL **codes**: C91, D64, H41, Q59

# 1. INTRODUCTION

An impure public good is a commodity that combines public and private characteristics in fixed proportions. Green goods such as dolphin-friendly tuna or green electricity programmes provide increasingly popular examples of impure public goods. Other examples include red goods which bundle items from popular brands with contributions to an AIDS fighting charity and goods made from fairtrade commodities. It is easier than ever to consume ethically and as a consequence we can expect an increasing share of the population engaging in the private provision of public goods.

A theoretical treatment of impure goods as a bundle of characteristics suggests people should be at least as altruistic as when impure alternatives are not available (Kotchen, 2006). Generosity is however more volatile than the theory suggests. Experimental economists have studied altruism extensively and have recently shown that people, though on average altruistic in the laboratory, take advantage of apparently irrelevant context features to wriggle out of giving (eg. Dana at al. 2007, Lazear at al. 2006). Social psychologists have identified that some people after engaging in an altruistic activity will feel licensed to behave less altruistically afterwards or even less honestly (eg. Zhong et al. 2009, Khan and Dhar 2006, Sachdeva et al. 2009, Mazar and Zhong 2009).

The examples of impure goods above are mostly selfish impure goods since the public good characteristic represents a small share of the price. In this experiment, we continue to explore the hypothesis that selfish impure goods license self-centered behaviour. Building on the theoretical treatment of impure goods as a bundle of characteristics, we propose a design that breaks down the consumer choice into an allocation decision between private and public goods implementable as a dictator game where the recipient is a charity (as in Munro and Valente, 2009 and Engelmann at al. 2011).

In this experiment, we explore how the type of decision setting (one-shot versus repeated) impacts allocation choices and pro-social behaviour and whether there is a potential offsetting effect that having an impure good repeatedly present would have on the wriggling effect identified previously (in Munro and Valente, 2009 and Engelmann at al. 2011).

## 2. HYPOTHESES

In this experiment we explore the effect of repetition in a dictator game setting with and without impure goods. The first issue concerns how repetition impacts behaviour in a dictator game setting. The second issue is an extension by including an impure good in the repeated decision setting. Finally, the design is extended further by including a social context, via observability of other players' choices in groups.

The first issue addressed in this experiment is how repetition affects behaviour in a so-called fragmented dictator game[1]. Impure public goods, essentially private goods bundled with a token contribution to a public good, are often present in repeated-choice settings. Everyday, people can recycle or choose locally grown produce and thus contribute to environmental public goods (conservation of resources and reduction of food miles, respectively) or make a donation. Therefore, the decision to allocate income to a public good cause can be validly framed in a repeated setting.

From a theoretical point of view, for the consumer to allocate a fraction of the endowment in *t* decisions or to allocate all the endowment in a single decision should be equivalent[2]. This raises the question of whether subjects are equally altruistic when several dictator games for shares of the endowment are presented to

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[1] The term fragmented game is used by Murnighan et al. (2001) to describe a treatment of Bolton et al. (1998), which consists of ten dictator game decisions with different recipients each involving 1/10 of the endowment ($1 each).

[2] This holds unless these are intertemporal choices, which is not the case. Even though in the experiment decisions are made consecutively, subjects are only paid at the end of the experiment.

them as opposed to when a single dictator game for all the endowment is presented. We set an experimental selfish impure good in a repeated setting. To answer this question, we first establish behaviour in a repeated dictator game as a benchmark and the recipient is a charity. The first research hypothesis can be framed as:

**RH1: Fragmenting a dictator game (with a charity recipient) has no effect on donations.**

The null hypothesis concerns the behavioural irrelevance of fragmenting a dictator game and serves as the baseline to study the impact of impure goods in the fragmented decision. Bolton et al. (1998) compare a dictator game with $10 endowment and a dictator game repeated ten times with $1 endowment and do not find statistically significant differences between the total amount shared in the fragmented game and in the conventional one-shot game[3]. However, given that some altruistic behaviour in experiments, and in particular in dictator game experiments, is reluctant (e.g. Dana et al., 2007), it is possible that dividing one dictator game decision into several smaller decisions has an impact on overall generosity, for example, if being altruistic in one of the fragments is enough to feel good about oneself. One possible behavioural pattern would be to behave generously in the first fragmented game and revert to more selfish choices afterwards. This would be consistent with the moral licensing concept of Zhong et al. (2009) who claim that one altruistic act may license a selfish act afterwards. Consequently, fragmenting the dictator game would reduce giving.

[3] Each of the ten fragmented games is played with different recipients, so there would be no reason for dictators to discriminate between recipients and hence similar contributions in each fragmented game would be expected. However, 13 out of the 25 dictators give irregular amounts. Given that this fragmented game involves different recipients, the results do not directly compare with the results being reported in Experiment 3, since the recipient is always the same and subjects are aware of this. The fact that the recipient does not change means when subjects are faced with ten fragments of a dictator game, this is in essence the same as playing one dictator game for the whole endowment with the same recipient. Playing with different recipients would not make the ten fragments equivalent to one game.

The second issue addresses how introducing a selfish impure good in a fragmented dictator game affects behaviour. The settings where impure goods are observable often involve repeated purchases, and given the spread of impure alternatives in many consumer markets, this is a pertinent and natural extension of the impure good dictator game. From a theoretical perspective, the presence of an impure good in any choice should be behaviourally irrelevant (Kotchen, 2006), unless it expands the consumption possibilities. Therefore if the impure good is either neutral or inefficient, it should be behaviourally irrelevant. In this experiment, we will focus on selfish neutral impure goods. The second research hypothesis is:

**RH2: Adding a selfish neutral impure good to a fragmented dictator game (with a charity recipient) does not alter donations relative to the fragmented game without the impure good.**

It is possible that the null hypothesis does not hold and, in fact, adding a neutral selfish impure good can be behaviourally relevant. Having established in Munro and Valente, 2009 and Engelmann at al. 2011 that the presence of selfish impure goods generates lower contributions to charitable causes in one-shot situations, it is interesting to study whether in a repeated choice setting, the same result holds. Subjects who would be generous in a fragmented dictator game may become less generous in the presence of the impure good. The selfish impure good may provide a cue for being less altruistic and act as wriggle room to justify decreasing one's donation. It may allow reluctant altruists to reduce their donations and still maintain high self-image. First, individuals who wriggle in the first choice can anchor their choices and consistently keep their donations low. Second, individuals who donate, even if symbolically, via the impure good in one period can maintain a self-image of being generous and "doing their bit" even if they only do so once out of all the periods. Also, the perceived prescription of a donation implied by the impure good may crowd out giving because individuals no longer feel warm-glow from giving (Andreoni, 1990), since this is not an active option but something they feel is imposed on them. Hence, overall contributions would decrease in the presence of the selfish impure good.

On the other hand, repetition in a consumption setting with a selfish impure good may generate higher donations than in the absence of it. Making a contribution close to the contribution in the impure good has only a small cost. If people engage in buying them repeatedly, in the end even small donations can add up to a non-negligible provision of public goods. Thus, repetition may in fact counteract the perverse wriggling effect on charitable donations that impure goods may have. Hence, overall contributions would increase in the presence of impure goods in a fragmented decision setting. This is an argument for the observed proliferation of impure goods in markets for private goods.

The third and final issue that will be addressed by an extension of the design is the impact of social context on a repeated impure good game. This extension is justified, since some impure goods are available in repeated choices that have a social dimension in the sense that choices can be observed by others. Therefore, it is relevant to address this in the laboratory and the design of this experiment lends itself to an extension where some information about choices is revealed after each decision.

The issue of repetition and group observability in experiments on pro-social behaviour has been extensively addressed in public good game experiments involving the voluntary contributions mechanism (Ledyard, 1995). In those experiments, strategies of conditional cooperation often emerge (Fischbacher and Gachter, 2006) and as such group observability is behaviourally relevant. However, in that case, the experimental public good benefits all group members since it corresponds to a group account shared by all at the end. In a dictator game with a recipient charity, the contributions of players accrue to the charity and not to the players. In this sense, it is not expected that strategic behaviour between players will emerge as in the voluntary contributions mechanism. Therefore, observing what others do or being observed is likely not to affect how subjects choose. One possible explanation for this is if people derive utility from contributing to charitable causes because of the "warm-glow" of contributing. In this case, learning what others do is behaviourally irrelevant. The third research hypothesis to be explored can thus be expressed as:

**RH3: Adding group observability to a fragmented impure good dictator game with a charity recipient has no effect on public good contributions.**

Alternatively, observability may affect contributions. Subjects may infer from the actions of others what the socially acceptable contribution is and try to conform to it. In this case, a subject who is more generous than the group will reduce her contributions and equivalently a subject who donates less than the group will increase her contribution, so as to converge to a norm of behaviour.

In the next section, we will present the design of the experiment and then present the results so as to address the three issues outlined above.

## 3. EXPERIMENTAL DESIGN AND IMPLEMENTATION

The impure good dictator game is essentially a modified dictator game with an impure public good. Subjects are endowed with tokens and can allocate them between themselves and a charity. The tokens allocated to the charity correspond to the private provision of a public good and the tokens kept correspond to private earnings and consumption. The amount donated is subsidized so that each unit donated within the experiment is matched by the experimenter.

For this experiment, the framework is the impure good dictator game with the following features:

- subjects play a dictator game with a charity. For this experiment, the chosen charity is the Royal Holloway - University of London (RHUL) Hardship Fund, which assists students in need;

- the dictator game is fragmented into ten games with 1/10 of the endowment each;

- in each fragmented game subjects are endowed with 100 tokens. Each token is worth £0.01 if kept and if donated will correspond to £0.02;

- the impure public good consists of a neutral and selfish combination of characteristics, yielding £0.90 for the subject and £0.20 for the charity, which corresponds to 90 tokens (90% of endowment) kept and 10 tokens donated (10% of endowment) in each period.

Four games form this experiment and they differ in the presence or absence of the impure good and whether or not choices are revealed in groups at the end of each game. The four games correspond to the ones in Table 1.

**Table 1 Differentiating characteristics of games in experiment**

| Impure good | Group Information | | |
|---|---|---|---|
| | No | Complete | Incomplete |
| Absent | Game B | | |
| Present | Game NI | Game CI | Game II |

- Baseline Dictator Game (Game B): dictator game played individually with no group feedback after each round.

- Impure Good Dictator Game (Game NI): impure good dictator game played individually with no group feedback after each round.

- Impure Good Dictator Game with incomplete group information (Game II): is similar to Game CI except that only the choice concerning the impure good is revealed. This setting is close to what happens in the field, whereby often people see whether the impure good is bought but not how much is donated.

- Impure Good Dictator Game with complete group information (Game CI): impure good dictator game played in a fixed group of three subjects with feedback at the end of each fragmented game concerning the choices of the other members in terms of how much each member earned, donated and whether or not the impure good was chosen; that is, there is revelation of the choices of private and public characteristics as well as the goods involved[4]. Although Game II is closer to how these decisions involving impure goods are made in the field, Game CI provides a comparison so as to analyze the incremental effect of providing more information on subjects' choices.

Each treatment consists of four consecutive fragmented games and differs in terms of the order with which each of the four games is presented. Three treatments were implemented with the game order illustrated in Table 2[5]. Only one game (with ten fragments) is paid at the end, which is determined by a random draw. Subjects are informed of this structure and of the fragmented nature of the games, but the differences among games are not explained in the beginning of the experiment. So when a subject is playing a game, she is not aware of how the next game will differ from the current one.

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[4] Given that subjects remain in fixed groups throughout Game II (and in another group but with fixed members in Game CI), each member's choices are not anonymous since members are not shuffled in terms of how information is revealed in each game fragment.

[5] The game order was not randomly determined by subjects, but in each session there was only one treatment being run, since treatments were implemented consecutively in time. As will be shown, the game order is not inconsequential given that there is an observed first game effect. So, there may be treatment effects driven by the order of the decisions. It is possible that the sample composition may also be driving these effects, although it is not possible to clearly isolate these effects. To check whether the fact that subjects were not randomly allocated to treatments has any impact on results, we run a WMW rank sum test comparing donations in the first game between treatments. The test yields no statistically significant differences, suggesting subjects do not behave differently; however, this test can not disentangle the game-specific effect from whether subject types are not randomly distributed across treatments.

**Table 2 Structure of treatments**

| Treatment | First game | Second game | Third game | Fourth game |
|---|---|---|---|---|
| 1 | 10 fragmented Game B | 10 fragmented Game CI | 10 fragmented Game NI | 10 fragmented Game II |
| 2 | 10 fragmented Game NI | 10 fragmented Game B | 10 fragmented Game II | 10 fragmented Game CI |
| 3 | 10 fragmented Game II | 10 fragmented Game NI | 10 fragmented Game CI | 10 fragmented Game B |

Note:
Game B: Baseline Dictator Game
Game NI: Impure Good Dictator Game
Game CI: Group Impure Good Dictator Game with complete group information
Game II: Group Impure Good Dictator Game with incomplete group information

Subjects were recruited at RHUL by campus and intranet advertisements and via the mailing list for recruitment for economic experiments. The sessions took place in the Experimental Economics Laboratory using z-Tree (Fischbacher, 2007) during the months of December 2008 and February 2009. Subjects were seated at computer terminals and informed that their decisions and earnings would remain anonymous. In this experiment, 30 subjects took part in Treatment 1, 30 in Treatment 2 and 27 in Treatment 3. There were 7 sessions with 9 to 18 subjects each (in multiples of 3). The sample consists of students at RHUL, with 77.9% of undergraduates and 19.5% studying Economics. The mean age of participants was 21.5 years and the sample was composed of 68.2% of women.

The possible private payoffs for the subjects range from £0 to £10, however given that the donated tokens are subsidized, the maximum possible donation is £20. The average private payoff was £8.92 with a minimum of £0.5 and maximum of £10. Including the donations made, the average total earnings were £11.08 with a minimum of £10 and a maximum of £19.50.

# 4. RESULTS

## 4.1. Fragmented conventional dictator games

Three treatments were implemented which differ in the order among the four games played (Table 2). The descriptive statistics for total donations per game as a share of the endowment are presented in Table 3. Given the random drawing of one game to count towards the payoff, the four games should be treated independently by subjects. However the inspection of Table 3 clearly shows that in the first game played, regardless of its features, subjects are more generous since both the mean and median are higher in the first game than in the other three games. In fact, pooling the total donations per individual (across the ten periods) in the first game played and comparing with the total donations in the second game played, yields statistically significant within-subject behavioural differences (W test for 87 subjects $z=3.646$, $p<0.01$[6]). Therefore, subjects seem to share more in the first game regardless of the game played.

Given the above-mentioned first game effect, it is not recommended to pool the data across the three treatments for each game, since when the game is played first subjects are more generous. One of the purposes of this experiment is to to analyze the effect of repetition on behaviour in conventional dictator games and impure good dictator games (that is to address RH1 and RH2). Pooling the data across the three treatments would introduce a confounding effect. Therefore, we will focus on the first game played by subjects in Treatment 1 and Treatment 2. For simplicity, in this section and the next one, these will be referred to as simply Game B and Game NI, respectively. In both these games, there is a first game effect, so their comparison shows the impact of the impure good on choices.

[6] For within-subject analysis, the Wilcoxon matched pairs signed-rank test (W test) is used. For between-subject comparisons, the Wilcoxon-Mann-Whitney test (WMW test) is used. The reported results are the corresponding test statistics and 2-tailed p-values (p).

**Table 3 Total donations per game in each treatment**

a) Donations in Treatment 1

| By order | | Mean | Standard deviation | Median | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | Game B | 12.0% | 12.9% | 9.6% | 0% | 46.0% |
| 2 | Game CI | 8.5% | 10.1% | 4.8% | 0% | 30.0% |
| 3 | Game NI | 8.3% | 10.8% | 2.1% | 0% | 38.0% |
| 4 | Game II | 7.2% | 10.0% | 1.0% | 0% | 31.0% |

b) Donations in Treatment 2

| By order | | Mean | Standard deviation | Median | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | Game NI | 17.1% | 18.4% | 14.5% | 0% | 95.0% |
| 2 | Game B | 16.6% | 20.7% | 10.0% | 0% | 99.0% |
| 3 | Game II | 13.1% | 20.0% | 6.3% | 0% | 98.0% |
| 4 | Game CI | 14.1% | 18.8% | 10.0% | 0% | 97.0% |

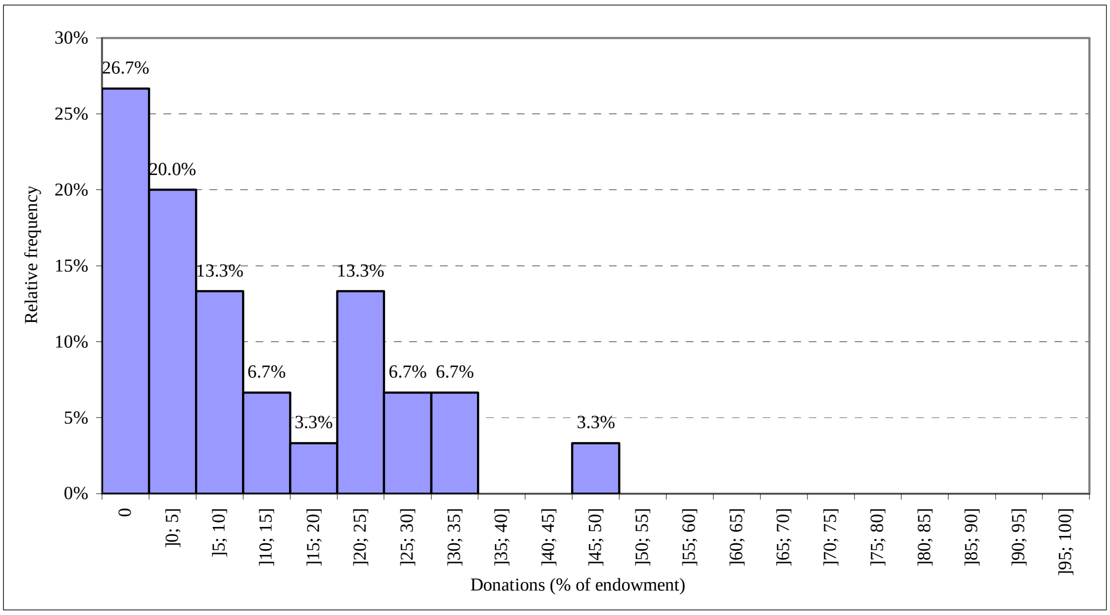
c) Donations in Treatment 3

| By order | | Mean | Standard deviation | Median | Minimum | Maximum |
|---|---|---|---|---|---|---|
| 1 | Game II | 11.5% | 10.9% | 10.0% | 0% | 41.0% |
| 2 | Game NI | 7.3% | 10.5% | 2.0% | 0% | 48.0% |
| 3 | Game CI | 6.3% | 8.1% | 3.0% | 0% | 27.1% |
| 4 | Game B | 6.4% | 10.7% | 1.0% | 0% | 41.0% |

Notes:
30 subjects in Treatment 1 and Treatment 2, 27 subjects in Treatment 3
Total donations as % of total endowment per game.
Game B: Baseline Dictator Game
Game NI: Impure Good Dictator Game
Game CI: Group Impure Good Dictator Game with complete group information
Game II: Group Impure Good Dictator Game with incomplete group information

In Game B, the mean donation is 12%. The distribution of donations is illustrated in Figure 1. Roughly 1/4 of subjects keep the endowment to themselves.

**Figure 1 Relative frequency of donations in Game B – Treatment 1**




The first research question underlying this experiment concerns the impact of fragmenting a dictator game with a charity recipient. One approach is to study how donations compare with a non-fragmented game. Even though these are different experiments, we will refer to Eckel and Grossman (1996) (henceforth EG) and the Baseline decision in Munro and Valente, 2009 (called henceforth Experiment 1 – Decision BaseHi) as benchmarks in terms of behaviour in single-shot dictator games with charity recipients. Firstly, the share of donors is in line with those studies. 22 out of 30 subjects (73.3%) donate something to the charity. EG report 73% of subjects donating to the charity and similarly, in Experiment 1 – Decision BaseHi there were 77% of donors in the baseline decision.

Secondly, we compare average donations. In Game B, the total amount donated over the ten periods corresponds to 12% of the maximum possible donation in the fragmented game (Table 3a). The share donated is lower than in the two benchmark dictator games. In Experiment 1 – Decision BaseHi the average donation is 24.2% of the £5 endowment and in the charity treatment in EG 31% of the $10 endowment. Comparing the share donated in Decision B and each of the benchmark studies yields statistically significant differences (WMW test for Game B and EG z=-2.2, p=0.028; WMW test for Game B and Experiment 1 – Decision BaseHi z=-2.27, p=0.023). One noteworthy difference between these experiments and the present one is the absence of a flat payment for participation in the latter. So, it can be argued that a comparable statistic would be to consider total earnings in the experiment. As such, the value of the donation relative to total earnings becomes lower in the mentioned benchmark studies and corresponds to 13.5% of £9 in Experiment 1 and 20.7% of $15 in EG. The donation of 12% in Game B in favor of the charity is still below these values, which seems to indicates that the fragmented game lowers the donations made on the whole game. However, the donation differences (including the participation fee for the benchmark studies) is only statistically significant with respect to EG and not Experiment 1 (WMW test for Game B and EG z=-1.71 p=0.088; WMW test for Game B and Experiment 1 – Decision BaseHi z=-0.718, p=0.473).

Another approach to analyzing how fragmentation impacts pro-social behaviour in a conventional dictator game is to examine how individuals make their choices along the timeline. The average donations in the ten fragments of the baseline decision are illustrated in Figure 2. The mean donation in the first period is 23% of the endowment (Table 4). In the last period of Game B, the mean donation decreases to 9.1% of the endowment. A Wilcoxon matched pairs signed-rank test confirms that comparing the first with the last period, donations are lower (z=3.321, p<0.01). To identify the time effect on donations, we run a robust OLS panel regression (Table 5) of donations on period. Regression 1 shows a statistically significant decrease in donations with repetition. Regression 2 splits the period variable into a dummy to denote first period and a linear term thereafter. In this case, donations are higher in period 1, whereas there is no significant time trend from period 2 onwards. Therefore on aggregate, subjects start more generous and decrease their donations after the first fragment of the game.

**Figure 2 Mean donation per period in Game B – Treatment 1**

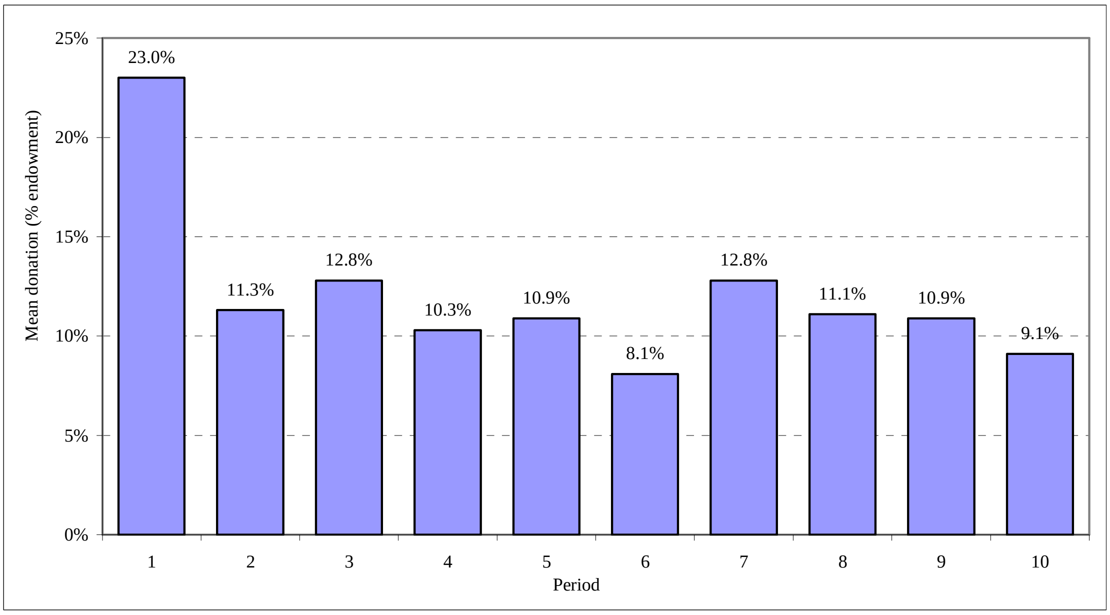



**Table 4 Donations in Game B – Treatment 1 (first and last period)**

| Period | Mean | Median | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| 1 | 23.0% | 20.0% | 24.6% | 0% | 100% |
| 10 | 9.1% | 0% | 19.9% | 0% | 100% |
| Total | 12.0% | 9.6% | 12.9% | 0% | 46% |

Note: 30 subjects, donations as % of endowment.

**Table 5 Coefficients for robust OLS regression of donations on period (Game B – Treatment 1)**

| | Regression 1 | Regression 2 |
|---|---|---|
| Period | -0.793 ** | |
| | -0.417 | |
| Period1 | | 11.136 ** |
| | | -5.111 |
| Period2-10 | | -0.176 |
| | | -0.430 |
| constant | 16.389 *** | 11.864 *** |
| | -2.513 | -2.543 |
| n | 300 | 300 |
| $R^2$ | 0.015 | 0.039 |

Notes:
Donations as % of endowment.
Period2-10 = 0 if Period=1; = Period if not.
Period1=1 if Period=1; 0 if not.
White (1980) standard errors in parentheses.
Coefficient significant at *** p <0.01, ** p<0.05

The above results indicate that the fragmentation of a dictator game with a charity reduces the overall contribution of subjects. The reaction to the first fragmented dictator game is to contribute 23% of the endowment, which is in line with previous dictator games with charity recipients (31% in EG and 24.2% in Experiment 1 – Decision BaseHi). However, as the decisions are repeated, the average donation is reduced to less than half that amount. This seems to support the hypothesis that some of the altruism observed in dictator games is partly reluctant altruism, in the sense that subjects acknowledge a norm for altruism and without room for justifying being selfish, end up sharing their endowment. In this case, as the decision is played again, they become less generous but can still maintain a favourable self-image, since they were generous already. If subjects derive warm-glow from their initial contributions, after the first donation, the marginal warm-glow does not compensate for the earnings lost, and donations settle at a lower level. An alternative explanation is related to an introspection process whereby subjects reconsider their choices. In one-shot dictator games, there is no follow-up decision, so subjects do not have the option to reconsider their choices. Regardless of whether it is a wriggling effect or an introspection process that is taking place, subjects begin more generously and decrease their donations after the first period.

## 4.2. Fragmented impure good dictator games

The analysis of Game B establishes that the fragmentation of the dictator game decision into smaller decisions reduces the initial level of generosity towards the recipient charity. The presence of the impure good may, on the one hand, reduce donations further, since in Munro and Valente, 2009 the introduction of a selfish impure good in a one-shot dictator game decreased the private provision of public goods. On the other hand, the impure good, by being repeatedly present in consumption choices, may generate small but consistent contributions, thus having ultimately a positive effect on contributions relative to the baseline.

To address RH2, this section will focus on Game NI in Treatment 2 (henceforth in this section, Game NI), since this is the treatment where Game NI is first played and there is no contamination from the other games. In Game NI, subjects are faced with ten consecutive impure public good dictator games. In each decision, the impure good corresponds to keeping 90% of the endowment and donating 10%. This is a selfish good in the sense that it favours private earnings and is neutral since an allocation of 90 tokens for the subject and 10 for the charity achieves the same result. This game allows addressing RH2 which focuses on the effect of adding a selfish and neutral impure good to a fragmented dictator game. Impure good purchases are present in repeated settings so Game NI is an appropriate and natural setting to study the effect of impure goods on generosity.

The research question underlying Game NI concerns the impact of the selfish impure good in a fragmented game. From a theoretical perspective it should not be behaviourally relevant, since it is possible to make the same allocation as implied by the impure good without it (Kotchen, 2006). A reference for comparison is the baseline fragmented game. A fragmentation effect was identified whereby subjects are more generous initially and then stabilize their donations at a lower level. The average donation is as a consequence below the level of one-shot dictator games with charities. Other than the inclusion of the impure good alternative, there are no other differences between Game NI and Game B, so individual behaviour should remain unaltered. However, one-shot experiments on impure goods (for example, Munro and Valente, 2009) established that the selfish impure good creates wriggle room and subjects are less generous than in the baseline. Therefore, the introduction of a selfish impure good in a fragmented game might have created the same effect. As we will show, this is not observed, since donations are similar in the two fragmented games.

In the presence of the impure good, the average total donation is 17.1% of the endowment, as opposed to 12% in the baseline (refer to Table 3). The relative frequency of donations is depicted in Figure 6.3.[7]. Comparing the behaviour of the subjects in Game NI and Game B, there are no statistically significant differences in total donations (WMW z=-1.46, p=0.144).

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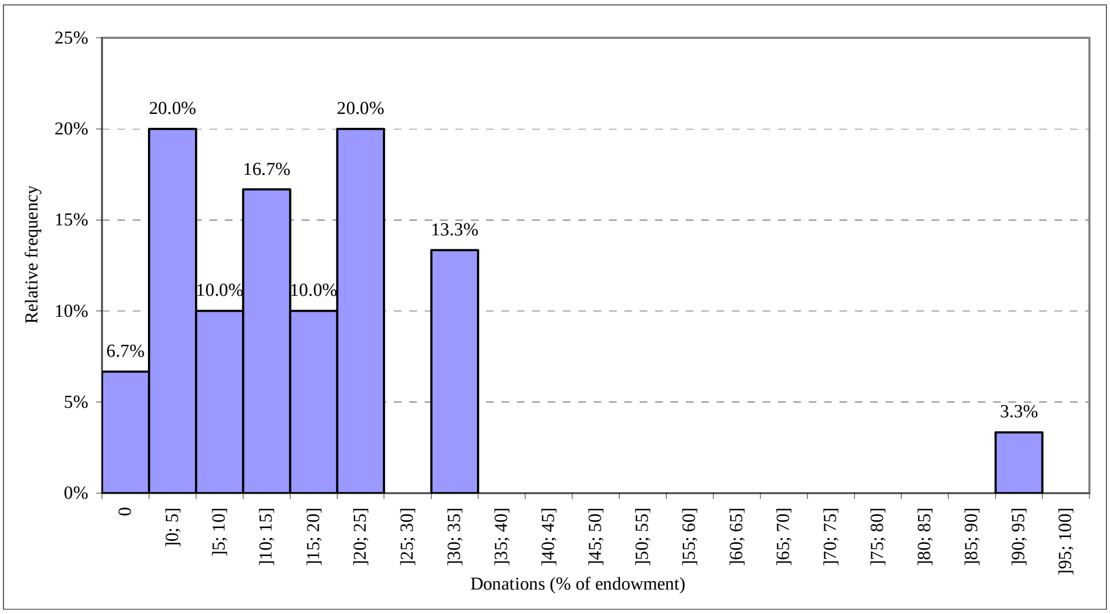
[7] As illustrated in Figure 6.3., there is one subject that makes a donation of 95% in Game NI. Excluding this subject, the mean donation becomes 14.4% of the maximum possible endowment. The direction of the comparisons between behaviour in Game NI and Game B does not change with the exclusion of this observation, so it was retained in the sample.

**Figure 3 Relative frequency of donations in Game NI – Treatment**




To understand the impact of the impure good, some comments on the nature of the embedded donations are in order. It should be noted that the mean donation in Game B of 12% of the endowment is only slightly above the donation implicit in choosing ten times the impure good (which corresponds to 10% of the endowment). In fact, out of the 300 choices made in Game B, as can be seen in Table 6b, 62% of the decisions are below a donation of 10% of the period endowment and 8.7% are exactly 10%, so in total 70.7% of all choices are below or equal to the impure good donation. It is possible that this result is driving the absence of statistical significance in the comparison between Game B and NI. Were we to observe an impure good effect of decreasing donations similar to the observed effect in Experiment 1, it might only affect the remaining 30% of choices. On the contrary, the presence of the token impure good could increase total contributions if it compelled subjects who would otherwise not give to contribute something. Since subjects are not giving more on average than the impure good donation, introducing a selfish impure good does not generate a net increase in average donations.

**Table 6 Relative frequency of donations by type**

a) Total donations (% endowment £10)

| | Game B | Game NI |
|---|---|---|
| 0 | 26.7% | 6.7% |
| ]0; 10%[ | 23.3% | 23.3% |
| 10% | 10.0% | 6.7% |
| ]10%; 100%] | 40.0% | 63.3% |
| # observations | 30 | 30 |

b) Period donations (% period endowment £1)

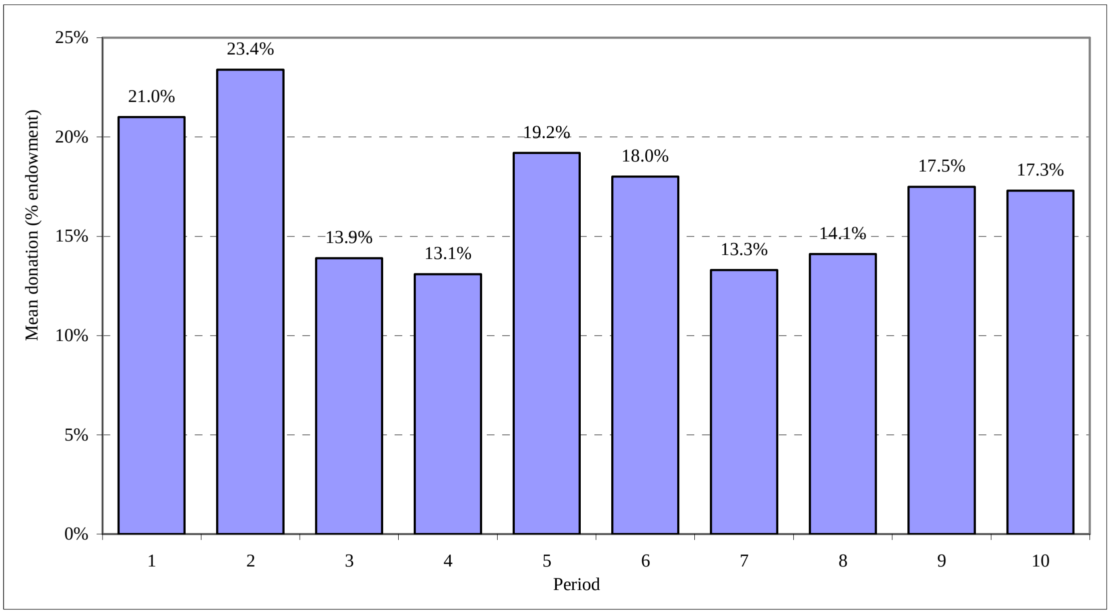
| | All periods | | Period 1 | | Period 10 | |
|---|---|---|---|---|---|---|
| | Game B | Game NI | Game B | Game NI | Game B | Game NI |
| 0 | 43.3% | 34.0% | 26.7% | 20.0% | 53.3% | 30.0% |
| ]0; 10%[ | 18.7% | 5.7% | 13.3% | 3.3% | 20.0% | 6.7% |
| 10% | 8.7% | 32.7% | 6.7% | 43.3% | 6.7% | 36.7% |
| ]10%; 100%] | 29.3% | 27.7% | 53.3% | 33.3% | 20.0% | 26.7% |
| # observations | 300 | 300 | 30 | 30 | 30 | 30 |

Note: Game B (Treatment 1), Game NI (Treatment 2)

Despite the absence of statistically significant differences in donations in Games B and NI, there are noteworthy behavioural differences. A closer inspection of the pattern of giving in both games reveals that more subjects donate in Game NI (Table 6a). Whereas in Game B there are 73.3% of donors on aggregate (over the ten repetitions), in this game 93.3% donate a positive amount (Table 6a). The difference in prevalence of donors and non-donors in the two games is statistically significant ($\chi^2$=4.32, p=0.038). Also, on the whole, 63.3% of individuals in Game NI and only 40% in Game B donate beyond the impure good donation. We will refer to these subjects as non-minimum donors and those who give a positive amount of 10% or less as minimum donors. The difference in shares of non-minimum givers in the two games is statistically significant ($\chi^2$=10.87, p<0.01). Pooling the ten fragments for all subjects, there are 300 decisions made in each game, and the share of non-minimum donors is similar in both games (29.3% and 27.7%). In Game NI the donation of 10% is chosen more often and the proportion of low donations is less prevalent.

Along the timeline as illustrated in Figure 4, the mean donation decreases, though not as steadily as in Game B. The mean donation starts as 21% of endowment in period 1, and when comparing donations in this period with those in Game B, there are no statistically significant differences (WMW z=0.105, p=0.916). However, the same comparison for other nine periods yields statistically significant differences (WMW z=-1.679, p=0.093). Also, at the end of the repetitions the donations are significantly different in both games (WMW z=-2.216, p=0.027). In fact, the mean donation of 17.3% of endowment in Game NI is at 82.4% of the starting level in Period 1; donations in Game B are on average 9.1% in Period 10 which corresponds to only 39.6% of the initial donations. Therefore, the fragmented impure good game maintains at the end of the repetitions higher donations than in the fragmented dictator game. This is consistent with the fact that there are more donors in Game NI at the end of the ten periods than in Game B (Table 6b). Furthermore, it should be noted that the level of 17% of donations at the end of Game NI is higher than the level of 10% corresponding to the impure good.

**Figure 4 Mean donation per period in Game NI – Treatment 2**




Finally, it is possible that the impure good creates a positive spillover effect on the other games. The inspection of the descriptive statistics in the three implemented treatments suggests that subjects are more generous in Treatment 2 in all games compared with other treatments. So the impure good might have even had a positive spillover effect on the other games in Treatment 2. To investigate this result, we check if there is a Game NI effect on donations. For this purpose, we now consider all 348 donations made by the 87 subjects in the four games (across the three treatments), and test whether there is an effect associated with Game NI (Table 7). In Regression 1, we control for the order of play and only the coefficient of *Order1* variable is significant and positive, corroborating the result in Table 5 that subjects are more generous in the first game played, regardless of the game. None of the indicator variables associated with the game played are statistically significant. However, when not only the order of play is included but also whether the first game played included the impure good, the coefficient of *IGfirst* is also significant and positive (Regression 2), which suggests positive spillover effects for the whole experiment from the presence of the impure good from the beginning. Regression 3 specifically considers whether Game NI or Game II are played in the first position, and only the coefficient for *GameNIfirst* is significant and positive. So, the spillover effect originates from the impure good in the game without group observability.

**Table 7 Coefficients for robust OLS regression of donations on game and order (all treatments)**

| | Regression 1 | Regression 2 | Regression 3 |
|---|---|---|---|
| GameNI | -0.890<br>(2.493) | -0.890<br>(2.487) | -0.890<br>(2.435) |
| GameCI | -0.701<br>(2.47) | -0.701<br>(2.459) | -0.701<br>(2.4) |
| GameII | -0.677<br>(2.152) | -0.677<br>(2.151) | -0.677<br>(2.108) |
| GameNIfirst | | | 6.208 ***<br>(2.036) |
| GameIIfirst | | | -1.148<br>(1.394) |
| IGfirst | | 2.723 *<br>(1.162) | |
| Order1 | 4.321 **<br>(2.084) | 4.321 **<br>(2.085) | 4.321 **<br>(2.038) |
| Order2 | 1.628<br>(2.457) | 1.628<br>(2.446) | 1.628<br>(2.386) |
| Order3 | 0.274<br>(2.381) | 0.274<br>(2.375) | 0.274<br>(2.324) |
| constant | 9.810 ***<br>(1.891) | 8.025 ***<br>(2.003) | 8.025 ***<br>(1.948) |
| n | 348 | 348 | 348 |
| $R^2$ | 0.015 | 0.023 | 0.065 |

Notes:
Observations for 87 subjects and 4 games each
Donation (% of total endowment) as dependent variable on:
Game*i* : indicator variable for Game *i*
Game*i* first: indicator variable for Game *i* played first in treatment
IGfirst: indicator variable for game with impure good played first in treatment
Order*j* : indicator variable for game being played in order *j*
White (1980) standard errors in parentheses.
Coefficient *** significant at p <0.01, ** p<0.05, * p<0.1

In summary, RH2 is corroborated since there are no donation differences in Game NI relative to the baseline. The wriggling effect is not observed and an opposite effect is present throughout the treatment where Game NI is played in first position. In fact, subjects are more generous throughout the treatment. Therefore, in this experiment the repeated presence of the impure good made subjects more generous. As such, impure goods, even if selfish, may help sustain higher private provision of public goods. However, the results from this experiment may be driven by the fact that the impure good donation is close to what was observed in the baseline dictator game. The wriggling effect observed in Experiment 1 resulted from a higher donation level in the baseline (24.2%) and a reduction of donations in the presence of the impure good (with 5% of donations embedded) to a level of 16.7%. With hindsight, the same effect is not possible in Game B and Game NI.

### 4.3. Fragmented impure good dictator games with group observability

Impure goods are often purchased in public situations where the buyer is observed by others and can observe the choices of others. Game CI is similar to Game NI, but after each round subjects observe what others do. Not only do they observe donations, but also if the impure good is chosen in their group. In this experiment the groups have three members each and the matching remains fixed throughout the ten repetitions of Game CI. Game II is similar to Game CI but subjects only observe whether the impure good is purchased within their group, not how much each person contributes to the charity (as illustrated in Table 1).

Introducing this social feature of group observability may impact subjects' behaviour. For individuals who do not care about the provision of the public good, the dictator game does not change with observability. For individuals who derive warm-glow from giving, the behaviour of others is irrelevant since only their own donations matter for their utility. In both cases, donations should not be altered with group observability. These subjects with unaltered choices will be denominated as stable subjects. Other subjects may be affected by group observability for a variety of reasons. These subjects will be referred to as non-stable subjects, since they will change their donations with group information. Those individuals who value the total level of the public good will prefer to free-ride on the contribution of others and will thus decrease their contribution as the group contribution increases. Equivalently, if the contribution of others decreases, it is possible that some of these non-stable subjects will increase their own to compensate. Some subjects may also engage in what Duffy and Kornienko (2007) called competitive giving and increase their own contribution as the contribution of others increases. Similar behaviour is expected if subjects observe group giving and conform to the norm of giving in the group. In these cases, observing group giving increases contributions, but as the contribution of others decrease, they will also decrease their own contributions.

To study the impact of observability on donation behaviour, we start by analyzing aggregate donations per game to identify overall treatment differences and whether individuals are affected by the behaviour of others or if they are unaffected. As already noted, and illustrated by Table 3, in the three treatments implemented, donations in the first game are higher on average than in the second game, regardless of the game. All observations from Game CI originate from treatments where the game is not played in the first position. Subjects have already been exposed to the type of decision before. Table 8 summarizes contributions in the four games with pooled samples including the first game played and excluding it. The mean donation in Game CI is 9.8% of endowment; in Game II it is either 10.6% or 10.1% for the whole sample or the subsample in Table 8b.

**Table 8 Descriptive statistics per game**

a) Pooled observations from all treatments

| | # | Mean | Standard deviation | Median | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Game B | 87 | 11,9% | 15,9% | 5,0% | 0% | 99% |
| Game NI | 87 | 11,0% | 14,4% | 15,0% | 0% | 95% |
| Game CI | 87 | 9,8% | 13,6% | 5,4% | 0% | 97% |
| Game II | 87 | 10,6% | 14,5% | 6,3% | 0% | 98% |

Note: % of endowment

b) Pooled observations from treatments where the game is not played first

| | # | Mean | Standard deviation | Median | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Game B | 57 | 11,8% | 17,3% | 5,0% | 0% | 99% |
| Game NI | 57 | 7,8% | 10,6% | 2,0% | 0% | 48% |
| Game CI | 87 | 9,8% | 13,6% | 5,4% | 0% | 97% |
| Game II | 60 | 10,1% | 15,9% | 5,0% | 0% | 98% |

Note: % of endowment

The evolution of donations over the ten periods for Games CI and II is illustrated in Figure 5 and Figure 6. The mean donation starts at 10.1% of endowment in Game CI and ends the repetitions at 10.2%. The mean donation in Game II is 12.3% in period

1 and 9.7% in period 10. Despite some fluctuation, donations are similar in the beginning and end of the repetitions.

**Figure 5 Mean donation per period in Game CI – all treatments**

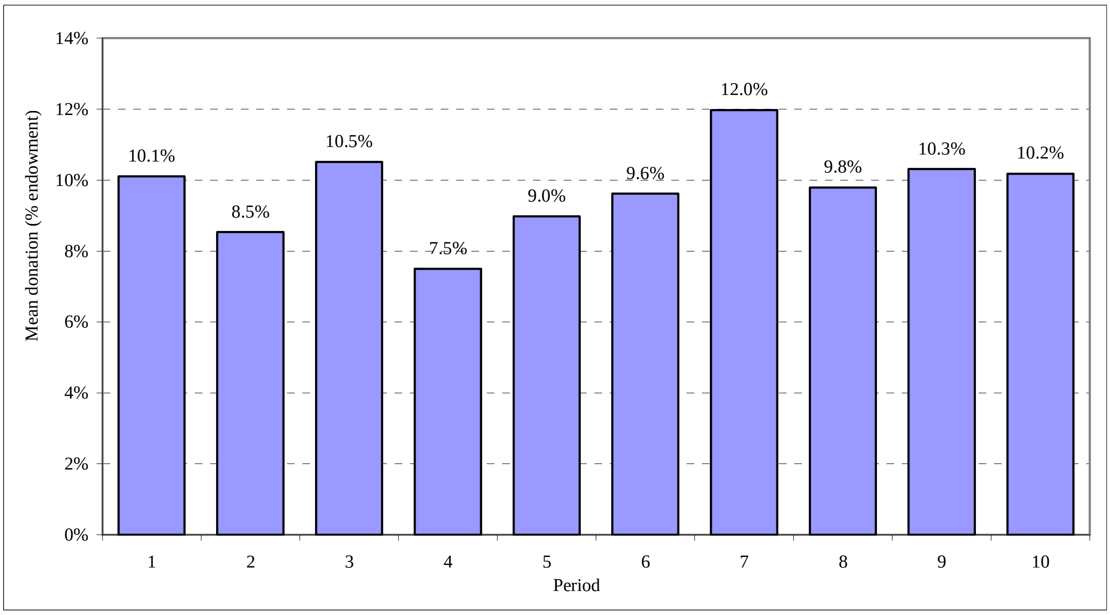
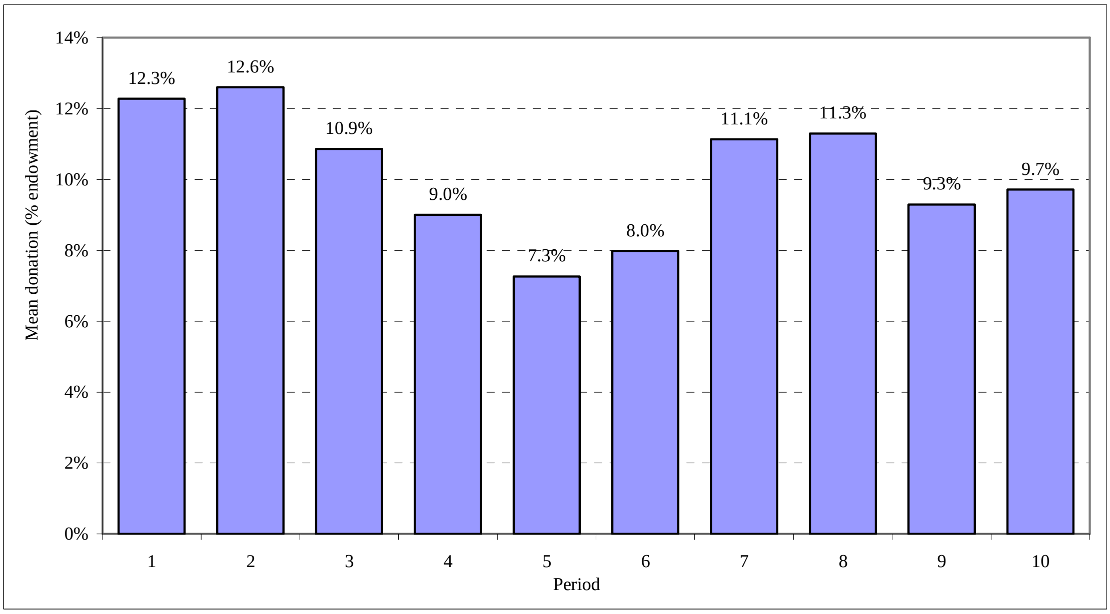



**Figure 6 Mean donation per period in Game II – treatments 1 and 2**



The within-subject comparison of total contributions in Game NI relative to Game CI and Game II does not yield statistically significant differences considering all treatments (for Game NI relative to Game CI W test: z=1.469, p= 0.142; for Game NI relative to Game II W test: z=0.715, p= 0.475). Therefore, the introduction of observability does not seem to affect behaviour. This result warrants further investigation given the effect of the first game played. One alternative approach is to test within-subject differences only for treatments where one of the games is not played first. In this case, there are still no statistically significant behavioural differences for Game NI relative to Game CI (W test: z=1.161, p= 0.246) nor for Game NI relative to Game II (W test: z=0.645, p= 0.519). Another approach is to control for the first game played and estimate the effect of introducing observability in the impure good game. The results from an OLS regression on subjects' total donations in Game NI, CI and II are presented in Table 9. Donations (as a share of the endowment per game) are regressed as a function of the game, controlling for order effects. There is no statistically significant effect of Game CI or II relative to Game NI on donations. Only order is statistically significant, with higher donations in the first game played.

**Table 9 Coefficients for robust OLS regression of donations on order and game**

| | OLS regression |
|---|---|
| Order1 | 5.431 ** |
| | (2.365) |
| Game CI | 0.619 |
| | (2.018) |
| Game II | -0.254 |
| | (2.126) |
| constant | 9.136 *** |
| | (1.393) |
| n | 261 |
| $R^2$ | 0.023 |

Notes:
Observations from Game NI, CI, II.
Donations in % of endowment.
Order1: dummy variable for first game played
Game CI: dummy variable for Game CI
Game II: dummy variable for Game II
White (1980) standard errors in parentheses.
Coefficient *** significant at p <0.01, ** p<0.05

In Game II subjects only learn if the other group members choose the impure good, but not how much is donated in private. In terms of overall contributions, there are no statistically significant within-subject differences between this game and Game CI (where subjects also learn the total amount donated by the other members in the previous period) (W test z=0.783, p=0.433). Also, the types of donations in both games are similar, namely the share of no donations and the share of giving beyond the token amount, as shown in Table 10. Comparing these shares with those observed in Game NI, there is no evidence that group observability affects the type of decision made. Furthermore, the impure good is chosen in 20.5% of choices made in Game CI and in 23.2% in Game II; the different prevalence of impure good choices between Games CI and II is not statistically significant ($\chi^2$=1.94, p=0.164).

**Table 10 Relative frequency of donations in Games CI and II (pooled data)**

| | Game NI | Game CI | Game II |
|---|---|---|---|
| 0 | 46.6% | 46.7% | 44.8% |
| ]0; 10%[ | 7.9% | 13.7% | 11.1% |
| 10% | 25.9% | 22.3% | 26.1% |
| ]10%; 100%] | 19.7% | 17.4% | 17.9% |

Notes: 870 observations per game

% of period endowment (£1)

On aggregate, there are no treatment differences in total donation when group observability is introduced. It is, however possible to identify different types of subjects in terms of how they are affected by the choices of others. A closer inspection at how subjects make their choices in groups, for example by looking at the behaviour in each group over the ten periods for Game CI and Game II, exposes the presence of two types of subjects. On the one hand, some subjects never change their choices over the ten periods, thus disregarding whatever group information they receive. In Game CI, these stable subjects are 35.6% of the 87 participants, since they never change their choices. The remaining 64.4% are non-stable in their choices. The mean donation of each of these two types of subjects is different, with stable subjects donating an average of 4.5% of endowment, whereas non-stable types donate 12.6% of endowment. Of the 31 subjects who make stable donations, 21 make no contribution throughout Game CI and thus do not seem to value the public good. The remaining 10 stable subjects donate on average 14.1% and seem to be motivated by some form of warm-glow. There is statistical significance in the behavioural differences between stable and non-stable subjects (WMW test $z=-4.63$, $p<0.01$). However, considering only subjects who make a contribution, the statistical significance disappears (WMW test $z=1.244$, $p=0.213$).

Similarly, in Game II, 40.2% of subjects never change their donation, whereas the remaining 59.8% change their choices at least once. The mean donation of the former is 4.3% of endowment. Twelve of the stable subjects always make positive contributions and donate 12.5%. The non-stable donors contribute 14.8%. There are statistically significant differences in behaviour between stable and non-stable subjects (WMW test $z=-5.01$, $p<0.01$) but if we exclude from the analysis the stable non-donors, there are no statistically significant differences in donations (WMW z=0.422, p=0.673). The non-stable types start by donating an average of 18.9% of endowment and in the last period of the game donate 13.8%, and these subjects are significantly less generous in the last period compared with the first period (W test z=2.884, p<0.01). As such, this behavioural change requires further analysis.

For Game CI, in each group of three subjects, we analyze how individual donations vary with information about the other members of the group by regressing changes in individual behaviour as a response to how the individual compares with group benchmarks. One hypothesis is for donations to converge to a group benchmark. This behaviour is consistent with preferences for complying with a social norm. The person adopts a benchmark based on the information of what group members are doing and will try to give neither beyond the benchmark nor below it. In this case, conformity to the norm is utility increasing and deviations are utility decreasing. If the subject is donating more or less than the group, then she will reduce or increase her contributions to match the group. The opposite hypothesis is for donations to diverge from the group benchmark, if for example subjects consider a certain level of total donations appropriate and adjust their own to that level. The results from running fixed effects panel data regressions are summarized in Table 11. We consider the change in donations between two consecutive periods as the dependant variable. Then this individual change is regressed on different group variables in the preceding period to verify if they are behaviourally relevant. To control for the effect of a regression to the mean on individual changes, a variable is introduced which measures for each individual, how her donation in the previous period ($Don_{t-1}$) deviated from the average up to that period, defined as:

$$IndDev_{t-1} = Don_{t-1} - \left( \sum_{j=1}^{t-2} Don_j \Big/ t-2 \right) \qquad (6.1)$$

**Table 11 Coefficients for fixed effects panel regression of individual donations on group donation decisions**

| | Regression 1 | Regression 2 | Regression 3 | Regression 4 | Regression 5 |
|---|---|---|---|---|---|
| $Dev_{t-1}$ | 0.484 *** (0.089) | | | | |
| $DevMin_{t-1}$ | | -1.491 *** (0.402) | | | -1.24 *** (0.442) |
| $DevMed_{t-1}$ | | | -0.768 *** (0.225) | | 0.258 (0.152) |
| $DevMax_{t-1}$ | | | | -0.06 (0.04) | 0.04 (0.061) |
| $IndDev_{t-1}$ | -0.769 *** (0.124) | 0.193 (0.356) | -0.459 (0.219) | -1.056 *** (0.082) | 0.194 (0.35) |
| constant | 0.336 *** (0.022) | 12.426 *** (3.245) | 3.597 *** (0.939) | -0.362 (0.502) | 10.975 *** (3.868) |
| n | 696 | 696 | 696 | 696 | 696 |
| $R^2$ | 0.562 | 0.603 | 0.580 | 0.544 | 0.607 |

Notes:
Donation variation (% of period endowment) as dependent variable on:
$Dev_{t-1}$: Difference between subject donation and group average in *t-1*
$DevMin_{t-1}$: Difference between subject's and the lowest donation in the group
$DevMed_{t-1}$: Difference between subject's and the median donation in the group
$DevMax_{t-1}$: Difference between subject's and the highest donation in the group
$IndDev_{t-1}$: difference between subject's donation in previous period and average donation up to previous period
Robust standard errors: clustering by group.
Coefficient *** significant at p <0.01, ** p<0.05, * p<0.1

One possible group benchmark is the average donation in the group. we compute the difference between the subject's donation and the group average in the previous period ($Dev_{t-1}$). The estimated coefficient is statistically significant and negative suggesting that a positive deviation in the previous period will decrease individual donations in the following period (Regression 1). This supports the hypothesis of convergence of donations.

Within each group it is possible to rank donations into the highest, median and lowest donation. We compute how an individual donation compares with each of these three benchmarks in the preceding period ($DevMax_{t-1}$, $DevMed_{t-1}$, $DevMin_{t-1}$). Regressions 2 to 4 consider each of these benchmarks individually. The coefficients of the deviation to the first two benchmarks are statistically significant and negative, which also supports the hypothesis of convergence of donations to a group benchmark. Regression 2 considers how donations vary in response to deviations from the lowest donation in the previous period. Individual donations either match the lowest donor, in which case there is no deviation, or they are above the benchmark. The negative coefficient suggests the larger the deviation from the lowest donation, the more the subject will decrease her donation. Regression 3 considers the median donation in the group. The deviation can be positive, null or negative. Subjects will correct the previous period's donation and converge their contribution to the median. Finally, Regression 4 uses the highest group donation as the benchmark, and the coefficient is not statistically significant. In the final regression, we test the impact of the three benchmarks and in this case only the coefficient for the lowest donation is statistically significant and negative (Regression 5). The coefficient for the lowest group donation is smaller than -1, indicating that the more subjects deviate in one period, the less they will deviate in the following period. Controlling for the influence of the lowest donation, the coefficients for the deviation relative to the maximum or median donation are no longer significant. Overall, regardless of the benchmarks used, subjects respond to how they compare with other donors in their group.

In summary, in this experiment, the introduction of group observability in an impure good dictator game does not impact overall charitable behaviour relative to the game with no observability. A closer inspection of the group dynamics suggests that when donations are made public in groups, subjects respond by adjusting their donations relative to the group.

## 5. DISCUSSION AND CONCLUSIONS

Given the repeated nature of impure good purchases it is natural to study their impact on public good contributions in repeated settings. In this experiment we explore several issues within that fragmented setting.

The first issue concerns how fragmenting a dictator game with a charity recipient affects charitable behaviour. In Game B, subjects make consecutive decisions on how to split shares of the endowment. The results on overall donations are in line with other studies in terms of the prevalence of donors and the share of the endowment donated to the charity. However, donations in the beginning of the repetition are higher than in the last periods. Therefore repetition seems to decrease the overall donations. When subjects are first faced with a dictator game, some of them appear to feel compelled to give more generously than later in the experiment. As the experiment progresses, their tendency towards generosity fades. As some sort of motivated reasoning starts taking effect, those subjects who continue to make contributions, reduce those contributions. Therefore, the norm for altruistic behaviour is not ignored since contributions remain positive, but its effect is subdued.

So, a dictator game without repetition does not account for the fact that “initial” generosity captured by the one-shot element of the game is not replicated as the repetitions progress. One possible explanation for this effect of fragmentation is that subjects do not feel obliged to be as generous all the time once they have “done their bit”, and they can feel good about themselves by simply making one generous choice out of the ten choices. Again, we can argue that altruism observed in one-shot dictator games can be partly reluctant altruism and in effect not merely multipliable with repetitions. This result adds to the literature on dictator games by raising a caveat concerning how sustainable pro-social behaviours exhibited in experiments is. We show that subjects continue to make positive contributions but on average these settle at much lower levels.

The second issue addressed by concerns the introduction of a selfish impure good alternative in the fragmented dictator game. Game NI involves a selfish impure good which ended up including a donation close to the average donation in Game B. The donation behaviour in Game NI is similar to that of Game B. Even though the share donated in the first period is similar in both games, donations plunge in Game B, whereas they remain at a level close to the initial level in Game NI. Also, the level in the last repetition in Game NI is above the 10% implied by the impure good. Therefore, the presence of the impure good partially offsets the “fragmentation effect” observed in Game B. Adding to this result, there are more donors by the end of the repetitions in Game NI than in Game B. In summary, introducing an impure good with a selfish public good component may have a positive effect on the private provision of public goods by sustaining higher donations throughout the repetitions and preventing the decline in donations and the share of donors. However, these effects were not sufficient to render the donation differences between the games statistically significant.

One limitation of this study lies in the impure good donation used. The fact that it roughly matches the average donation in the baseline suggests there is little margin for the impure good to create wriggle room in Game NI. This would warrant further investigation with impure goods with a lower donation.

The final issue addressed concerns dictator game decision making in groups. It is possible that social information affects individual contributions. The design implemented to approach this issue is an extension of Game NI with group observability. There were no noteworthy treatment differences between contributions where subjects observed both the types of goods and the amount donated and where they only observed if the impure good was purchased. Despite the group feature, roughly 1/3 of subjects in Game CI and 2/5 in Game II do not alter their behaviour throughout the experiment and a majority of these do not make a contribution at all. However, the remaining subjects are non-stable in their choices. Even if on aggregate Games CI and II generate an equivalent level of donations, there is statistical evidence that subjects react to group information. In fact, individual donations will converge to a group benchmark, be it the average or median donation, or the lowest group donation. When the subject is donating more than the benchmark, on average in the following period, her donation is reduced. When she is less generous than the benchmark she will increase her generosity.

As a conclusion, this experiment addresses issues related to the repeated nature of choices where impure public goods are present. The issue of fragmentation and the corresponding decrease in donations is pertinent for the study of pro-social behaviour in dictator games. For the specific study of the impact of impure goods on pro-social behaviour, the experiment suggests that the presence of impure goods may offset the negative effect of fragmentation.

Even though the conclusions are limited by the type of impure good used, it appears that the presence of selfish impure goods may in fact promote the private provision of public goods. Also, given that group information impacts some individuals' choices, making them converge to a group benchmark. In reality, many impure good purchases are made in public, so this result suggests that when people observe others and are observed, they are likely to be swayed to become more generous as contributions increase in the group. These issues are relevant for the field. Given that a fragmented setting may be a more natural way to study impure goods, the issues raised by this experiment warrant further exploration.

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