

Two are better than One!

Individuals' Contributions to “Unpacked” Public Goods

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Abstract

Public goods are of paramount importance to economic and societal life, but their provision through private contributions constitutes a major (incentive) problem. The present paper experimentally demonstrates how “unpacking” provides a possible approach to mitigate this dilemma. Subjects' total contributions increase when a single public good is split into two identical public goods, although marginal per capita returns of contributions are constant across treatments. This finding not only informs NGOs about possible new ways to increase charitable donations – in general, the unpacking effect presented here might potentially be of importance for a broad range of mechanisms involving individually subdividable decisions. (100 words)

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1 Introduction

When forming beliefs, appraising events, or evaluating categories, people often act as if “*the whole is less than the sum of its parts*” (Van Boven and Epley 2003). Scholars of the Support Theory call this psychological artifact “unpacking effect” (Rottenstreich and Tversky 1994). First studied in relation to the formation of subjective probabilities, unpacking effects have since then been described to occur in several situations, including the economic evaluation of bundles of private goods (Diamond and Hausman 1994, Bateman et al. 1997).

The aim of the present paper is to test empirically whether the “unpacking effect” provides a possible approach to mitigate a public goods dilemma¹. Therefore, we conduct a laboratory experiment in which a single public good is split into two identical public goods (keeping marginal per capita returns of contributions constant), and subjects have to choose their voluntary contributions *to each* of the fragments *separately*. Comparing the results to a benchmark treatment with only a single public good, we observe that the unpacking leads to an increase in subjects’ total voluntary contributions – which suggests that individuals’ contributions are super-additive in the number of identical public goods.

In the next section, we describe the experimental design and derive theoretical predictions. Subsequently, the experimental results are presented in Section 3. Section 4 discusses possible implications and concludes.

2 Experimental Design and Predictions

In the **benchmark treatment (1PG)**, subjects participate in 12 periods of a typical linear public good game in randomly rematched groups of four players. All players receive an endowment of 60 tokens per period and simultaneously decide how to share this endowment between a private account and a collective account. Players receive 4 points for each token that they

¹Cp. the surveys by Ledyard (1995) or Andreoni (2006, 2007).

put in their private account. Additionally, all players in the group earn 2 points for each token that is put in the collective account by themselves or by any other player (i.e. $MPCR = .5$).

The **unpacking treatment (2PG)** only differs with respect to the number of collective accounts that the players face. Instead of a single collective account, players now have to decide how to share the endowment between their private account and *two* collective accounts. The returns from the accounts are the same as before: For each token that a player puts in the private account, he receives 4 points. Additionally, each token in either collective account pays two points to all players in the group – so again, the $MPCR$ equals .5.

The computerized² experiment took place at the Experimental Laboratory of the University of Varese Insubriae in June 2007. We ran 10 sessions with a total of 20 matching groups (160 subjects, mainly students of Economics). In 5 sessions (1PG-2PG), subjects played the benchmark treatment followed by the unpacking treatment. This allows us to perform a within-subject analysis, because we observe each subject under both treatment conditions. Since we are also interested in an across-subject analysis, we reversed the treatment order in the other half of the sessions (2PG-1PG). The reversion additionally helps to identify possible order effects (anchoring).

In all sessions, instructions were distributed only at the beginning of each part and read out aloud.³ Afterwards, participants could pose clarifying question in private and had to answer a set of control questions to ensure that everybody had understood the game. A session lasted about one hour. Points earned were accumulated over all periods and converted at an exchange rate of 1 Euro per 600 points. Subjects earned on average 12.86 Euro.

Behavioral Predictions

If all players would contribute their total endowment to the collective account(s), they would earn 480 points each (instead of 240). However,

²Fischbacher (2007)

³The treatment switch was announced only at the end of the first twelve periods (see Andreoni 1988 or Croson 1996 for similar designs). English translations of the instructions for both treatments are provided as supplementary material.

because selfish and rational players have a dominant strategy to free-ride, zero contribution of all players is the unique subgame-perfect Nash equilibrium in each period of the finitely repeated linear public good game – in treatment 1PG as well as in 2PG. If one moves away from the standard assumptions and introduces, e.g., fairness or efficiency concerns, this affects the hypothesized behavior in both treatments in the same way and to the same degree. Thus, any observed difference in contributions between treatments should be due to the unpacking effect of splitting up the public good.

3 Results

Unexperienced Subjects

Figure 1 illustrates the average contributions for the first twelve periods in both treatments.

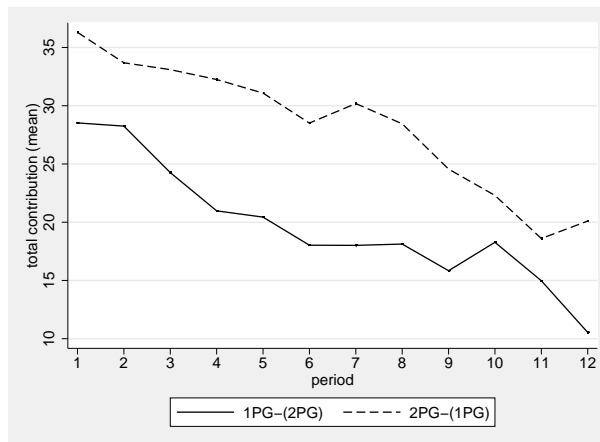


Figure 1: Mean contributions per period before the restart

The effect of unpacking the public good is strong and significant. Overall, subjects contribute on average 43.6% more when they face two rather than only a single public good (ranksum test, $p \leq .01$, 2-sided). The difference in contribution between the treatments remains stable and significant over time (cp. Table 1). The panel regression results reported in Column (1) of Table 2 are in line with the nonparametric analysis. The coefficient of 7.3

for the treatment indicator ($2PG-1PG$) is significantly positive.

Table 1: Mean contributions to the public good(s) before the restart

	Period(s)					
	1	1-4	5-8	9-12	12	1-12
2PG(-1PG)	36.3	33.8	29.6	21.4	20.1	28.3
1PG(-2PG)	28.5	25.5	18.7	14.9	10.5	19.7
Difference	7.8	8.3	10.9	6.5	9.6	8.6
Prob $> z $	0.003	0.016	0.010	0.096	0.034	0.010
Obs.	160	20	20	20	20	20

Note: This table reports average contributions to the public good(s) for treatment 2PG-1PG and 1PG-2PG (first two rows) and the average difference in contributions between treatments (third row). The fourth row reports p-values from a nonparametric (two-sided) Wilcoxon ranksum test.

Our data thus suggests that voluntary contributions to a public good can indeed be raised when the good is split into fragments.⁴ Unfortunately, the observed unpacking effect is not able to sustain cooperation over the course of time. As is usually observed in linear public goods experiments, low contributions of others in the group induces initially high contributors to subsequently reduce their contribution – resulting in an overall decreasing time trend. This “conditional cooperation” is also present in both our treatments: Subjects react negatively to other group members’ low contributions and vice versa (cp. the highly significant and positive coefficient of *Contribution of others (t-1)* in the regression reported in Table 2). This, in turn, translates into a decline of contributions over time, as can directly be seen from Figure 1, but as is also indicated by the significantly negative coefficient (-1.298) of the time indicator *Period* reported in Column (1) of Table 2.

Experienced Subjects

After period twelve, a restart was announced and treatments were switched. Figure 2 illustrates the development of the average contributions over time (before and after the switch), and Table 3 contains the average contributions

⁴This is not caused by the existence of an additional public good per se, but rather by the fact that subjects in 2PG tend to contribute to both public goods (overall average contributions in 2PG to the two unpacked public goods are 13.53 and 8.91).

Table 2: Regression results: Linear two-way random effects model

Contributions	(1)	(2)
	Periods 1 - 12	Periods 13 -24
2PG-1PG	7.317** (3.055)	-3.977* (2.405)
Contribution of others (t-1)	0.027*** (0.008)	0.017** (0.008)
Period	-1.298*** (0.105)	-1.020*** (0.076)
Contribution (t=12)		0.452*** (0.048)
Constant	26.310*** (2.374)	29.790*** (2.348)
Obs.	1760	1920
Wald χ^2	227	303
Prob> χ^2	0.000	0.000

Note: This table reports coefficient estimates (standard errors in parentheses) from a two-way linear random effects model - accounting for both potential individual dependency over time and dependency within each matching group. The dependent variable is the total contribution to the public good(s) in each period. *Contribution of others (t-1)* is the sum of the other group members' contributions to the public good(s) in the previous period. *Period* captures the time trend by indicating periods 1 to 24. *Contribution (t=12)* indicates individual contributions in period 12. Treatment order *1PG-2PG* serves as the reference category (i.e. in periods 1 to 12, the reference category is 1PG, whereas in periods 13 to 24, the reference category is 2PG). Significance level is denoted as follows: *p<0.1, ** p<0.05 and *** p<0.01.

and treatment effects for the periods 13 to 24, as well as the average increase in contributions between period 12 and 13 (restart effect).

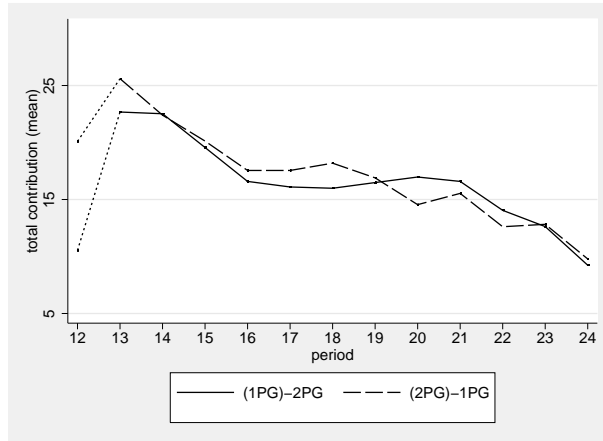


Figure 2: Mean contributions per period before and after the restart

When evaluating the effects of unpacking the public good on ‘experienced’ subjects, we have to take into account the fact that, due to the unpacking effect, contributions in period 12 of 2PG-1PG are significantly higher than those of 1-PG-2PG. Therefore, a direct comparison of the average contributions in the second phase of the experiment is difficult to interpret – and without a correction for the differences in the game history in the first phase of the experiment, one might indeed be tempted to conclude that the unpacking effect does not affect subjects’ behavior in the second half (cp. Figure 2 and Table 3).⁵

Table 3: Mean contributions to the public good(s) after the restart

	Period(s)			Restart Effect
	13	24	13-24	Period 13-12
2PG-1PG	25.6	9.8	17.0	+27.4% (+5.5)
1PG-2PG	22.7	9.2	16.6	+115.2% (+12.1)
Prob > z 	0.450	0.545	0.940	0.016
Obs.	20	20	20	20

⁵For the same reason, test statistics from a simple within-subject analysis would be meaningless, so we do not report them in the following.

However, even experienced subjects are prone to the unpacking effect. First, consider the strong asymmetry in the strength of the restart effect as reported in Table 3. Between periods 12 and 13, the average jump in contributions when moving from 2PG to 1PG is only 27.4% (or 5.5 units), whereas it is 115.2% (or 12.1 units) when moving from 1PG to 2PG, the difference being significant (ranksum test, $p = .016$, 2-sided). Second, the panel regression results for the second half of the experiment as reported in Column (2) of Table 2 show that, when controlling for the individual contributions in period 12, the coefficient for the treatment indicator (*2PG-1PG*) is again significant (-3.977). We thus conclude that the unpacking of the public good not only stimulates contributions of unexperienced subjects but also induces experienced subjects to contribute more.

4 Concluding Remarks

To the best of our knowledge, we are the first to show that the splitting of a single public good into distinct but identical parts strongly and significantly increases subject's voluntary contributions in a laboratory experiment. This unpacking effect even persists when subjects are experienced (in the sense that they already participated in a single public good game).

In comparison to the existing possible solutions of the public goods dilemma in the literature (e.g. funding public goods with lotteries, Morgan and Sefton 2000; introducing costly opportunities to punish free-riders, Fehr and Gächter 2000, Maslet et al. 2003, Nikiforakis and Normann forthcoming), our concept of unpacking public goods does not suffice to sustain cooperation in the long run. However, our framing idea is characterized by its appealing simplicity and practicability, and it is able to increase contributions in the short run. In this regard, unpacking appears to be a good means in situations involving one-shot interactions.

The scope of the existing research on the unpacking effect is usually limited to individuals' judgements and beliefs, and the corresponding evidence typically stems from hypothetical questionnaire studies. With respect to this,

we show that unpacking affects *actual decisions* in an incentivized environment. Along the same line, the present article also informs the literature on contingent valuation methods. Existing studies already demonstrate serious flaws from evaluating a project or assigning economic values to (natural) resources by asking citizens for their hypothetical willingness to pay (e.g. Kahneman et al. (1999)). In view of the present paper, the resulting estimations might be biased alone by asking citizens to state dollar valuations for more than one ‘sub-project’ at the same time. More generally, the unpacking effect that we present here might potentially be of importance for a broad range of mechanisms involving individually subdividable decisions.

If the unpacking effect is used outside the lab environment, splitting a public good will frequently coincide with providing more detailed information about the usage of the voluntary contributions – which in itself might increase voluntary contributions, because individuals tend to donate more when they manage to identify recipients (cp. Small and Loewenstein 2003). While NGOs presently try to make use of this *identifiable victim effect* by providing information about the specific projects that are supported, in light of our results NGOs might even do better if they additionally would ask donors to simultaneously decide on a contribution *to each* (or a subset) of these distinct projects, instead of asking for *a single* contribution to the NGO’s program in general. Yet, the test of this interesting implication of our results is for a separate empirical field study.

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Supplementary Material - Instructions

Instructions were originally written in Italian. Instructions for the second phase were distributed at the end of the first phase.

FIRST PHASE

[ALL TREATMENTS]

Welcome. Thanks for participating in this experiment. If you follow the instructions carefully you can earn an amount of money that will be paid to you in cash at the end of the experiment. During the experiment you are not allowed to talk or communicate in any way with other participants. If you have any questions raise your hand and one of the assistants will come to you to answer it. The rules that you are reading are the same for all participants.

General rules

In this experiment there are 16 persons who will interact for 12 periods. At the beginning of each period you will be assigned randomly and anonymously to a group of four people. Therefore, of the other three people in your group you will know neither the identity nor the earnings.

How your earnings are determined

[1PG-2PG]

In each of the 12 periods you have to decide how to allocate an endowment of 60 tokens between a PRIVATE ACCOUNT and a COLLECTIVE ACCOUNT, considering the following:

- for each token that you allocate to the PRIVATE ACCOUNT, you receive 4 points;
- for each token allocated to the COLLECTIVE ACCOUNT by you or by any other of the members of your group, every group member receives 2 points.

At the end of each round the computer will display how many tokens you have allocated to the PRIVATE ACCOUNT, how many tokens you have allocated to the COLLECTIVE ACCOUNT, how many points have been allocated by your group to the COLLECTIVE ACCOUNT, how many points you have obtained from the PRIVATE ACCOUNT, how many points you have obtained from the COLLECTIVE ACCOUNT, and how many points you have obtained in total in the period.

[2PG-1PG]

In each of the 12 periods you have to decide how to allocate an endowment of 60 tokens between a PRIVATE ACCOUNT, a COLLECTIVE ACCOUNT A and a COLLECTIVE ACCOUNT B, considering the following:

- for each token that you allocate to the PRIVATE ACCOUNT, you receive 4 points;
- for each token allocated to the COLLECTIVE ACCOUNT A by you or by any other of the members of your group, every group member receives 2 points;
- for each token allocated to the COLLECTIVE ACCOUNT B by you or by any other of the members of your group, every group member receives 2 points.

At the end of each round the computer will display how many tokens you have allocated to the PRIVATE ACCOUNT, how many tokens you have allocated to the COLLECTIVE ACCOUNT A, how many tokens have been allocated by your group to the COLLECTIVE ACCOUNT A, how many tokens you have allocated to the COLLECTIVE ACCOUNT B, how many tokens have been allocated by your group to the COLLECTIVE ACCOUNT B, how many points you have obtained from the PRIVATE ACCOUNT, how many points you have obtained from the COLLECTIVE ACCOUNT A, how many points you have obtained from the COLLECTIVE ACCOUNT B and how many token you have obtained in total in the period.

[ALL TREATMENTS]

At the end of the experiment the total number of points you have obtained in the 12 periods will be converted in Euros at the rate 600 points = 1 Euro.

SECOND PHASE

[ALL TREATMENTS]

The experiment includes a second phase. If you follow the instructions carefully you can earn an amount of money that will be added to what obtained in the first phase of the experiment. We remind you that during the experiment you are not allowed to talk or communicate in any way with other participants. If you have any questions raise your hand and

one of the assistants will come to you to answer it. As in the previous phase, the rules that you are reading are the same for all participants.

The general rules are the same of those used in the previous phase of the

experiment. For your convenience we repeat them as follows.

In this experiment there are 16 persons who will interact for 12 periods. At the beginning of each period you will be assigned randomly and anonymously to a group of four persons. Therefore, of the other three people in your group you will know neither the identity nor the earnings.

The only differences between this phase and the previous one concern the rules used to determine your earnings.

[1PG-2PG]

In each of the 12 periods you have to decide how to allocate an endowment of 60 tokens between a PRIVATE ACCOUNT, a COLLECTIVE ACCOUNT A and a COLLECTIVE ACCOUNT B, considering the following:

- for each token that you allocate to the PRIVATE ACCOUNT, you receive 4 points;
- for each token allocated to the COLLECTIVE ACCOUNT A by you or by any other of the members of your group, every group member receives 2 points;
- for each token allocated to the COLLECTIVE ACCOUNT B by you or by any other of the members of your group, every group member receives 2 points.

At the end of each round the computer will display how many tokens you have allocated to the PRIVATE ACCOUNT, how many tokens you have allocated to the COLLECTIVE ACCOUNT A, how many tokens have been allocated by your group to the COLLECTIVE ACCOUNT A, how many tokens you have allocated to the COLLECTIVE ACCOUNT B, how many tokens have been allocated by your group to the COLLECTIVE ACCOUNT B, how many points you have obtained from the PRIVATE ACCOUNT, how many points you have obtained from the COLLECTIVE ACCOUNT A, how many points you have obtained from the COLLECTIVE ACCOUNT B and how many token you have obtained in total in the period.

[2PG-1PG]

In each of the 12 periods you have to decide how to allocate an endowment of 60 tokens between a PRIVATE ACCOUNT and a COLLECTIVE ACCOUNT, considering the following:

- for each token that you allocate to the PRIVATE ACCOUNT, you receive 4 points;

- for each token allocated to the COLLECTIVE ACCOUNT by you or by any other of the members of your group, every group member receives 2 points.

At the end of each round the computer will display how many tokens you have allocated to the PRIVATE ACCOUNT, how many tokens you have allocated to the COLLECTIVE ACCOUNT, how many points have been allocated by your group to the COLLECTIVE ACCOUNT, how many points you have obtained from the PRIVATE ACCOUNT, how many points you have obtained from the COLLECTIVE ACCOUNT, and how many points you have obtained in total in the period.

[ALL TREATMENTS]

As in the previous phase, at the end of the experiment the total number of points you have obtained in the 12 periods will be converted in Euros at the rate 600 points = 1 Euro. At this point, the computer will show you the total earnings (in Euros) obtained in the experiment.