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Two are better than one! Individuals' contributions to "unpacked" public goods☆

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ABSTRACT

We experimentally demonstrate how "unpacking" provides a possible approach for mitigating the dilemma of public goods provision through private contributions. Subjects' total contributions increase when a single public good is split into two identical public goods.

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 the "unpacking effect" (Rottenstreich and Tversky, 1997). First studied in relation to the formation of subjective probabilities, unpacking effects have since been found to occur in several situations, including the economic evaluation of bundles of private goods (Diamond and Hausman, 1994; Bateman et al., 1997).

In order to test whether the "unpacking effect" provides a possible approach for mitigating a public goods dilemma, we conduct a laboratory experiment in which a single public good is split into two identical fragments, and subjects have to choose their contributions *to each* of them *separately*. Comparing the results to a benchmark treatment with only a single public good, we observe that unpacking leads to an increase in total contributions. This suggests that contributions are super-additive in the number of identical public goods. A possible explanation for our results is that fragmenting a public good into two identical parts makes cooperation a more salient strategy — or, in the terminology of Support Theory, increases the support for cooperation relatively to the alternative.[1]

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 divide this endowment between a private account and a collective account. Players receive 4 points for each token that they put in their private account. Additionally, all players in the group earn 2 points for each token they or any other player puts in the collective account — i.e., marginal per capita return (MPCR) = .5.

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[1] One could think of several alternative mechanisms that mediate the unpacking effect. Indeed, the literature up to now is still far from being conclusive, trying to attribute their findings to enhanced availability of information, repacking, and anchoring (Van Boven and Epley, 2003).

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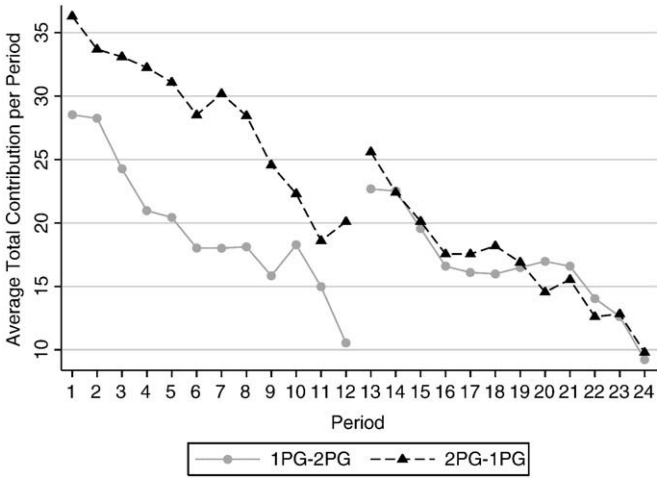

Fig. 1. Mean contributions per period.

In the *unpacking treatment (2PG)*, groups are formed according to the same procedure explained above and players divide the 60 tokens between their private account and *two* identical collective accounts, each of which implying the same MPCR as in 1PG.

At the end of each period, players are informed about the number of tokens their group contributed to (each of) the collective account (s) and the payoff in points from the private, from the collective account(s) and in total.

The computerized[2] 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 economics students). Subjects in five of the sessions played the benchmark treatment followed by a surprise restart with the unpacking treatment (1PG–2PG); the order was reversed in the other half of the sessions (2PG–1PG). The reversion helps identify possible order effects.

In all sessions, instructions were distributed at the beginning of each part and read out aloud.[3] After hearing the instructions, participants could pose clarifying questions in private and had to answer a set of control questions to ensure they understood the game. The accumulated points were converted at an exchange rate of 1 Euro per 600 points (average earning 12.86 Euro).

Under classical assumptions, a contribution of zero in each period is the unique subgame-perfect Nash equilibrium in both treatments. Alternative assumptions, e.g., fairness or efficiency concerns, should affect hypothesized behavior in both treatments in the same way. Thus, any observed difference in contributions between treatments should be due to the unpacking effect.

3. Results

3.1. Inexperienced subjects

Total average contributions for the first twelve periods in both treatments are illustrated in Fig. 1. The effect of unpacking the public good is strong and significant from period 1 on and remains stable over time (cp. Table 1). Overall, subjects contribute on average 43.6% more when they face two rather than only one public good (rank sum test, $p \leq .01$, 2-sided[4]). The panel regression results reported in Column (1) of Table 2 are in line with the nonparametric analysis.

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

Notes: The fourth row reports *p*-values from a nonparametric (two-sided) Wilcoxon rank sum test. With the exception of the first period (where individual contributions are independent), statistical tests are based on matching group averages.

Table 2
Regression results: linear two-way random effects model.

Contributions in periods	(1) 1–12	(2) 13–24	(3) 1–12	(4) 13–24
2PG–1PG	7.317**	−3.977*	9.517***	−5.182**
	(3.055)	(2.405)	(3.273)	(2.600)
Contribution of others ($t-1$)	0.027***	0.017**	0.050***	0.007
	(0.008)	(0.008)	(0.016)	(0.011)
Period	−1.298***	−1.020***	−1.272***	−1.005***
	(0.105)	(0.076)	(0.106)	(0.076)
Contribution ($t=12$)		0.452***		0.452***
		(0.048)		(0.048)
Contribution of others ($t-1$)*2PG–1PG			−0.030*	0.022
			(0.018)	(0.017)
Constant	26.310***	29.790***	24.714***	30.048***
	(2.374)	(2.348)	(2.520)	(2.372)
Obs.	1760	1920	1760	1920
Wald χ^2	227	303	231	305
Prob> χ^2	0.000	0.000	0.000	0.000

Notes: 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 ($t-1$)* stands for 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 12 and 13 to 24. *Contribution ($t=12$)* indicates individual contributions in period 12. Treatment *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: * $p<0.1$, ** $p<0.01$ and *** $p<0.01$.

The coefficient of 7.3 for the treatment indicator (*2PG–1PG*) is significantly positive.

Our data thus suggests that voluntary contributions increase when the good is split into fragments.[5] However, the observed effect cannot sustain cooperation over the course of time. Consistent with the phenomenon of conditional cooperation documented in other linear public-good experiments (e.g., Fischbacher et al., 2001), we observe a positive and significant relation between contributions and the number of tokens allocated to the collective account by the other group members in the previous period (cp. the coefficient of Contribution of others ($t-1$) in Column (1) of Table 2). The interaction term in Column (3) of Table 2 suggests that conditional cooperation in periods 1 to 12 tends to be weaker in the 2PG case. This effect is, however, only marginally significant ($p=0.089$).

3.2. Experienced subjects

After period twelve, a restart was announced and treatments were switched. Fig. 1 and Table 3 describe subjects' behavior for periods 13

[2] Fischbacher (2007).
[3] The treatment switch was announced only at the end of the first twelve periods (cp. Andreoni, 1988).
[4] With the exception of the first period (where individual contributions are independent), all reported statistical tests are based on matching group averages.
[5] This 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 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	

Notes: The third row reports *p*-values from a nonparametric (two-sided) Wilcoxon rank sum test. Statistical tests are based on matching group averages.

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

When evaluating the effects of unpacking the public good on "experienced" subjects, we have to take into account the fact that contributions in period 12 of 2PG–1PG are significantly higher than those of 1PG–2PG due to the unpacking effect. 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 be tempted to conclude that the unpacking effect does not affect subjects' behavior in the second half (cp. Fig. 1 and Table 3).

However, even experienced subjects are susceptible 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 (rank sum 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 from inexperienced subjects but also induces experienced subjects to contribute more. In contrast to periods 1 to 12 we find no significant interaction between the treatment dummy and the lagged contributions from other group members.

4. Concluding remarks

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

In comparison to existing possible solutions of the public goods dilemma (e.g., funding public goods with lotteries, Morgan and Sefton, 2000; introducing costly opportunities to punish free-riders, Fehr and Gächter, 2000; Nikiforakis and Normann, 2008), our concept does not suffice to sustain cooperation in the long run. However, it 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.

In contrast to the existing research on the unpacking effect, we show that unpacking affects *behavior* 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 about 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 might potentially be of importance for a broad range of mechanisms involving individually subdividable decisions.

Outside the lab, 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 are able to identify recipients (cp. Small and Loewenstein, 2003). While NGOs currently try to make use of this *identifiable victim effect* by providing information about the specific projects they support, in light of our results NGOs might do even better if they additionally asked donors to decide simultaneously on a contribution *to each* (or a subset) of these distinct projects, instead of asking for *a single* contribution to the program in general. Yet, the test of this interesting implication is for a separate empirical field study.

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