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Abstract : Experimental studies have shown that sanctions effectively deter free riding within groups. However, the over-use of costly punishment may actually harm overall welfare. A main reason for over-punishment is that free-riders generate negative emotions that likely favor excessive punishments. In this paper we ask whether the venting of one's emotions in different ways can reduce the level of excessive punishment in a standard VCM-with-punishment environment while preserving the norm enforcement properties of punishment. We find that venting emotions reduces (excessive) punishment, and under certain conditions the net effect is an increase in final payoffs (i.e., welfare) to the group.

Keywords: sanctions, public good, experiment, venting emotions
JEL Classifications: C92, H41, D63

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1. INTRODUCTION

Numerous experimental studies have investigated the conflict between individual behavior and collective interest in social dilemmas. In the typical voluntary contribution mechanism, each member of a group of players receives an initial endowment that she may allocate between a private account that returns money only to her, and a group account that benefits all individuals. The payoff structure has the property that each individual has a dominant strategy to allocate all of her endowment to the private account, while the maximum group payoff can only be reached if all members contribute their entire endowment to the group account. Laboratory experiments have shown that substantial cooperation, in the form of high contribution levels, occurs in the initial periods of play. However, the rate of cooperation decreases as the game is repeated (Isaac *et al*., 1985; Andreoni, 1988; Isaac and Walker, 1988a; Ledyard, 1995).

In light of this empirical regularity of declining contributions across decision periods, many more recent studies have attempted to identify modifications to the game that may increase cooperation considerably.[1] Most relevant to the present paper is the existence of endogenous sanctioning as a norm enforcement tool to deter free riding within groups (Fehr and Gächter, 2000; Carpenter, 2007a,b; Masclet *et al*., 2003; Noussair and Tucker, 2005; Bochet *et al*., 2006; Anderson and Putterman. 2006; Sefton *et al*., 2007; Carpenter, 2007a,b; Egas and Riedl, 2008; Gächter *et al*., 2008; Nikiforakis, 2008; Nikiforakis and Normann. 2008; Engelmann and Nikiforakis, 2013). These studies have shown that the existence of a sanctioning institution is effective in deterring free riding within groups. However, while the introduction of sanctioning institutions

[1] These include preplay communication (Dawes et al, 1977; Isaac et al., 1985; Isaac and Walker, 1988b, 1991; Ostrom et al., 1992; Kerr and Kaufman-Gilliland, 1994; Krishnamurthy, 2001; Brosig et al., 2003), creation of group identification in conjunction with post-play open discussion (Gächter and Fehr, 1999), and having each individual assign a rating to each other group member's contribution decisions (Masclet et al., 2003).

significantly improves cooperation, it also has important detrimental effects on welfare. Punishment reduces welfare because it is costly to implement, reducing both the punisher and the target's payoff.

In the short-run, the net effect of punishment is to reduce welfare, although punishment increases welfare if the horizon is sufficiently long (Fehr and Gächter, 2000; Gächter *et al*., 2008). Punishment must be at an appropriate level to be effective, and people may over-punish due to the negative emotions generated by free riders. In other words, negative reciprocity can be disproportionate relative to what is efficient if it results from an emotional reaction that may lead to punishment that does not "fit the crime". Efficiency will only result if strategic punishment is in place but emotionally excessive punishment is removed.

In this paper we ask whether the venting of one's emotions might effectively reduce the level of excessive punishment while preserving cooperative incentives created by the punishment mechanism? Allowing people to express their negative emotions may help restrain later aggressive punishment by providing an alternative opportunity to vent one's own frustration. This is related to the catharsis theory perspective in psychology (Feshbach and Singer, 1971; Lee, 1993). The process of venting emotions is rather complex. One may vent emotions in many different ways, from simply taking a "time out" to distance oneself from the negative stimulus[2], to another extreme where one is allowed the opportunity to even "violently" release negative emotions in a controlled environment.

There is evidence that venting emotions is desirable, and even some example of formalizing the venting process. "Venting rooms" are places that allow individuals to venting their negative emotions by screaming, smashing

[2] This is related to the idea of temporary nature of emotions, (see Ekman, 1994; Loewenstein, 2000).

dishing, destroying a T.V. with a baseball bat, or basically demolishing anything in the room with impunity (recent examples are found in US, Bosnia, China, and Japan).[3] In some cases, stand-alone venting room businesses charge a fee to the privilege of demolishing stuff. The fact that individuals are willing to pay a fee to vent emotions attests to its perceived usefulness for emotional health.

Could the introduction of emotion venting opportunities lead to reduced (excessive) punishment while maintaining the incentive effect of sanctions, possibly increasing welfare? One may reasonably conjecture that allowing people to vent their emotions will reduce excessive sanctions, leading to reduced punishment and positive effects on welfare. On the other hand, the introduction of emotion venting may have a negative net effect on welfare if the reduction in punishment also reduces the strategic punishment necessary to limit free riding.

In this paper we report results from experiments that supplement a standard VCM punishment environment (Fehr and Gächter, 2000) with several treatments that allow players to vent their emotions prior to making punishment decisions. The treatments we administer each add additional opportunities to vent emotions: we start with a simple cooling off period, but then add the opportunity to self-report one's emotional state as well as assign virtual punishment points. We find that venting emotions can increase efficiency under certain condition, over and above what punishment itself may accomplish. The venting emotions treatments lead individuals to assign significantly less punishment points to others compared to treatment without the opportunity to vent emotions. The reduction in

[3] See for instance anger rooms in Texas (http://www.cbc.ca/news/offbeat/story/2012/03/09/video-anger-room.html), in Japan (http://healthehelen.wordpress.com/tag/anger-rooms/ or in Bosnia http://www.thehimalayantimes.com/fullNews.php?headline=Serbians+pay+to+vent+anger+in+Rage+Room+&NewsID=362269). There also exist some smart phone applications that could be considered tools to vent emotions such as Angry Birds or games that allow you to shoot or smash things (although there is debate whether in extreme cases this may promote real violence for those with predispositions).

punishment leads to a reduction in contributions, but the net effect is often an increase in overall welfare.

Our paper is related to previous studies that have investigated the behavioral impact of emotions on punishment decisions. It is known that emotional processes are involved in the decision to punish in two-person interactions. In particular, anger accompanies the application of costly punishment (Bosman and van Winden, 2002; Ben Shakhar et al., 2007; Hopfensitz and Reuben, 2009; Joffily et al. 2012). It has also been shown that when observing opportunistic behavior, anterior insula activation, which is typically associated with aversive stimuli, correlates with subsequent individuals' decision to punish others (Sanfey et al., 2003). Punishment of social norm violators has also been related to satisfaction, as punishment activates the dorsal striatum, a brain area often associated with pleasant stimuli and reward-driven actions (De Quervain et al., 2004). While punishing free riders activates reward centers in the brain, so does the pro-social behavior of cooperation. For example, striatum activation has been associated with mutually cooperative behavior in prisoner's dilemma games (Rilling et al., 2002; Rilling et al., 2004).

Only a few studies have analyzed the behavioral impact of venting emotions on punishment, and the results are somewhat mixed. Some studies found no effect of venting emotions (Bushman et al. 1999; Bushman, 2002) while others observed a positive effect of venting (e.g. Bolle et al. forthcoming). Our experiment differs from Bushman et al. (1999) and Bushman (2002) in the way we measure emotions using a simple elicitation procedure. Our paper is most closely related to Bolle et al (forthcoming), with the notable exception that our purpose is not to investigate the occurrence of vendetta. Rather, our purpose is to examine whether venting emotions may induce higher efficiency in a standard

social dilemma where norm enforcement via punishment may be particularly sensitive the one's emotional state.

The remainder of the paper is organized as follows. In section 2, we describe the experiment and hypotheses. Section 3 presents the results and section 4 consists of a brief discussion.

2. THE EXPERIMENT

2.1: The Treatments

Our experiment consists of four treatments summarized in Table 1. Our baseline treatment is based on a design used in Fehr and Gächter (2000). Participants interact during 10 periods under a partner matching protocol.[4] Each period of the *Baseline* treatment has two stages. At the beginning of stage one, each member of a 4-player group receives an endowment of 20 ECU, an experimental currency convertible to Euros, to allocate between a private account and a group account. No player can observe any other player's contribution decision before he makes his own choice. Each ECU that any group member allocates to the group account yields 0.4 ECU to each member of the group. The payoff of subject *i*, at the end of the first stage, π_i^1, equals:

$$\pi_i^1 = (20 - c_i) + 0.4\sum_{j=1}^{4} c_j \qquad (1)$$

[4] To avoid reputation effects across periods, participants were associated with a letter of the alphabet, A,...,D that was randomly changed after each period. An individual's activity was displayed in a different position on other group members' screens in different periods. This made it impossible for an individual to track another player's behavior from period to period.

where c_i is player i's contribution to the group account. The more ECU an individual allocates to the group account, the lower her own earnings but the greater the group's total earnings. For this reason, allocations to the group account are referred to as contributions, and higher contributions can be interpreted as greater cooperation.

Each participant is then informed of her first-stage payoff, the total contribution of the group, and the individual contribution of each of the three other members of her group. In stage two, she has an opportunity to assign punishment points to each of the other members of her group. No player could observe any other's punishment decision at the time she made her choices. Punishment points assigned to any given group member could be in the [0,10] range. Each point assigned costs one ECU to the punisher and reduces the target player's payoff by 3 ECU. Therefore, player i's payoff after the second stage is given by:

$$\pi_i^2 = \pi_i^1 - \varepsilon \sum_{j \neq i} p_j^{i2} - \sum_{j \neq i} p_i^{j2} \qquad (2)$$

where p_i^{j2} is the number of points i assigns to j in stage 2, and the punishment penalty parameter, ε, equals 2 (note also that superscripts 1 and 2 refer to stages 1 and 2).

The *Waiting* treatment is identical to the *Baseline* except that a cooling off period of five minutes is included after observation of contribution levels and before the punishment stage. During this cooling off period, the subjects have nothing to do. The *Waiting & Emotion* treatment is identical to the *Waiting* treatment except that each participant has now the opportunity to express his/her emotions during the 5-minute wait period by indicating (on a scale of 1-7) their self-reported measure of anger, joy, and surprise regarding each of the other group

member's contribution levels. Subjects are also allowed a text-box within which they may anonymously type messages to the other subjects within their group.

Finally, the *Virtual Punishment* treatment is identical to the *Waiting & Emotion* treatment except that an additional stage is included after the contribution stage and before the waiting phase. In this additional stage, each player was required to assign virtual punishment points in the [0,10] range to each of the other members of her group. The subjects were informed that these punishments points were nonbinding in the sense that they could be modified after the waiting phase, and they were also private information since they were not communicated to the other players. After virtual punishment points are assigned, the players are required to wait five minutes. Participants give self-reported emotions ratings during this 5-minute wait period, and afterwards must submit their choices for the actual costly punishment points.

In all treatments, assuming that players maximize their own earnings, the subgame perfect equilibrium is complete free riding (i.e., zero contributions) and zero punishment. The marginal per capita return of the public good is always lower than the marginal return of keeping one's own endowment for oneself, which generates the free riding theoretical prediction. In contrast, the socially optimal behavior is to contribute one's full endowment to the public good, since $0.4*n > 1$. In the treatment with virtual punishment points, any virtual punishment profile is compatible with the subgame perfect equilibrium, since virtual punishment points are pure cheap talk and the equilibrium is unique. No costly punishment is observed in equilibrium in any treatment since assigning punishment always reduces the payoff of the punisher.

The detailed instructions of each treatment are detailed in an online appendix.

2.2: Behavioral Predictions

We can relax some of the above assumptions and assume that behavior may be influenced by emotions. In particular, individuals may experience emotions when observing the others' contributions relative to one's own contributions. Observing high contributions may induce positive emotions in the anticipation of higher own-payoffs. In contrast, observing free riding may induce negative emotions. This is stated in H1.

> **H1.** *Observing free riding induces negative emotions, while observing cooperative behavior induces positive emotions.*

Our second conjecture concerns the role of emotions in the decision to punish. Two non-strategic motives are generally evoked in the literature to explain why subjects are willing to sacrifice payoffs to punish others: a reaction to unfair intentions and distributional concerns. These two motives presumably have emotional underpinnings. We conjecture that individuals who have been more emotionally aroused when learning of others' low contributions may be more willing to punish free-riders. This conjecture is summarized in H2.

> **H2.** *The more individuals are (negatively) emotionally aroused when learning that others free ride, the more punishment points they will assign.*

Our third conjecture concerns the effect of venting emotions on the extent of punishment level. One may reasonably conjecture that allowing people to vent their emotions will reduce excessive sanctions, and thus reduce punishment levels. One should expect to observe less punishment compared to the baseline in each of the treatment that allow emotional venting, with the greatest reduction in punishment in instances where there exist the most opportunities to vent emotions. This is described in H3.

H3. *Punishment should decrease in the number of avenues to vent emotions. The predicted ordering of punishment points assigned across treatment is:*

Baseline > Waiting > Waiting & Emotion > Virtual Punishment

Finally regarding the net effect of venting emotions on welfare, we have no clear conjecture since it seems that two effects go in opposite direction, leaving the net effect indeterminate. On the one hand, reduced punishment predicted by venting emotions should increase welfare given the reduced use of costly punishment points. However, on the other hand, since punishment is a key norm enforcement tool to deter free riding, reduced punishment should therefore reduce cooperation and harm welfare.

2.3: The parameters of the experiment

The experiment consists of 6 sessions conducted at the LABEX facility of the Center for Research in Economics and Management (CREM), at the University of Rennes I, located in Rennes, France. Informed Consent was obtained from all subjects prior to the start of the experiment. The 108 participants were recruited from various undergraduate courses. No subject participated in more than one session. The experiment was computerized using the Ztree software package (Fischbacher, 2007), and conducted in French. On average, participants earned 12.10 Euros, including a €3 show-up fee.

3. RESULTS

3.1. Sanctions and emotions

3.1.1. Punishment Choice and Intensity of Punishment

Figure 1 displays the frequency of total punishment points assigned by each individual subject towards the three other group members in each treatments. We see in Fig. 1 that, though the modal punishment is zero, punishment is nevertheless widely employed in all treatments. Compared to the baseline, it also appears that individuals punish less in the treatments in which people have the opportunity to vent their emotions. Subjects punish at least to some extent in 45.27% of all subject decision rounds in the *Baseline* treatment (163 observations out of 360). Punishments are made in 37.91% of the *Waiting* treatment decision rounds (91 observations out of 240), and punishment is even lower when people can express their emotions in addition to the cooling off period: 27.91% (67/240) and 30.41% of the time (73/240) in the *Waiting & Emotion* and *Virtual Punishment* treatments, respectively. Our data also indicate that the degree of punishment is less severe in each of the three emotion-venting treatments compared to *Baseline*. These emotion venting treatments each impose a common 5-minute cooling off period, but the additional emotion venting opportunities seem effective to some extent as well. Figure 2 displays the evolution of the average number of punishment points across treatments over the course of the 10 decision rounds.

Both Fig. 1 and 2 show that introducing the opportunity to vent emotions seems to promote reduced punishment. The average number of costly (real) punishment points assigned by each subject to all other group members is 1.62 in the *Baseline* treatment compared to 1.15 and 1.23 in the *Waiting* and *Waiting & Emotion* treatments, respectively. In the *Virtual Punishment* treatment, where nonbinding punishment points are initially assigned but may then be revised after the cooling-off period, the average number of costly punishment points assigned after the 5-minute wait is 0.67 points. Our findings regarding punishment decisions are summarized in Result 1.

RESULT 1: *Punishment is widely used in all treatments. However, subjects punish significantly less in the treatments in which people can vent their emotions.*

Statistical support for result 1 is found in Tables 2 and 3. In Table 2 we model the total number of punishment points assigned by a given player to other members of her group. In addition to the treatment dummy variables we include a variable for the round of the treatment, a dummy variable for the final round of the treatment, and the panel on the right includes demographic controls for the subjects (gender, education level, dummy variables for University student and economics students). Each of the emotion venting treatments is estimated to have a negative effect on the total punishment points that a subject assigns to others in her group, and the estimated effect become larger in magnitude and more precisely estimated and statistically significant when additional venting options are added to the basic cooling off period in the *Waiting* treatment. That is, consistent with hypothesis H3, adding the ability to express emotions in *Waiting & Emotions* significantly reduces punishment points assigned compared to just *Waiting* (and *Baseline*), and allowing subjects to assign virtual punishment points in the emotionally "hot" moment following the revelation of others' contribution decisions (*Virtual Punishment*) further reduces eventual actual punishment points. This appears to be largely due to due to those choosing moderate levels of virtual punishment points as is seen in Figure 3 (i.e., punishment of between 2-6 points).

We also model the individual choice to punish each member of one's group in a series of estimation equations in Table 3. The dependent variable in Table 3, $P_{i,j}$, measures the punishment points player i assigns to player j in her group in each round. Exogenous variables in column (1) of Table 3 include dummy variables for each treatment (leaving *Baseline* as the reference group). As in Table 2, we also include a trend variable period as well as a dummy controlling for the last period of the game. Estimate (2) replicates estimate (1) with the

addition of demographic controls for gender, the level of education, and dummy variables for University and economics students. Finally, we include variables to measure the effect of a positive as well as the negative deviation (measured in absolute value) of player *j*'s contribution from the remaining group average, and well as a variable measuring the average contribution level of the entire group.

Table 3 shows negative coefficient estimates on all treatments that allow emotion venting, confirming the fact that subjects punish less in the treatments in which people can vent their emotions. However, only the coefficients on *Virtual Punishment* in estimates (1) and (2) of Table 3 are statistically significant, which indicates that the significance of the effects grows with the addition of extra avenues for venting emotions. The variables *Period* and *Final Period* estimate similar effects as in Table 2. Namely, punishment declines across periods except for the final period end-game effect of increased punishment. Not surprisingly, players contributing less than the group average are punished more while players contributing more than the group average are punished less. This pattern is consistent with H2 and in agreement with previous studies (e.g., see Fehr and Gächter, 2000; Masclet *et al*., 2003; Nikiforakis, and Normann. 2008; Nikiforakis, 2008; Bochet et al., 2006; Bochet and Putterman, 2009). Average group contributions also reduce punishment points assigned to a specific player, ceteris paribus.

In column (3) of Table 3 we estimate the same model for the subset of period 1 data, which highlights that the effects of the *Virtual Punishment* treatment are strongest in the first period. Finally, columns (4) and (5) present the results of a two-stage Heckit estimation to examine both the extensive margin (i.e., choosing to punish or not), as well as the intensive margin choice of how many punishment points to assign (column (5)). The Heckit estimates results are qualitatively similar to the Tobit results in columns (1)-(3), and they indicate that

the most comprehensive emotion venting treatment, *Virtual Punishment*, decreases punishment point on both the extensive and intensive margins of the punishment choice.

3.1.2. The relationship between emotions and punishment

Altogether, these findings columns (1)-(5) of Table 3, along with Table 2 results indicate that venting emotions seems to play some role in reducing punishment. We therefore turn our attention to an analysis of the self-reported emotion data generated in *Waiting & Emotions* and *Virtual Punishment* treatments.

Figure 4 compares the difference in frequency of self-reported emotion levels for individuals choosing to punish or not punish other group members. Recall that the self-reported emotions are elicited *after* contribution decisions are made, but before punishment is assessed. These graphs indicate that higher self-reported "joy" ratings are associated with decisions to not punish, while higher rating of "surprise" and particularly "anger" are associated with punishment decisions. These findings are consistent with H2. Thus, we have result 2:

RESULT 2: *Self-reported emotions predict punishment decisions.*

Support for Result 2 is found in Figure 4 and Table 3. Figure 4 shows the percentage of those reporting a positive level of anger is 71.05% among the punishers and only 28.71% among those who chose not to punish. In contrast, self-reported joy are negatively correlated with punishment decisions—those reporting positive level of joy represent 64.11% of the non-punisher subjects compared to representing 39.47% of those choosing to punish. The correlation between surprise and punishment is positive but weaker than anger and punishment.

More rigorously, we analyse how self-reported emotions impact punishment intensity in the context of the Table 3 models. The final Table 3 estimate in column (6) includes self-reported emotions (Anger, Joy, and Surprise) as covariates in the Tobit estimation. The *Baseline* and *Waiting* treatments data are omitted from this model since neither allows for self-reported emotion ratings. We use the *Waiting & Emotion* treatment as the omitted category such that the model (6) estimates in Table 3 are to be interpreted as effects on individual punishment choices relative to the *Waiting & Emotion* treatment. These results indicate that the addition of virtual punishment prior to real punishment does not affect one's choice to punish another subject, as compared to the *Waiting & Emotion*. Those contributing less than the group average are still assessed more punishment points. However, we also find that subjects expressing anger or surprise punish more, while subjects self-reporting higher levels of joy (prior to punishment points assignments) assess fewer punishment points. Thus, our column (6) results offer some evidence for both rational (negatively reciprocal) and emotion-based punishment decisions.

If we consider that other individuals' contribution levels are what produce varied levels of self-reported emotions, one might more properly analyze emotions ratings as dependent variables. To do this, Table 4 reports results from separate random effects Tobit model estimates of each of the three self-reported emotion levels experienced at the moment of observing contributions of others. Model (1) uses a Tobit model on the determinants of anger player i feels toward player j. The independent variables include the other group member's contribution, the value of any positive difference between player j's contribution and the average contribution of others, and the absolute value of the negative difference between player j's contribution and the average contribution (i.e., player j contributes less than the average). We include a dummy variable for the

Virtual Punishment treatment to measure whether there exists any differences across treatments. Lastly, the regression includes a time trend and several demographics (mot reported here but available upon request). Models (2) and (3) in Table 4 report similar results for the emotions of joy and surprise. The independent variables are the same as in model (1).

Model (1) shows that the more another group member contributes, the less anger is expressed. On the other hand, observing that player j contributes less than the average triggers anger. Model (2), not surprisingly, shows opposite findings regarding joy. Model (3) indicates that any deviations from the average triggers emotion of surprise. These findings are consistent with our assumption H1. Finally the dummy variable "virtual punishment" is never significant. Our findings are summarized in Result 3.

RESULT 3. *Individuals experience less joy and more anger when others free ride. Surprise results when a group member contributes differently from the group average.*

3.2. The effects of venting emotions on contributions and earnings

3.2.1. The effect of sanctions on contributions

We now turn to treatment differences in contribution levels to examine whether venting emotions influences cooperation and, ultimately, efficiency (payoffs). Figure 5 displays the time path of individual contributions by period, averaged across groups, in each treatment. Alternatively, Figure 6 shows the distributions of contributions pooled across all periods for each treatment. Our observations regarding contribution levels in the different treatment are described as Result 4.

RESULT 4: *While the cooling off period may increase contributions, the additional opportunities to vent emotions reduce contributions.*

As support for this Result 4, we turn to Fig. 5 and 6, as well as econometric analysis in Table 5. As shown in Figure 5, the average individual contribution level is highest in *Waiting* (15.19 ± 5.56 ECU), followed by *Baseline* (13.89 ± 6.08 ECU), then *Waiting & Emotion* (11.60 ± 7.39 ECU) and finally *Virtual Punishment* (9.25 ± 7.13 ECU). We have estimated several regressions in which the dependent variable is the individual contribution of player *i*. Table 5 reports the results of these estimations. The independent variables include dummy variables for the treatments, a time trend, a dummy variable for the final period, and demographic controls.

Table 5 shows that the participants contribute significantly less in *Waiting & Emotion* and *Virtual Punishment* compared to *Baseline* (see columns (1) and (3) of Table 5). On average individuals contribute 2.69 ECU less per round in the *Waiting & Emotion* compared to *Baseline*, and they contribute 4.81 ECU less per round in *Virtual Punishment* (column (1)). In contrast, no statistically significant difference is found between *Waiting* and *Baseline*. Column (3) shows similar estimates when accounting for censoring in the data (Tobit model, column (3)).

Models (2) and (4) in Table 5 also show that introducing the opportunity to self-report emotions and virtually punish decreases cooperation significantly, compared to *Waiting*, where only the 5 minute cooling off period exists. Models (2) and (4) therefore use *Waiting* as the reference treatment category, and the *Baseline* data are omitted. All the models in Table 5 describe a robust result: additional avenues for venting emotions significantly decrease contributions to the public good. Recall that these same avenues for venting emotions also significantly decreased punishment, and the progressive pattern of these effects indicates that more opportunities to vent emotions leads to even fewer contributions as well as (or, as a result of) even less punishment.

In addition to the general link between punishment and contributions, reduced contributions in *Waiting & Emotions* and *Virtual Punishment* may also result from a differential impact of a given level of punishment across treatments. To explore this possibility, check this and to measure the impact of punishment, we have estimated the magnitude of some influences on changes in individual contributions between periods t and t+1 in separate random-effects GLS regressions (not reported here but available upon request). Indeed, the number of sanctions received in the previous period has not been included in the regressions shown in Table 3 to avoid autocorrelation. We conducted the estimations separately for the participants who contribute less than the group average (designated as low contributors), and for those who contribute more than the average (high contributors), in period t (N = 137 and 184, resp.; R^2 = 0.43 and 0.21, resp.). We also include terms for interactions between the punishment received and treatment, as well as for the difference between i's own and the others' average contributions.

The estimates show that, while sanctions increase subsequent contributions of low contributors (coeff. = 0.866, p = 0.001), they have no significant impact on the behavior of high contributors (p = 0.715).[5] The impact of punishment on subsequent contributions is similar in the *Baseline* and the *Waiting & Emotion* treatments (p=0.521). In contrast, the effect is higher in the *Waiting* treatment (p=0.043) and in the *Virtual Punishment* treatment (p=0.091), suggesting that the lower contribution levels in the emotion-venting treatments cannot be explained by lower impact in the *Waiting & Emotion* treatment but rather they result from the fact that individuals punish less.

[5] This last finding differs from one reported in Masclet et al. (2003), Cinyabuguma et al. (2006), Ones and Putterman (2007), and Page *et al.* (2008). They find that punished high contributors reduce their contributions on average.

3.2.2. The effect of venting emotions on earnings (i.e., efficiency)

In this section we investigate the consequences of venting emotions on earnings or efficiency. In other words, does the reduction in costly punishment found in the emotion-venting treatments offset the reduced earnings due to lower contribution levels in those same treatments. Figure 7 shows the percentage difference in payoff compared to *Baseline* of each emotion venting treatment across the 10 decision periods. The mean final payoff amounts to 21.95 ± 8.7 ECU *Baseline*, 24.51 ± 7.19 in *Waiting*, 22.12 ± 8.41 ECU in *Waiting & Emotion*, and 22.87± 5.40 ECU in *Virtual Punishment*. In *Waiting*, in particular, the positive effect of costly punishment reduction seems to largely compensate for the negative effect of reduced public goods contribution levels. These welfare implications of venting emotions are summarized in result 5.

RESULT 5: *In the Waiting treatment, the welfare-increasing effect of reduced punishment more than offsets the welfare-reducing decrease in contribution levels. The net effects of Waiting & Emotion and Virtual Punishment are less clear.*

Table 6 offers additional support for Result 5 beyond what is shown in Fig. 7. In Table 6 we estimate a random effects model for total group payoffs both before punishment (first stage) as well as after punishment (final payoff). Controls are included for the period, final period, group contribution levels, and the key emotion venting treatment (*Baseline* is the reference treatment). The key result in Table 6 indicate that final payoffs of the group are significantly higher in the *Waiting* treatment and in the *Virtual Punishment* treatment, compared to *Baseline*. Of course, the result of higher payoffs in *Virtual Punishment* is clearly driven by substantial improvements in welfare in the early periods (see Fig. 7 and estimate (3) of table 6), while these benefits appear to disappear and even reverse by the end of the 10 decision rounds. While Gächter et al. (2008) show that the

benefits of sanctions may increase over a long-term interaction, our experiment does not compare punishment against a no-punishment benchmark. Rather, our results indicate a possible welfare improvement beyond what one might achieve in a benchmark punishment institution if there is a cooling off period to allow the hot-emotional state to subside.

4. CONCLUSION

Emotions often contribute to decision making, and social dilemmas represent a common class of decision environments where norm enforcement may involve punishment. We designed an experiment to study the effects of venting emotions on punishment and final outcomes in a classic social dilemma setting—the Voluntary Contributions Mechanism. Our *Baseline* treatment is a standard VCM game with monetary sanctions as the norm enforcement tool. Our contribution to the literature is the addition of several treatments which vary the degree to which a subject may vent her emotions prior to assigning costly punishment points to others. We start by adding a simple 5-minute cooling off period in the *Waiting* treatment. The *Waiting & Emotions* treatment additionally allows subjects to express their emotional states through self-reported emotion ratings. Our most comprehensive treatment, *Virtual Punishment*, additionally allows non-binding virtual (and confidential) punishment points to be assigned prior to the cooling off period.

We find robust effects of emotional venting on both punishment behavior and contribution levels in the VCM game. Since punishment is the norm enforcement tool thought to discipline group members into behaving more cooperatively, these results imply both a payoff increasing and decreasing effects as a result of emotion venting. As such, the net welfare effect of emotional venting in the social dilemma is of particular interest in our results. In short, our

results indicate that it may be most efficient to allow a cooling off period so that emotions, which may lead to inefficient levels of irrational punishment, may dissipate. In some instances, the effect of venting emotions may not be as clear. The effectiveness of allowing for the additional expression of emotions may depend on the context of the decision environment. For example, our *Virtual Punishment* treatment allows individuals to not only cool-off and express emotions but also to assign costless virtual punishment points, which may later be revised, while still in a hot emotional state immediately following contribution decisions. There are significant welfare gains in this treatment for only the first few rounds, though these gains disappear and even reverse after continued interaction. Because we find a declining trend of emotional state ratings across the 10-periods of a given treatment, this likely indicates that implementing emotional venting in a way similar to *Virtual Punishment* may only be effective in limited or one-shot interactions.

Our research implies that the common advice suggesting one should take time to cool off and not make decisions while in the heat of emotions may hold wisdom in the realm of social dilemmas and norm enforcement. While others have shown that punishment institutions can be welfare improving, we also find the potential for additional benefits by allowing for the venting of one's emotions. Any opportunity to remove one from a hot emotional state implies that choices are more likely to be based on deliberate and rational thought. This is not to imply that emotions are irrational, but decisions based on emotional responses may be rash or regrettable or lead to inefficiencies in some instances. Importantly, by documenting the fundamental trade-off between the reduced use of punishment and the resulting decrease in contributions as a result of reduced punishment, our research also highlights the beneficial impact of maintaining some level of strategic punishment as a deterrent. In the end, this research shows

where fruitful efforts may be directed in the future study of emotions, norm enforcement, and efficiency.

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Figure 1. Frequency of punishment in each treatment

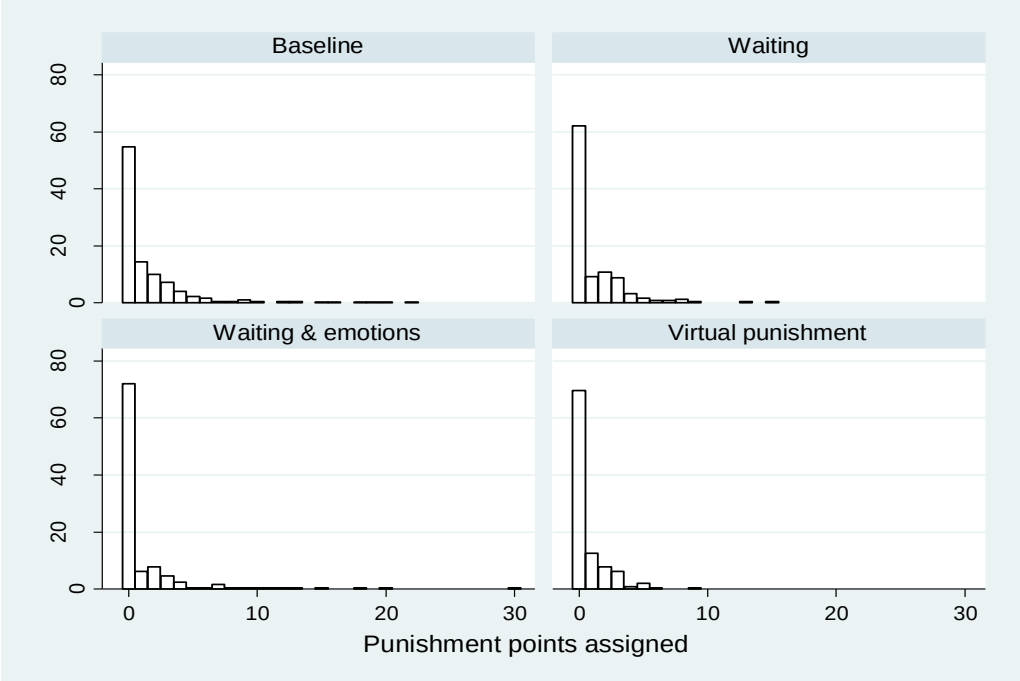
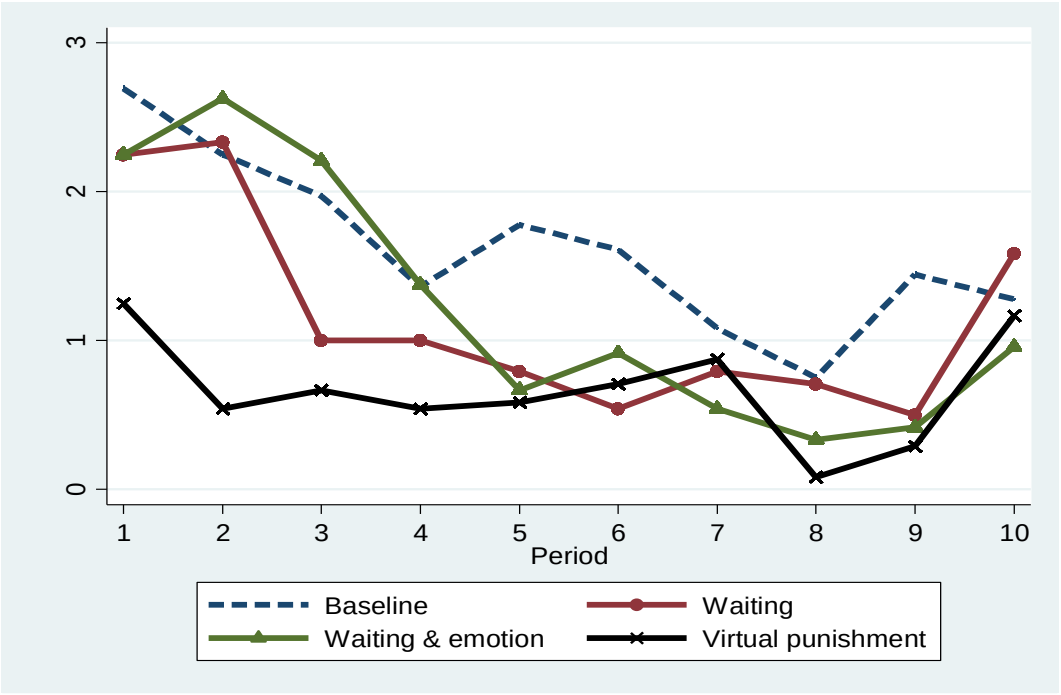


Figure 2. Punishment decision over time in each treatment


0
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2
3
1
2
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4
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6
7
8
9
10
Period
Baseline
Waiting
Waiting & emotion
Virtual punishment

Figure 3: Intended and actual Punishment decision over time in the announcement emotion and waiting treatment

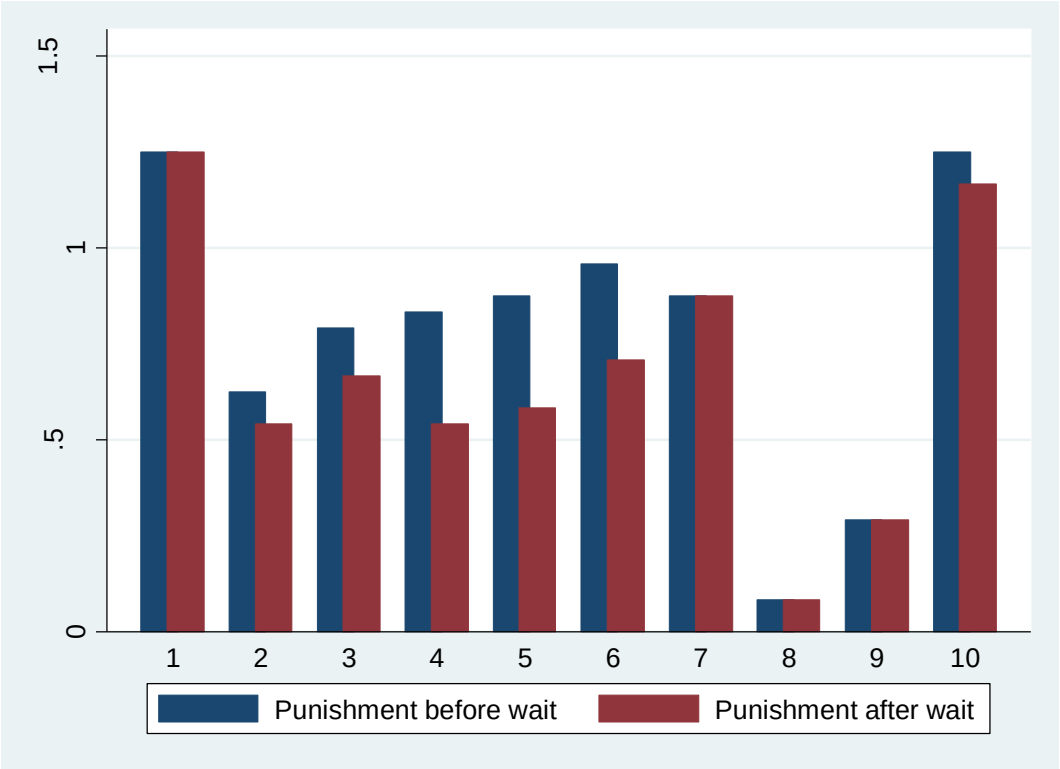


Figure 4. Punishment decision and intensity of emotion

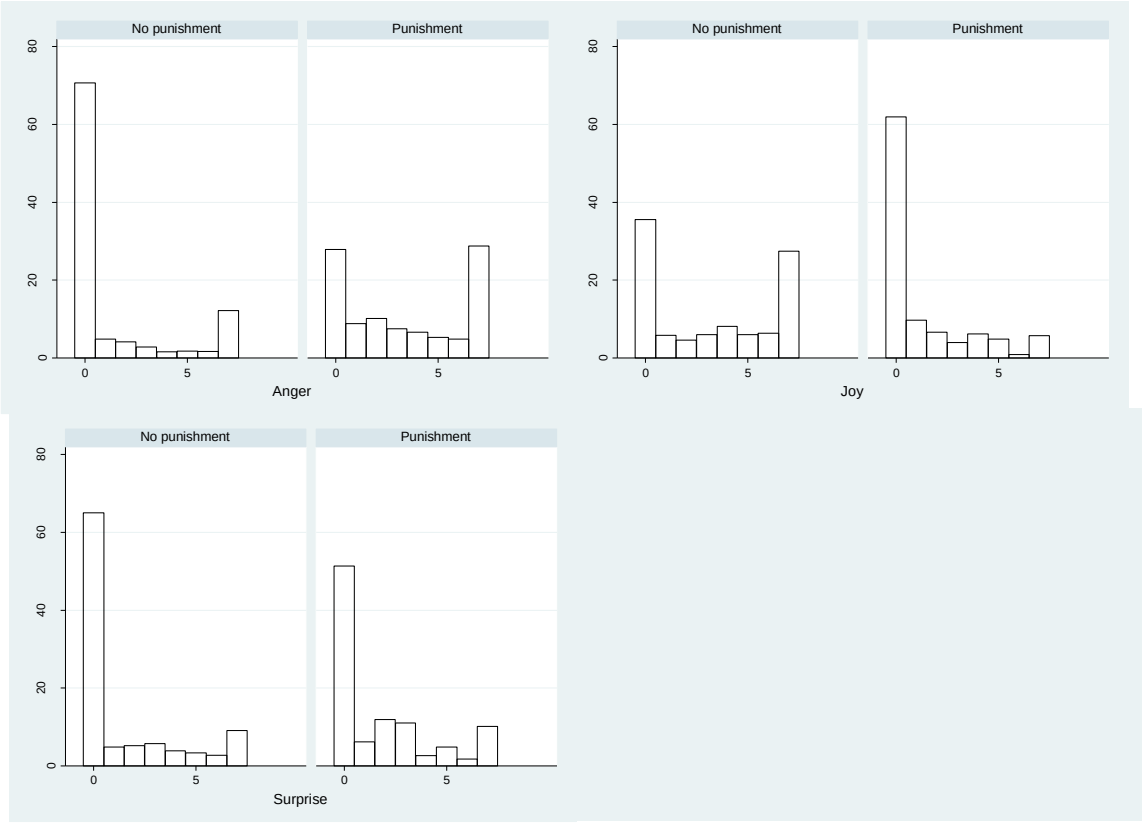


Figure 5: Contribution over time per treatment

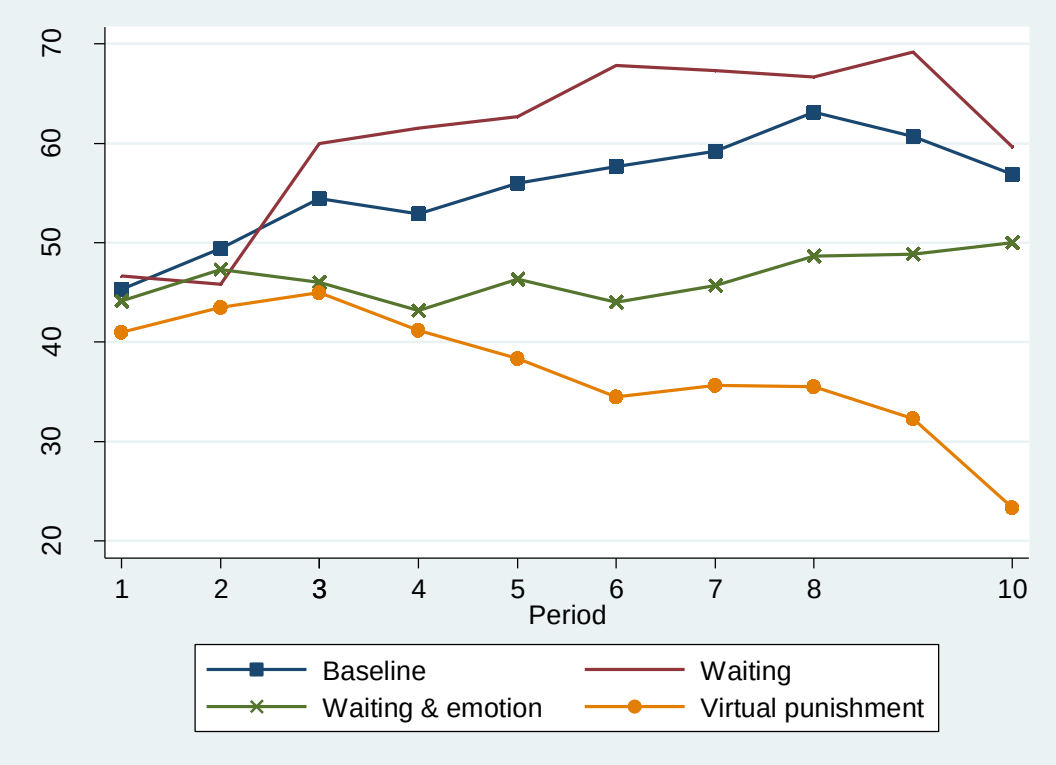


Figure 6: The frequency of contribution per treatment

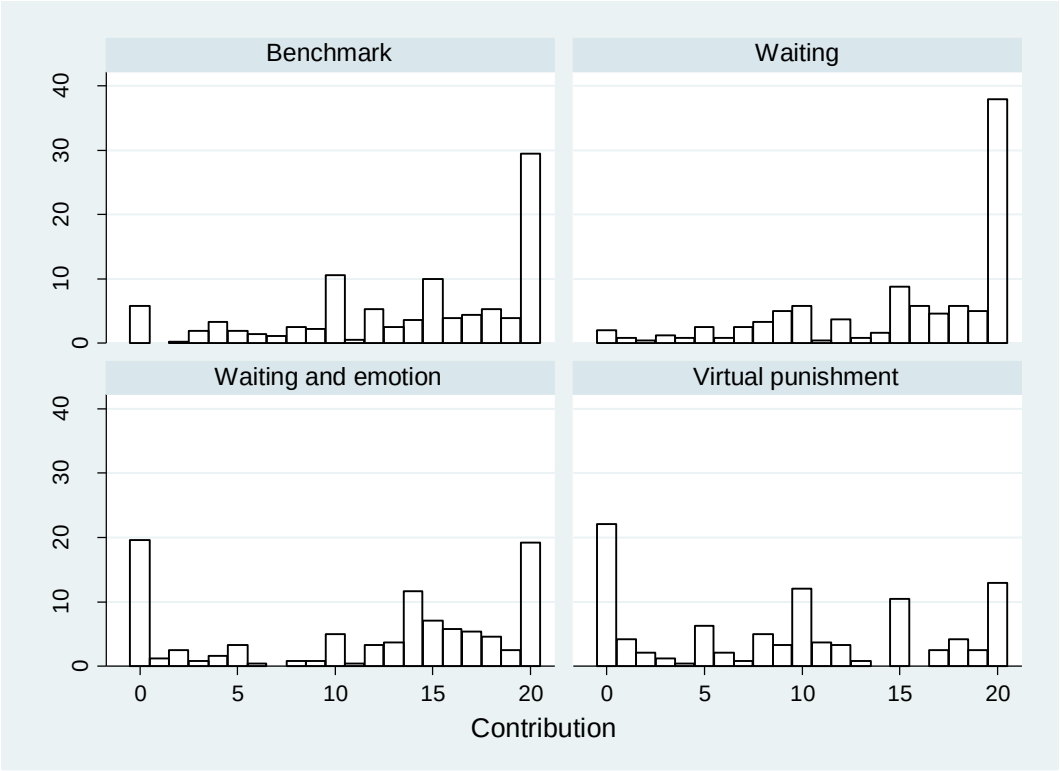
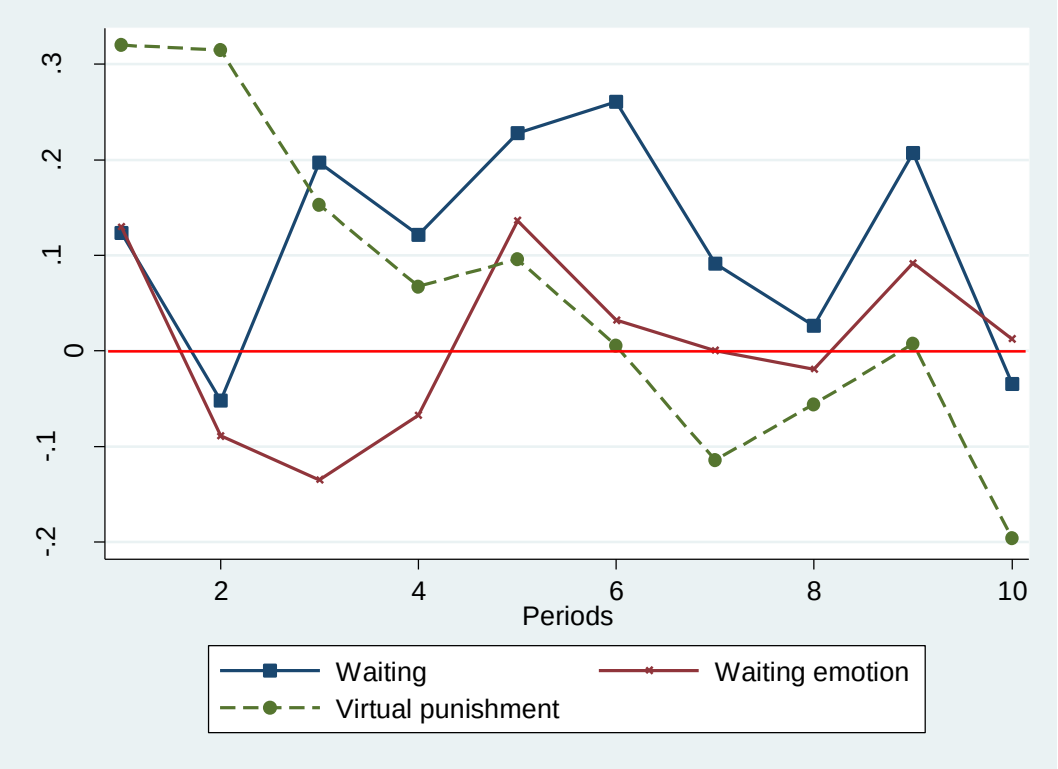


Figure 7: Average payoff difference between venting treatments relative to Baseline



The payoff difference is calculated as *(treatment-Baseline)/Baseline*.

Table 1: Characteristics of the experimental sessions

Session number	*# subjects*	*# groups*	*Treatment*	*Stage I*	*Stage II*	*Stage III*
1	24	6	Baseline	Contribution	---	Punishment
2	12	3	Baseline	Contribution	---	Punishment
3	24	6	Waiting	Contribution	Waiting	Punishment
4	24	6	Waiting emotion	Contribution	Waiting & emotions	Punishment
5	24	6	Virtual Punish	Contribution	Virtual punish+Waiting & emotions	Punishment
Total	108	27				

Table 2: Determinants of Total Individual Punishment (RE Tobit Models)

Dep Var **Costly Punishment** **Points assigned**	(1)	(2)
Waiting	-0.923	-1.160
	(0.994)	(0.980)
Waiting & Emotion	-1.784*	-1.784*
	(1.015)	(1.015)
Virtual Punishment	-1.875*	-2.107**
	(1.002)	(1.010)
Period	-0.586***	-0.586***
	(0.062)	(0.062)
Final Period	2.772***	2.780***
	(0.603)	(0.603)
Demographics	No	Yes
Constant	2.011**	8.251**
	(0.687)	(2.608)
Observations	1080	1080
Log likelihood	-985.520	-1437.02
Lef cens. Obs.	686	686

Notes: *** Significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level.

Table 3: Determinants Subject-Specific Punishment (Random Effect Tobit Models)

Treatments	*All*	*All*	*All (Period 1 Only)*	***2- STAGE HECKIT***		*Treatments with Emotions Venting*
				Intensity	*Probit Selection*	
Dep Variable	$P_{i,j}$	$P_{i,j}$	$P_{i,j}$	$P_{i,j}$	$P_{i,j}$ =0,1	$P_{i,j}$
Coefficient	(1)	(2)	(3)	(4)	(5)	(6)
Waiting	-0.25 (0.58)	-0.35 (0.57)	-0.62 (0.49)	-0.64 (0.43)	-0.06 (0.23)	----
Waiting & Emotion	-0.63 (0.59)	-0.52 (0.59)	-0.46 (0.50)	-0.02 (0.45)	-0.10 (0.24)	Reference Group
Virtual Punishment	-1.15* (0.59)	-1.27** (0.60)	-2.06*** (0.56)	-0.95* (0.50)	-0.49** (0.223)	-0.67 (0.71)
Anger	----	----	----	----	----	0.22*** (0.07)
Joy	----	----	----	----	----	-0.44*** (0.08)
Surprise	----	----	----	----	----	0.09*** (0.06)
Pos Dev Avg	-0.10*** (0.03)	-0.10*** (0.031)	-0.17*** (0.06)	----	-0.01 (0.02)	0.07 (0.06)
|Neg Dev| Avg	0.39*** (0.02)	0.39*** (0.02)	0.31*** (0.05)	----	0.17*** (0.02)	0.21*** (0.05)
Average Contribution	-0.01 (0.02)	-0.01 (0.02)	-0.12* (0.06)	----	0.01 (0.01)	0.08* (0.04)
Period	-0.21*** (0.03)	-0.21*** (0.03)	----	-0.02 (0.03)	-0.06*** (0.02)	-0.30*** (0.06)
Final Period	0.82*** (0.23)	0.814*** (0.27)	----	0.63* (0.36)	0.24 (0.15)	1.78** (0.53)
Demographics	No	Yes	Yes	Yes	Yes	Yes
Constant	-1.65*** (0.50)	2.01 (1.57)	5.70*** (1.60)	4.17*** (1.19)	0.48 (0.473)	1.43 (2.33)
Observations	3240	3240	324	3240	3240	1440

Notes: *** Significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level.

Table 4: Determinants of Emotions (Random Effect Tobit Models)

Dep. Var =	Anger	Joy	Surprise
Coefficients	(1)	(2)	(3)
Waiting & Emotion	Ref	Ref	Ref
Virtual Punishment	0.611 (0.990)	0.711 (0.665)	0.457 (1.080)
Positive *j* Deviation from average	-0.611*** (0.0609)	0.438*** (0.0226)	0.354*** (0.0400)
Negative *j* Deviation from average	0.655*** (0.0399)	-0.742*** (0.0428)	0.150*** (0.0437)
Avg Group Contributions	-0.337*** (0.0384)	0.412*** (0.0227)	0.164*** (0.0404)
Period	-0.0803* (0.0484)	-0.0787*** (0.0270)	-0.463*** (0.0527)
Final Period	-0.342 (0.445)	0.395 (0.254)	-0.363 (0.568)
Demographics	Yes	Yes	Yes
Constant	4.889 (3.284)	-4.837** (2.169)	-3.320 (3.546)
Observations	1440	1440	1440

Notes: *** Significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level.

Table 5: Determinants of contributions (robust standard errors in parenthesis)

Models	***RE GLS[a]***	***RE GLS[a]***	***RE Tobit[b]***	***RE Tobit[b]***
Treatments	***All***	***All except Baseline***	***All***	***All except Baseline***
Coefficient	**(1)**	**(2)**	**(3)**	**(4)**
Waiting	1.30 (1.38)	----	1.467 (1.56)	----
Waiting & Emotion	-2.61* (1.42)	-3.74** (1.62)	-3.03* (1.56)	-4.27** (1.83)
Virtual Punishment	-4.81*** (1.50)	-5.89*** (1.60)	-5.45*** (1.58)	-6.76*** (1.81)
Period	0.27*** (0.05)	0.16** (0.07)	0.25*** (0.06)	0.11 (0.08)
Final period	-1.90*** (0.57)	-1.82** (0.73)	-2.14*** (0.55)	-2.20*** (0.73)
Demographics	Yes	Yes	Yes	Yes
Constant	20.57*** (4.55)	22.74*** (4.80)	21.69*** (4.83)	24.94*** (5.54)
Observations	1080	720	1080	720

*** significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level.

Table 6: Determinants of first stage and final payoffs (random-effects GLS models)

Dependent variables	First stage payoffs	Final payoff	Final payoff
	(1)	(2)	(3)
Baseline treatment	*Ref.*	*Ref.*	*Ref.*
Waiting treatment	1.044	2.143*	2.465*
	(0.829)	(1.27)	(1.371)
Waiting & emotion treatment	-1.849**	0.834	-0.478
	(0.83)	(1.35)	(1.92)
Virtual punish	-3.746***	2.257*	6.301***
	(0.84)	(1.16)	(1.43)
period* Waiting treatment			-0.048
			(0.14)
Period*Waiting & emotion treatment			0.216
			(0.25)
period*Virtual punish			-0.776***
			(0.19)
Contribution	-0.209***	0.317***	0.270***
	-0.024	-0.056	-0.061
Periods	0.215***	0.831***	0.978***
	-0.043	-0.091	-0.117
Final period	-1.535***	-4.504***	-4.593***
	-0.411	-0.732	-0.737
Constant	30.202***	14.317***	14.540***
	-0.645	-2.74	-2.775
Observations	1080	1080	1080

Note: *** significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level. Robust standard errors are in parentheses. The "Baseline treatment" variable is omitted as it is the reference category. The "Waiting (waiting and emotion, respectively) treatment" variable is a dummy that takes 1 if the subject plays the Waiting (Waiting emotion, respectively) treatment, and 0 otherwise.