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Reputation and household recycling practices: Field experiments in Costa Rica

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ABSTRACT

Pro-environmental behavior is the willingness to cooperate and contribute to environmental public goods. A good understanding of why individuals undertake pro-environmental actions is important in order to construct policies that are aligned with preferences and actual behavioral patterns, such as concern for social esteem and reputation. In this paper, we present the results of a framed field experiment that explores reputation formation as a driver in support of household recycling practices. We use a "shame" and a "pride" treatment to test which is more effective, if at all, in increasing recycling effort. We find that reputational concerns indeed play a role in shaping individual pro-environmental behavior. Surprisingly, subjects cooperate more if the situation is framed as avoiding shame (bad reputation) rather than as acquiring pride and gratitude (good reputation). The actual experiment is based on a real recycling program, with participants who are heads of urban households in Costa Rica.

1. Introduction

In Costa Rica, insufficient attention is being paid to the country's rapid economic development and sprawling urbanization. The main consequences of these phenomena are urban pollution and congestion due to soaring traffic, and drastically inappropriate management of waste water and solid waste. San Jose, the most urbanized city in Costa Rica, is facing the problem of increasing waste generation which it is not prepared to handle. In fact, more than 60% of daily waste ends up in open landfills leading to increasing health and environmental risks to its residents. Moreover, a considerable amount of domestic waste is illegally disposed of. Although one third of households in San José claim to do some sort of recycling, on average less than 10% of the city's waste is recycled after suitable separation at the household (Census Costa Rica, 2011).

Current solid waste management practices in San Jose involve daily or weekly curbside collection by municipalities. The lack of infrastructure for recyclable materials, the absence of separation centers, and limited funding for the creation of proper landfills are some of the main obstacles to the further development of source separation and waste reduction. Recently, the government of Costa Rica passed a legislation aimed at reducing pollution by modifying how people dispose of their waste and how much they recycle. 'The Solid Waste Plan for Costa Rica' (Presol, 2008) suggests improving waste management practices through technical innovation, increasing the number of landfill projects and promoting source separation to significantly reduce the volume going to final disposal. Nevertheless, until now there has been little organizational effort to facilitate waste recycling by private households. So far, only some community-run recycling and education centers have been initiated, including the set-up of information guides for households, the operation of collection trucks and the establishment of centralized separation centers. This may not be sufficient in scale to contribute significantly to environmental protection and conservation. To understand how to encourage participation in recycling activities, the current research investigates the role of public disclosure of individual behavior in promoting recycling.

The objective of this paper is to explore non-monetary incentives affecting the decision to engage in recycling activities at the household level, involving costly and time-consuming effort. This is motivated by broad anecdotal evidence from developing countries suggesting a key role for social sanctions and rewards in promoting prosociality in informal settings, like community organizations. In particular, we investigate the hypothesis that people can be motivated by feelings of pride, shame or both when their behavior is disclosed to their neighbors. Moreover, we also explore whether shame or pride is the more effective mechanism in enhancing pro-environmental behavior. Finally we also test whether an environmental regulation crowds recycling effort in or out, particularly for those already committed to the task.

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We use a modified public goods experiment to study the effect of exposing behavior that falls below a set threshold of acceptable effort. While the threshold for adequate behavior is oftentimes endogenous in real life, the threshold in our own experiment was determined ex-ante and set by the experimenter. The use of a threshold was motivated by the fact that a municipal solid waste management program based on separation at the source (household) requires a minimum level of effort by a significant number of households, as otherwise the high fixed costs associated with waste management might render the whole program financially unviable for the municipal government.

In our field experiment, people participated in a series of one-shot, modified threshold public goods games. In a typical threshold public goods game, participants are given a certain endowment that they may either contribute to a public good or keep to make up their personal payment. Only if a group of participants collects a pre-announced target is the public good provided, and its payoff is evenly divided among the group. However, if contributions are insufficient, the public good is not provided and any contributions are lost. In some variants of the game, the contributions are refunded if the target is not met (Marks and Croson, 1998). To our knowledge, only a few experimental studies have examined the determinants of local public goods provision in developing countries with a threshold involved. For example, De Hoop et al. (2010) shows that people are willing to contribute substantially to a health education program in Peru which is only realized if the cumulative investment surpasses a certain threshold value. Carlsson et al. (2010) study the impact of social influence on individual willingness to contribute to the funding of a bridge in a rural village in Vietnam and find significant and substantial effects when reference information on the behavior of others is provided. For example, if the reference level is zero contribution, this reduces average donations by almost 20%.

These previous field experiments focus on typical donations with the possibility of a refund, thus ignoring the fact that much individual pro-environmental behavior, in particular household recycling effort, is devoted to goals that exclude the possibility of refunding: once significant effort is spent sorting the household's waste, that effort cannot be undone if the municipal government fails to deliver on the promise of keeping waste separated for final disposal or reuse. In our experimental design, we implement a field experiment involving contributions to a real community project under different incentive structures. The situation was framed as a decision on how much effort (time) to dedicate to recycling, since time is likely to be the largest cost associated with sorting solid waste in a household. If a group of four participants reached a minimum total time dedicated to recycling, the monetary value of that time was then donated to fund an education program in the community aimed at encouraging solid waste management. If the threshold was not met, the value of the recycling effort was not donated, neither refunded, and hence was lost. In terms of our frame, if families do not support the program with their effort so that the threshold is met, then the municipal solid waste management program collapses and all the effort goes to waste. Our three treatments consisted of one designed to expose groups below the threshold (shame treatment) and a second one aimed at rewarding those above the threshold (pride treatment). Moreover, we compare these results to a treatment with an environmental regulation mandating a minimum contribution to the public good. In this way, the impact of an external intervention on intrinsic motivation can be examined. We also asked participants to fill out a questionnaire in order to assess the effect of individual characteristics and social context on experimental outcomes.

We find that disclosure of information leads to approximately 20–30% higher investments in conservation, demonstrating that both shame and pride can increase pro-environmental behavior. Surprisingly, we observe that negative information provision in the form of shame and disapproval results in higher average contributions to the public good compared to the pride treatment. We also find that a standard environmental regulation can crowd in pro-environmental behavior (i.e. more recycling takes place above and beyond the minimum regulated mandate), probably as a result of eliminating the risk of not meeting the threshold. Our insights point the way toward effective communication strategies to increase recognition of pro-environmental behavior and motivate public support for environmental conservation polices.

The premise in these papers that efforts to design successful environmental policy instruments and regulations may want to consider the role of pro-social motivations underlying sustainable and unsustainable behaviors. Pro-sociality can be defined as a behavior that benefits others at a cost to oneself (Andreoni, 1989; Rabin, 1993; Fehr and Fischbacher, 2003; Bénabou and Tirole, 2006). Recent studies have investigated the important implications of pro-social behavior for environmental conservation, i.e. pro-environmental behavior (Stern, 2000; Biel and Thøgersen, 2007; Hage et al., 2009; Steg and Vlek, 2009). Experimental evidence affirms the significance of pro-social motivation in environmental conservation, such as sustainable harvest from common-pool resources or investments in climate change mitigation (Ostrom et al., 1994; Milinski et al., 2008).

There may be different motives for individuals to behave pro-environmentally. Deci (1972) argues that an individual's intrinsic motivation, a form of impure altruism (Andreoni, 1989), is the main motivator of individual behavior. Related social preferences like fairness or reciprocity are other explanations (Fehr and Schmidt, 1999; Gintis et al., 2003). Extrinsic motivations (taxes, charges, levies, subsidies) that alter cost-benefit ratios will also shape an individual's motivation to behave pro-environmentally, although not always as expected. A growing literature predicts that such external incentives can conflict with intrinsic motivation and could partially or wholly crowd out environmental preferences (Frey, 1997; Cardenas et al., 2000; Gneezy and Rustichini, 2000; Heyman and Ariely, 2004; Ariely et al., 2009).

Research in behavioral economics and social psychology suggests that social interaction shapes pro-social environmental behavior too. In fact, many people engage in pro-social behavior in order to improve their image and reputation, hoping to feel proud or trying to avoid feelings of shame (Gächter and Fehr, 1999; Rege and Telle, 2004; Semmann et al., 2005; Bénabou and Tirole, 2006). In this sense, pride and shame can be classified as moral emotions or sentiments able to promote prosociality (Goldberg, 1991; Haidt, 2003). Similar behavioral effects have been found for other (negative) emotions such as guilt. For example, Ketelaar and Au (2003) find that individuals are more likely to cooperate in social dilemmas when they experience guilt. These findings suggest that social interactions, including feelings of pride, shame and others, may be an effective strategy to foster more environmentally friendly behavior when such behavior is the social norm (Stern, 2000; Markowitz and Shariff, 2012).

Shame and pride are common forms of social sanctions and rewards to encourage desired behaviors. For example, the best and worst students in schools are often disclosed and singled out in front of their entire class. In Mexico, the worst-performing student has to wear “orejas de burro” (donkey ears) during class time to signal his/her negative evaluation by the teacher to others, while the best student is awarded with a crown to positively stand out from others. Such rules or “policy” is supposed to motivate students to learn and strive for better achievements. Another example from Latin America is that small shopkeepers in Costa Rica publish the name of the largest debtors on a list posted next to their cash counters. This reflects the assumption that feelings of shame and guilt are strong incentives to shape behavior, even when monetary incentives like fines or interest on the debt fail to do so.

Our study contributes to several strands of literature. First, there are a number of studies that employ information disclosure to motivate cooperative behavior and investigate its impact on public good provision in the laboratory as well as in the field. One prominent example is Rege and Telle (2004) who use a one-shot public goods game where all subjects' identities were revealed after contribution decisions were made. Contributions increased from 34.4% in the treatment without disclosure

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and approval possibilities, to 68.2% in the approval condition. Lopez et al. (2009), in a framed field experiment with coastal communities using a standard linear public goods game, randomly reveal one member out of the five-person group and find that contributions to the public good increase from 14.6% without random revelation to 20.2% when the contribution is revealed. Barr (2001) obtained similar results in rural communities in Africa. A unique feature of our study is that in our case we vary the level of identity revelation while the previous one relied on making all contributions public. In our case we alternate recognizing high and low contributors. We also contribute to a number of studies which have evaluated public recognition to increase charitable donations. For example, List et al. (2004) confirm the increase of donations to an environmental charity if made public in a field experiment. Similarly, Alpizar and Martinsson (forthcoming) find that donations upon entering a protected area are significantly more frequent for individuals who are members of a group, compared to visitors arriving alone to the park. Moreover, when a third party is present, total donations by individuals who are part of a group are significantly higher. We complement this literature by studying donations in a framed field experiment with public good character.

Lastly, we contribute to a number of natural field experiments on non-monetary performance incentives focusing on the study of employment relations. For example, Ashraf et al. (2014) study experimentally how non-financial rewards affect work performance in public organizations. Some, such as Kosfeld and Neckermann (2011), Ashraf et al. (2014) and Bradler et al. (2013) use natural field experiments in firms to analyze how non-financial rewards, that means positive social recognition, affect employee work effort and others, like Kube et al. (2012) focus on actual non-monetary gifts. All find very large effort effects. A distinguishing feature of our study is that most of the empirical paper inclusively focused on real effort experiments or real world labor settings, while we study how to solve a collective action problem using a variant of a public goods game.

The remainder of this paper is structured as follows. Section 2 introduces the experimental design as well as details about the procedure. Section 3 presents the organization of the experiment, while results are given in Section 4. Section 5 draws conclusions and derives policy lessons.

2. Experimental Design

We apply a modified threshold public goods game sharing features of the work of Milinski et al. (2008) to a field context. The game can be characterized by three main features: First, four players can make contributions to a public account to ensure provision of a public good. Second, the public good is only provided in case contributions of a group of four players do reach a required preset threshold or target. The latter is a typical feature of threshold public goods game. Third, unlike traditional versions of the game, there is no direct redistribution of benefits to participants. Instead, the money of the public account is donated to a local NGO to finance services such as the set-up of recycling workshops in the community. In fact, the scale of the recycling program and number of workshops would depend on how much in total participants contributed. So again, whether the NGO service is provided hinges on whether or not a critical threshold is reached.

In our framed field experiment, subjects are assigned to groups of four players and individual endowment is set at 5 points, which is denoted as x_i.[1] Participant i can divide his or her total initial endowment between a public and a private account. A random partner matching protocol was applied, thus subjects remained anonymous to the other members in their group during the course of the experiment. In order to enhance external validity, we tried to keep the experiment as close as possible to the participant's daily household behavior and therefore framed the instructions using frame-specific terminology. In this sense, participants were instructed that each point of their endowment was equivalent to either an hour of leisure or an hour of recycling effort per month.[2] Besides labeling contribution decisions as recycling effort or leisure time, the public account is described for a local public good, in our case the funding of recycling workshops and education in the community. In fact, the contributions collected in the public account would be donated to a local NGO[3] to fund recycling workshops in the community.[4] Overall, the use of frame-specific wording ensured that the experiment represents an actual environmental problem, in our case recycling and waste reduction (experimental instructions can be provided by the authors upon request).

Another essential design characteristic involves the fact that donations to the NGO took place only in case the group total allocated to the public account reached or surpassed a contribution threshold, in our case set at 12 points. Note that this means that the individual threshold is set at 3 points, assuming an equal contribution burden per participant. This reflects a serious individual commitment, as this makes up more than 60% of each player's endowment. Yet, demanding a rather high effort better reflects our case study, as a lower commitment and thus lower effort in carrying out recycling would only negligibly contribute to the success of a recycling program. Similarly, Milinski et al. (2008) assume a high and strong commitment (50% of endowment) to secure climate protection in their modified threshold public goods game. In our game, if voluntary contributions were insufficient to meet this collective goal, the group contribution was lost and remained with the experimenter. The instructions contained an explicit declaration on this point to assure participants of the fate of their contributed money. All group members always kept any endowment not invested into the public account.

In order to facilitate comprehension of individual payoffs corresponding to $5 - x_i$, we constructed a payoff matrix that was shown during the course of the experiment to the participants. All possible combinations of the earnings from contributions for participant i can be read from the matrix (see Table 1). The exchange rate used for the payment in the experiment was 1000 Costa Rican Colones (CRC) for 1 point.[5]

To measure the level of contributions under different incentives, our participants were divided into two sessions, which we here refer to as pride and shame sessions, although we did not use those descriptions in the experiment. See Table 2 for detailed characteristics of the experimental design. The sessions proceeded as follows. Our control round (Round 1) is essentially a modified threshold public goods game, as described above. In Round 2, participants play the same game with one modification: we told all group members prior to their decision that, at the end of this round, the experimenter will assign a red flag to participants who contributed less than 3 points in the shame sessions and a green flag to participants who contributed more than 2 points in the pride sessions. Note that in no session sanctioning and rewarding

[1] We ran various pilots with a higher endowment (10 points) but it quickly became apparent that larger endowments lead to excessive nervousness in our subject pool. Moreover, tokens of lower value were also considered and disregarded, as subjects were more comfortable with rounded numbers.

[2] Note that the hourly average wage of the sampled population amounts roughly to US$3, which corresponds closely to a 1 point endowment equal to US$2.

[3] The local NGO is called Terranostra. It is a well-known and active NGO in Costa Rica, with experience in solid waste management. Its good reputation and trustworthiness among Costa Rica's citizens established credibility that the money donated by the participants would be used for its intended purpose.

[4] A reader of the manuscript pointed to the possibility of differing motivations for donating to a simple charity and recycling in more general, which would cofound our results. We agree that people may show different degrees of pro-social behavior depending on the specific context. Nevertheless, due to vast empirical evidence of quite stable altruistic motives for many types of voluntary contributions to public goods, including monetary contributions to charities, household recycling activities, and voting (e.g., Meier, 2007), we find it plausible to use donations to an environmental charity as best proxy for the willingness to recycle in one's household.

[5] At the time of the experiment, the Dollar-Colones exchange rate was approximately US$1 = 500 Colones (Col.).

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Table 1
Example of payoff matrix.

Points in private account	Your payment	Points in public account	Your contribution to the recycling program if your group collects at least 12 points
0	0 Col.	5	5000 Col.
1	1000 Col.	4	4000 Col.
2	2000 Col.	3	3000 Col.
3	3000 Col.	2	2000 Col.
4	4000 Col.	1	1000 Col.
5	5000 Col.	0	0 Col.

Table 2
Experimental design.

Type	Subjects	Round			
		1	2	3	4
Pride	118	Control	Pride	Regulation	Pride
Shame	119	Control	Shame	Regulation	Shame
Total	237				

were exerted at the same time. Rewarding and punishing by assigning green and red flags visible to all participants provided public information. In fact, participants were told that research assistants will verify all individual decisions at the end of this round and assign flags in case contribution decisions met the criteria just explained before. Once all decisions were verified and assistants had distributed all flags, participants were requested to look around and take notice of their peer's decisions. This procedure took about 3–5 min and was ended by the experimenter removing the flags from the tables of the participants and the game continued with Round 3. In Round 3, besides having the same characteristics as the decisions in Round 1, all individuals faced a uniform environmental regulation in the form of an obligatory contribution of 3 points. This was the same in both sessions (shame and pride). Finally, in Round 4, subjects were exposed to the same incentives as in Round 2. Again, this means that subjects in the shame session were exposed to red flags, while subjects in the pride session were exposed to green flags. There was no case in which participants had the opportunity to receive red and green flags at the same time in any given round or workshop. On average, we conducted 5 sessions each for our pride and shame treatment. Each session had an average number of around 24 participants and was divided into six groups; the minimum acceptable number of groups was four in any session (an excerpt of the experimental instructions for the pride session is provided in Appendix 1).

One potential concern is that subjects might be affected by the number of red or green flags they observe in Round 2. Note that our combination of random matching and anonymity ensures that subjects cannot learn who is playing with them as part of the group of four participants deciding on the public good, which in turn ensures that behavior is not triggered by awareness of selfish or altruistic behavior in one's own group. Still, if a particular session was characterized by a very high or very low occurrence of red or green flags in Round 2, this might potentially affect coming rounds (in particular, round 4). For example, in the case of observing a high frequency of red flags in round 2, participants may conclude that all other players are very selfish and so decrease their contributions in round 4. We tested this, and strongly rejected that concern (chi-square test, p-value = 0.794 for green flags and p-value = 0.420 for red flags).[6]

We believe that our design accurately captures the decision faced by a given household on whether to engage in separation and recycling activities. A common concern during focus groups is the fact that other households and local governments are ill-prepared to do their part of the separation, collection and transportation processes needed for a successful recycling program, thereby making any effort by individual households futile. The threshold (without refund) public good captures the need to reach a minimum level of separation for any recycling program to be sustainable; otherwise, all effort by households that do make the commitment is most likely lost. Moreover, the separation of solid waste in any given household, particularly in the absence of deposit-refund schemes, as in Costa Rica, is likely to bring very small, if any, individual benefits, and all benefits are to be enjoyed by a very large group of citizens well beyond the individual household. The Milinski et al. (2008) design feature of defining a zero marginal per capita return to the public good in the context of climate change fits our context well too. Finally, we chose to expose individual and not group behavior because, at the level of a neighborhood or a small community (represented by the groups in our experiment), the number of factors affecting the final success of a recycling program are many, responsibility is therefore diluted and group accountability is low. In contrast, a green or red dot at the curbside in front of a house where garbage is separated or not before collected, would be an easy way of identifying individual actions and hence of bringing our treatment into practice.

3. Organization of Experiment

The research took place in an urban neighborhood in the capital city of Costa Rica. Our sample is made up of residents of the community of Santa Rosa. The community of Santa Rosa was selected as it was in contact with a local NGO involved in environmental protection and conservation issues and, until now, no local recycling initiatives have been initiated there. In recruiting people, the same NGO facilitated the organization of invitations (leaflets and posters) and local logistics for each experimental session. The days before experimental workshops were carried out, a member of the NGO advertised the workshops, distributed invitations and signed up interested people for the scheduled experiments.

When the experimental workshops were advertised, potential participants were informed that their task was to make economic choices and that the amount that they would earn depended on their own decisions. Based on the assumption that some of the people who committed may later not show up at the experiments, we chose to sign up the maximum number of people (35 participants) that we would be able to handle in the experiment. Furthermore, we took care that only one member from each household, preferably the head of household, which in most cases was a woman, signed up for the workshops.[7] In total, 237 people took part in the field experiment at the local school or community center during April 2011. Apart from this, we conducted various separate pilot studies in the community with a considerable number of participants (113). Table 3 summarizes the descriptive statistics of the community data and the sampled participants.

On the day of the experiment, the participants who showed up for their experimental session were asked to provide their identity and were checked against the list of names of people who had already participated. By following this strategy, we avoided double participation and possible multiple participation by members of the same household. Once the sign-up procedure was complete, participants were seated at single tables in the community's school or community hall room. The subjects were randomly assigned to their seats with enough space

[6] Additionally, we used OLS regression to test if a high number of red flags in round 2 may lower contributions in round 4 as subjects might assume that they are paired with selfish others. We find no significant influence (significance level 5%). Similarly, we tested if a high number of green flags in round 2 might lower contributions in round 4 as subjects might assume that they are paired with cooperative others. We find no significant influence (significance level 5%).

[7] We acknowledge that great variabilty in session composition, in particular with respect to the number of close acquaintances within the same experiment, may affect behavior. In fact, one would expect that "friends" would contribute more to the public good (e.g., Haan et al, 2006). Nevertheless, the regulation of permitting one family member only to our experiments partly controls for this potential concern.

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Table 3
Descriptive statistics of community data and sampled individuals/households.

	Community	Sample
Population	2360	237
No. of households	439	237
Women	51%	85%
High school completed	62%	56%
Pride treatment		118
Shame treatment		119

Source: Census data (2007), Santa Rosa municipality.

between the desks to guarantee anonymity when making their decisions. From the outset, participants were instructed not to talk to each other and informed that doing so would mean not being permitted to continue and leaving without any payment. They were informed that they were going to take part in a series of decisions in situations that resemble real life situations. We also clarified that our aim was not to teach them how to recycle. Finally, it was made clear that, on the basis of their decisions, they were capable of earning a considerable amount of money.

Every participant received a decision manual containing four decision sheets for each round of play (see Appendix 2 for an example). The decision sheet served as documentation on which participants recorded the number of points distributed between the private and public accounts. They received oral instructions on the objectives of the experimental decision task with the aid of a PowerPoint presentation. Emphasis was placed on their understanding of the payment function. Various examples of a hypothetical participant dividing his/her endowment between the public and private accounts were explained in detail in order to enhance subjects' understanding of this important matter. We decided to present a set of examples of possible distribution choices in order to avoid participants being primed on some particular choice. To make sure that everyone understood the decision task before starting, all participants played a practice round that was designed to test their understanding of the experiment, and any remaining questions were answered in private.

The procedure during Round 1 was as follows: the subjects needed to decide how to distribute their endowment between the public and private accounts. They had to indicate their distribution on their decision sheet. The following instructions were read to them in Spanish before making their decision: *Suppose that the 5 tokens you received are equivalent to time and effort spent recycling. Each token has a value of 1000. We want you to tell us how many tokens you want to put in your personal account, where you are free to spend them as you please, and how many tokens you want to put in the common fund. Remember that you are part of a group of four persons, and that, if the common fund has at least 12 tokens, we will then donate the total amount to Terranostra.* Enough time was given to the participants to think about their distribution decisions. Following this, experimenters checked to see whether all participants had made their decisions, and subjects were advised to turn the page of the decision manual and wait for instructions for the following round.

In the treatments that disclosed information, a team of assistants verified the value of individual contributions and assigned green (red) flags to the concerned players when the session included a pride (shame) treatment. Flags were placed on the table and subjects were asked to look around to get a better impression of the behavior of others. The flags were then removed before the next round started.

Note that group contributions and individual earnings were not computed during the various rounds, and thus no additional information was provided. After all rounds were completed, we asked participants to remain seated and use a standard random procedure to select the round that was to be used as a basis for their payment calculation. We used a random payment mechanism and asked one participant to randomly draw out of a box containing four numbered balls (1–4) to correspond with all rounds played. This procedure made sure that all rounds were equally important and that each participant was paid for one round only. After the end of the experiment and payment selection, the participants were asked to complete a questionnaire aimed at eliciting socio-economic data, motivation in the game, environmental attitudes and social background information.

Finally, subjects received their earnings from the experiment, plus a show-up fee of 2000 CRC ($5). Sessions lasted approximately 2 h, and subjects earned on average 5000 CRC ($10) in total, including the show-up fee. The total sum of money invested in the public account accumulated from all sessions was donated to Terranostra to be used for environmental education in the community after the completion of the study. In total, the sum of $2404 was donated to this local NGO.

4. Experimental Results

A total of 237 observations were gathered in 12 workshops with a minimum size of 4 groups. In this section, we present an overview of the results for all experimental treatments to explore our main research questions: 1) whether information disclosure achieves higher levels of recycling effort; 2) whether positive information disclosure (pride treatment) is more effective than negative information disclosure (shame treatment) in achieving the high levels of household recycling effort needed to justify implementing a municipal recycling system, and how these reputational incentives perform relative to an environmental regulation, and 3) whether an environmental regulation crowds out recycling efforts, particularly on the part of those initially committed (that is in Round 1) to solid waste management. For both questions, we use individual contributions and also observe whether a four-player group is successful in reaching the contribution threshold.

As an order test, all sessions included a Round 4, repeating the reputation treatment (either pride or shame) of Round 2, and we cannot reject the null hypothesis of no order effects. In the analysis that follows, the shame ($n_s = 238$) and pride ($n_p = 236$) treatments include data from both Rounds 2 and 4. These subsamples are then compared to Round 1 (control) in all sessions ($n_c = 237$). Moreover, results from the regulation treatment in Round 3 are not significantly different in sessions with a shame or a pride treatment, so again data from both sessions is pooled ($n_r = 237$).

4.1. Shame and Pride

Table 4 summarizes the average level of individual contributions in the control, pride and shame treatments. In addition, this table shows the success rate of four-player groups (i.e., the proportion of groups reaching the collective threshold of 12 points).[5] In the control treatment, the average investment is below 2 and thus is the lowest relative to all other treatments. As expected, both treatments led to a general increase in average individual contribution and higher group success rates. In the pride treatment, average individual contributions are significantly higher (by 21%) than in the control (t-test, $p = 0.002$). Similarly,

Table 4
Average individual contributions and group success.

Treatment	N	Individual contribution mean (in points)	Group success (# of groups)
Control	237	1.86	14%
Pride	236	2.25	23%
Shame	238	2.58	32%

[5] In some workshops, the number of participants resulted in a few groups of less than four players. Because participants were not aware of whether their group was complete or not, their decisions are still included in the analysis of individual behavior, but dropped from the analysis of group behavior.

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the shame treatment results in contributions that are 39% higher than in the control (*t*-test, p = 0.000).

We also analyze differences in individual contributions between shame and pride treatments. The disclosure of negative information about the subjects' pro-environmental decisions results in significantly higher contributions, compared to the provision of positive information (*t*-test, p = 0.012). Fig. 1 depicts the distribution of individual contributions under the three treatments, clearly showing that the two information disclosure treatments lead to more frequent contribution of amounts higher than, or equal to, three.

Regarding group success in reaching the public good threshold, the disclosure of information increases the number of groups that manage to reach the threshold. In the control treatment, only 14% of all groups succeeded in reaching the contribution threshold, versus 23% and 32% in the pride and shame treatments. Using the group as the statistical unit of analysis, we find that only the disclosure of negative information in the shame treatment significantly increases group success, compared to the control (proportion test, p = 0.016). The difference for the pride treatment is not statistically significant (proportion test, p = 0.215). Although the group success rate in the shame treatment is about 40% higher than in the pride treatment, this difference is not significant (proportion test, p = 0.243). Fig. 2 presents average group contribution by treatment and success rates.

4.2. Environmental Regulation

We also investigate the average number of points when subjects faced a minimum compulsory contribution of three points. This obviously leads to higher mean contributions equal to 3.69 points (p-values = 0.000 in all cases) and a very low standard deviation (std = 0.72, compared to 1.35 in the control), indicating that individual contributions were clustered around the level required by the regulation.

In the regulation treatment, the interesting analysis focuses on the change in the subject's decisions when a compulsory contribution is imposed for subjects that have shown a strong pro-environmental inclination by contributing three or more points in the control. We find that most individuals who contributed exactly three points in the control treatment tend to increase their contributions (in total 85.4%), i.e., when faced with the regulation they contribute more than the compulsory three points (*t*-test, p = 0.000). Moreover, individuals providing more than three points in the control (altruists) mostly maintain their contributions in the regulation treatment, and only 13% decrease their contributions (*t*-test, p = 0.80).

In contrast to our expectations and previous results from field experiments (e.g. Cardenas et al., 2000), we find no evidence that a regulation requiring a minimum contribution crowds out voluntary contributions; rather, most players decided to contribute even more than just the mandated three points. There are several possible explanations for this finding. First, information from the exit questionnaire sheds some light on the reasoning used by most subjects. When asked whether recycling should be regulated by law, more than 80% answered positively. Second, it could be that the compulsory contribution, when applied to a threshold public good game, takes away the uncertainty associated with losing the contributions if your group members fail to reach the threshold. In the contextualization of the experiment, we emphasized the importance of getting everybody involved, because neither the government nor individual households can sustainably implement a solid waste management program on their own. This was again captured by the exit survey, where fear of losing their time and effort in recycling hampers a bigger involvement of the community members in the program. Again, the following reactions to a suggested mandatory recycling program reflect such concern: "if it is mandatory, it forces everyone to be aware of their own responsibility", or "I agree, because in this way we can create a standard protocol and it will be clear for everyone what and how to do it".

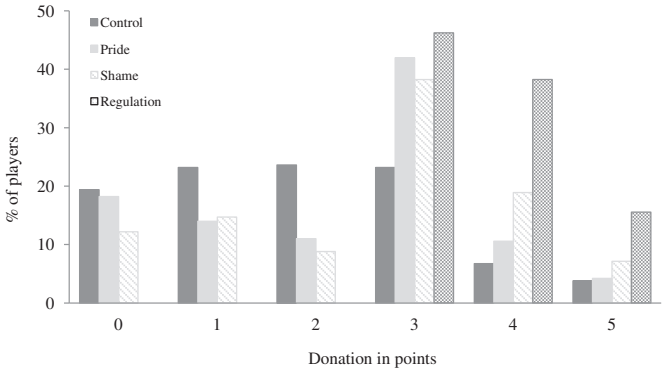

Fig. 1. Histogram of individual contributions in different treatments.

Our explanations are in line with literature pointing synergistically to effects of incentives and social preferences. For example, Shinada and Yamagishi (2007) show in a laboratory setting that a fine introduced on free-riders in a public goods game can promote cooperation by making sure that those who cooperate are less likely to be exploited by defectors. In fact, in their experiment punishment not only transforms free-riders into cooperators, but also enhances cooperation among already cooperative subjects as it takes off the fear of being exploited.

4.3. Individual Types

Continuing with the analysis, we classified subject's decisions into three categories depending on their level of contribution. A subject's decision is considered *selfish* if he/she invested less than three points. *Limited altruists* are subjects who contributed exactly three points to the public good. We call a subject's decision *altruistic* if the participant invested more than three points. The shares of subject's decisions classified into the aforementioned categories in all treatments are shown in Table 5.

Concerning the distribution of subject choices, we observe that, in the control treatment, most subjects behave like free riders, and only a small share of all subjects (11%) can be classified as altruists, i.e., players contributing more than three points. Such results are in line with results from Milinski et al. (2008), which, using a similar experimental design, find that 60% of subjects are selfish.

Importantly, the distribution of selfish, limited altruistic, and altruistic decisions is significantly different in the treatments in which decisions are publicly disclosed, when compared to the control (*chi-square*

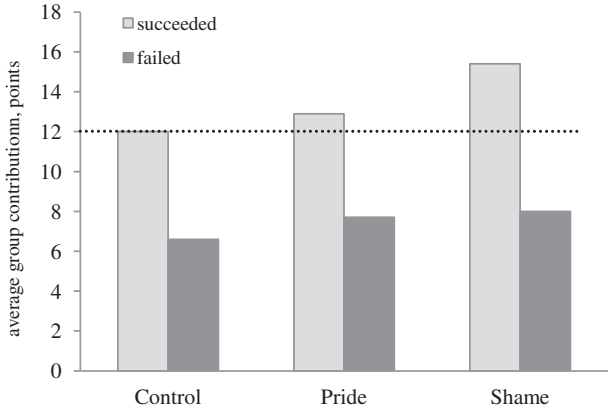

Fig. 2. Average group contribution by treatment and success rate.

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Table 5
Proportion of individual types in the experiment.

Type of subject	Control	Pride	Shame	Regulation
	Anonymous condition	Exposure of altruistic behavior	Exposure of selfish behavior	Minimum contribution
Selfish	66%	43%	36%	0%
Limited altruist	23%	42%	38%	46%
Altruist	11%	15%	26%	54%
No. of observations	237	236	238	237

test; p = 0.000 in both tests). Transparency achieves a significant increase in choices that meet the threshold of altruism.

A key difference between the pride and shame treatments is that the former singles out altruistic decisions by rewarding subjects with a green flag if contributions are equal to or larger than three, whereas the shame treatment singles out selfish decisions by disclosing subjects contributing less than three. Indeed, we find that the shame treatment results in a significantly lower share of selfish decisions when compared to the control (*proportion test*, $p_s = 0.000$), and also compared to the pride treatment (*proportion test*, p = 0.09). Unexpectedly, though, we find that even the share of altruists is significantly higher in the shame treatment (*proportion test*, p = 0.002), confirming the social strength of disclosing negative information to change subjects' decisions.

5. The Link Between Behavior and Individual Characteristics

We continue our empirical analysis by investigating the determinants of individual contributions including several variables of interest. We start by using an OLS regression to explore the behavior of only those subjects with a positive contribution (*conditional contributions*). We use observations of Round 3 for the regulation treatment, and Rounds 2 and 4 for the pride and shame treatments, as we have shown earlier that those rounds are not significantly different at a 5% level. The descriptive statistical information for all participants, which we collected in an exit survey, is presented in Table 6. We start the analysis by regressing treatment dummies (using the control treatment as reference case and clustering of errors at the individual level), socio-economic characteristics and behavioral variables on conditional contributions. Besides controlling for typical socio-economic characteristics, including gender, age, household size, employment, and education, we also measured a set of behavioral variables such as associational norms and environmental knowledge and behavior. Furthermore, we include a dummy (*session size*) to capture potential differences in behavior between sessions with many versus few participants. Results can be seen in Table 7.

Table 6
Individual characteristics of participants and definition of variables.

Variable	Description	Mean	Sd
Socio-economic variables			
Female	1 = female	0.85	0.35
Age	Age in years	38.12	15.58
Household size	number of household members	4.24	1.68
Employment	1 = one member of the household is fully employed	0.65	0.47
Education	1 = education less than completed secondary school	0.55	0.49
Behavioral variables			
Social norm	1 = more than 50% of their social group is recycling	0.25	0.43
Natural capital	1 = player knows how to recycle	0.80	0.39
Institutional capital	1 = player knows the legal regulations for solid waste	0.25	0.43
Responsibility	1 = player is responsible for recycling in own household	0.41	0.49
Need regulation	1 = player thinks that recycling should be regulated by law	0.84	0.35
Legal norm	1 = player thinks that the local government expects recycling	0.91	0.28
Warm glow	1 = player appreciates social approval for recycling	0.77	0.42
Environmental impact	1 (very small) to 5 (very large)	4.37	1.02
Governance	1 (very good) to 5 (very bad)	2.65	1.27
Recycling	1 = the player's household is recycling	0.69	0.46

Table 7
Explaining contributions across treatments.

	Model	
	Regression of conditional contributions	
	Coef.	p-Value
Game variables		
Regulation dummy	1.42	0.000***
Shame dummy	0.68	0.000***
Pride dummy	0.34	0.002**
Session-size	−0.01	0.257
Socio-economic variables		
Female	0.06	0.683
Age	0.02	0.000***
Household size	−0.01	0.817
Employment	0.34	0.012*
Education	−0.05	0.691
Behavioral variables		
Social norm	0.12	0.439
Natural capital	0.28	0.083*
Institutional capital	0.35	0.071
Responsibility	−0.25	0.074**
Need regulation	−0.14	0.495
Legal norm	−0.27	0.131
Warm glow	0.04	0.798
Environmental impact	0.10	0.116
Governance	−0.07	0.153
Recycling	−0.40	0.013*
r2		0.36
p>F		0.00
Number of observations		562

Note: *p < 0.05, **p < 0.01, ***p < 0.001.

Results can be seen in Table 7.

We observe statistically highly significant positive effects of the treatment dummies confirming our statistical testing on treatment effects, as described in previous sections. Our controls for socio-economic and behavioral variables had little effects on the results. We do find that *age* and *employment* seem to be a significant determinant of larger contributions. Thus, older and employed participants in this setting contribute relatively more to the public good. Other socio-economic variables such as gender, household size and education are far from significant in any of the models.

In the case of our behavioral variables, we find that the amount contributed is positively affected by *natural capital* (a dummy variable that equals 1 if the player knows how to recycle and can state recycling practices, based on the respondents' self-evaluation about their own knowledge). The positive association suggests an important role for education and capacity building to better inform individual households on basic recycling practices and disposal options as knowledge seems to be an important prerequisite to engage in pro-environmental action.

With respect to *social norms*, our expectation that those who in real life belong to social groups in which a majority of people recycle (i.e. those exposed to such a social norm) tend to contribute significantly more, is not statistically significant. Here, our simple approach to measure social interaction by categorizing individuals according to their number of pro-environmental friends highlights no actual relationship between social context and contribution behavior. This result

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is opposed to survey-based evidence on social networks and their important function for natural resource management (Bodin et al., 2006). Similarly, others highlight the motivational function of the pro-environmental behavior of others on one's own individual practices (e.g. Nolan et al., 2008).

For *responsibility* (a dummy variable that equals 1 if the participant is the person responsible for recycling in the household), we find that it had an unexpected negative effect on contributions: those who are responsible for recycling practices contribute less. An explanation may be that individuals who are not responsible contribute more because they think that other people in their own household have to do the job in the end anyway. Similarly, *recycling* (a dummy that equals one if the subject's household carries out recycling activities[8]) has a negative sign too, although it is not significant. One possible explanation is that these subjects might think that they are putting enough effort into recycling activities in their real life, and hence refrain from doing so in the experiment.

In an additional analysis, we investigate the relative importance of the pride and shame treatments, and compare those to the control round. In line with previous research (e.g. Alpizar et al, 2008), we model contributions as a two-stage decision in which the decision to donate a positive amount is captured by a logit model, followed by the decision on how much to donate, which is analyzed using a regression model using only subjects with a positive contribution.[9] We also present a third regression that looks at the probability that a given subject contributed three or more, i.e., the likelihood of a group reaching the threshold. Differences in the two-stage decision due to the pride or shame treatment are captured by a dummy variable that is equal to one in the shame treatment and zero in the pride treatment. Again, we cluster errors at the individual level.

Table 8 shows the three regression results. We find that subjects in the *shame* treatment significantly contributed higher amounts compared to the pride treatment and were more likely to contribute positive amounts overall. This confirms our statistical analysis in Section 5 on the differences between our main treatments, and is in accordance with experimental evidence on the superiority of a costly punishment (in our case, disclosing a negative value judgment on behavior) over a reward mechanism for maintaining cooperation in public goods games (e.g. Sefton et al., 2007; Rand et al., 2009). Disregarding the numerous design differences in previous studies and ours, it seems that punishment strategies, costly or not, are better than rewards in achieving higher contributions.

Table 8
Determinants of contributions.

	Model 1		Model 2		Model 3	
	Regression of conditional (>0) contributions		Logit regression prob (>0)		Logit regression prob (≥3)	
	Coef.	p-Value	Coef.	p-Value	Coef.	p-Value
Game variables						
Shame dummy	0.68	0.000***	1.03	0.002**	1.64	0.000***
Pride dummy	0.35	0.002**	0.27	0.289	1.14	0.000***
Session-size	−0.01	0.218	0.02	0.653	−0.03	0.284
Socio-economic variables						
Female	0.07	0.734	−0.08	0.897	−0.003	0.995
Age	0.03	0.000***	0.03	0.071	0.04	0.007**
Household size	−0.02	0.558	−0.01	0.943	−0.04	0.682
Employment	0.45	0.007**	0.06	0.886	0.59	0.097*
Education	−0.09	0.569	−0.73	0.106	−0.27	0.427
Behavioral variables						
Social norm	0.18	0.331	0.89	0.126	0.63	0.109
Natural capital	0.32	0.119	0.19	0.746	0.43	0.399
Institutional capital	0.32	0.161	−0.66	0.268	0.25	0.568
Responsibility	−0.31	0.070*	−0.28	0.512	−0.52	0.102
Need regulation	−0.15	0.510	0.34	0.543	−0.22	0.682
Legal norm	−0.38	0.102	0.15	0.842	−0.32	0.519
Warm glow	0.02	0.919	−0.03	0.938	−0.03	0.934
Environmental impact	0.12	0.152	0.05	0.796	0.19	0.285
Governance	0.09	0.135	−0.26	0.219	−0.02	0.911
Recycling	−0.48	0.087*	0.31	0.919	−0.64	0.107
r2		0.24				
p>F (chi^2)		0.00		0.00		0.00
Number of observations		477		477		477

Note: *p < 0.05, **p < 0.01, ***p < 0.001.

6. Conclusions

This paper reports data from a field experiment that investigates the effect of public disclosure on pro-environmental action, and specifically on household solid waste management efforts. By using a modified threshold public goods game based on the design developed by Milinski et al. (2008), we assess the degree of interaction between positive and negative information provision with social preferences and intrinsic motivations that underlie existing environmental practices. We implement four different treatments, namely: disclosure of negative information enforced through feelings of shame; disclosure of positive information driven by social esteem and pride; environmental regulation; and a treatment without any intervention. Our experimental design goes beyond previous field and lab experiments by presenting a test on the relative effectiveness of positive and negative information disclosure in the same setting; to our knowledge, others have focused on introducing only one of the two interventions (e.g., Maier-Rigaud et al., 2010; Lopez et al., 2009) or used disclosure experiments with approval and disapproval mechanisms operating at the same time (e.g., Rege and Telle, 2004; Martinsson and Villegas-Palacio, 2010).

We find evidence indicating that pro-environmental actions can be encouraged by more transparency. Our results indicate that each of our treatments significantly increases contributions to the public good compared to the treatment without intervention. With respect to higher individual contribution and higher probability of group success, we find that the reputational effects induced by shame and pride led to approximately 20–30% higher contributions to the public good when compared with a treatment without disclosure. Punishment in the form of negative information provision (singling out free-riders) outperforms the reward treatment triggering pride (singling out those who contribute a lot). Our emotional punishment and reward mechanisms are in line with the theory of moral emotions and its potential significant behavioral consequences for economic decision making (e.g., Lerner et al., 2004) and moral behaviors (e.g., Nelissen et al., 2013). In particular, both can make selfish behavior less attractive and promote prosocial behaviors. Only a few experimental applications including ours demonstrate this type of functionality of emotions (e.g., Ketelaar and Au, 2003; de Hooge et al., 2008).

When we introduce a compulsory contribution equal to the threshold, we find, surprisingly, that the proportion of subjects contributing more than the regulated minimum contribution significantly increases compared to all other treatments. These results suggest that the environmental regulation acted as a coordination device for cooperation; i.e., that taking away all uncertainty regarding reaching the threshold leads to many participants putting in extra effort. In this case the regulation crowded in social preferences being motivated by the desire of most subjects to not be exploited by

[8] The available data is based on self-reports using the following question: *In your household, are you recycling?* (*Yes*/*No*).

[9] Given that the regulation treatment forced a donation out of all participants, this treatment was not included in this participation analysis.

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their fellow citizens. Another important and related explanation is that a regulation might be favored, particularly for threshold public goods such as solid waste management, as it acts as an important baseline and reference level for individual effort.

Our field experiment provides a practical application of the effect of disclosure-based policies on pro-environmental behavior. Our findings show that the image value of pro-environmental behavior seems to significantly increase with the disclosure of negative information. This suggests that scarce public funds may be allocated to discouraging antisocial behavior (singling out free riders) rather than to rewarding pro-social behaviors (singling out altruists), as the latter may not be able to provide a similar powerful incentive to increase contributions. One mechanism that can be applied in the context of solid waste management in developing countries is the disclosure of recycling performance metrics of individual households through the labeling of garbage cans by the local authorities responsible for waste collection. Postings in the local press or placards in stores to single out those households with worse recycling performance may be another approach.

Finally, the importance of leveling the playing field by making sure that nobody's effort goes to waste was found to be a key element in motivating pro-environmental behavior, both in the experiment and in the accompanying exit survey. Surely a compulsory effort in household solid waste management is highly unlikely, but authorities should spare no effort in ensuring that a solid waste management campaign is not perceived to be weakened by the failure of some households to participate. By showing strong commitment to the recycling program, authorities can achieve significantly higher effort from individual households.

Acknowledgments

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Appendix 1. Excerpt From Experimental Instructions (Translation From Spanish)

[TREATMENT WITH GREEN FLAGS]

[Round 2]: *Now let's move on to round 2. Please open the next page. Again, you receive 5 tokens; each token corresponds to 1 hour of work and effort worth 1000.*

To ensure that the program is a success, the government has decided to publicly reward those who put 3 tokens or more in the public pool with a green flag. [SHOW GREEN FLAG] *At the end of the round, we will distribute those green flags.*

Please write down your decision and remember not talk to each other. [WAIT] *Does anyone need more time? Ok, now my colleagues will pass through and distribute the green flags.* [WAIT] *Now you can look around to see which ones of you received a green flag and which ones not.*

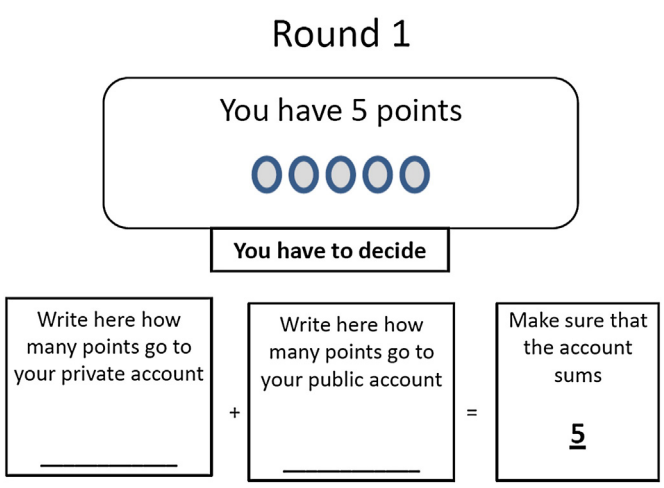
[Round 3]: *Now let's move on to round 3. Please open the next* page. [WAIT] *Again, you receive 5 tokens; each token corresponds to 1 hour of work and effort worth 1000.*

In this round we will not use flags to promote contributions to the public pool. My colleagues will now collect those flags. [COLLECT FLAGS]

As I said, in this round we will not use flags to promote contributions to the public pool. Instead, in order to make sure that the minimum amount of 12 tokens is collected per group, every one of you needs to obligatory donate 3 tokens to the public pool. This means you have already contributed 3 tokens to the pool, and only have 2 tokens left to distribute between your personal account and the public pool. You need to decide how to use the 2 tokens you are left with.

Please write down your decision. Does anyone need more time? [WAIT]

Appendix 2. Sample Decision Sheet (Translation From Spanish)



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