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Emotion Venting and Punishment in Public Good Experiments

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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

In typical voluntary contributions mechanism (VCM) experiments, free-riding incentives are at odds with group efficiency. Substantial contributions to the public good are common in VCM games, but such cooperative play 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 periods, more recent studies have attempted to identify modifications to the game that may increase cooperation.[1] Of particular interest to the present paper is the use of sanctions 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 sanctioning is effective in deterring free riding. However, while the introduction of sanctioning significantly improves cooperation, it may also harm overall welfare because punishment is costly and reduces both the punisher's and target's payoff.

The short-run net effect of punishment is to reduce welfare, although punishment may increase welfare if the horizon is sufficiently long (Fehr and Gächter, 2000; Gächter et al., 2008). However, a concern with punishment is that 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 emotionally excessive reaction (i.e., punishment will not "fit the crime"). Efficiency requires punishment intended for deterrence with emotionally excessive punishment removed.

[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).

The focus of our paper is to study whether the venting of one's emotions might reduce excessive punishment while preserving cooperative incentives created by the punishment mechanism. Allowing people to express their negative emotions may help restrain 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 examples of formalizing the venting process. "Venting rooms" are places that allow individuals to vent their negative emotions by screaming, smashing dishes, 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. A more straightforward workplace application, where worker effort can be considered a contribution towards a public good, would be to recognize that decisions made in hot emotional states can be suboptimal (e.g., excessive workplace discipline).

Could the introduction of emotion venting opportunities increase 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. This is

[2] This is based on the idea that emotional states are temporary (see Ekman, 1994; Loewenstein, 2000).

[3] For instance, see 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 exists 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).

particularly important given that punishment seems to primarily result from a personal desire to express dissatisfaction through punishment, as opposed to a desire to deter free riding through strategic punishment efforts (Casari and Luini, 2012; Duersch and Müller, 2013; Ouss and Peysakhovich, 2013). On the other hand, the introduction of venting emotions may have a negative net effect on welfare if the reduction in punishment also reduces the strategic punishment necessary to limit free riding.

Emotions have been traditionally absent from the economic analysis (but also from the pre-1960 literature in psychology) given the fact that they had long been considered the antithesis of rational decisions (see Kaufman, 1999, for a discussion), with a few exceptions (e.g., Frank, 1988; Elster, 1998). This sharply contrasts with the contemporary view of the role of emotions in economics, psychology, as well as in neuroscience. In the current view, emotions are not in opposition to reason but instead provide essential support to the reasoning process that guides human decisions toward particular ends (e.g. Damasio, 1994). Furthermore, it has been argued that optimal decisions require an intermediate level of emotional arousal (Yates, 1990), thus highlighting the role that emotions may play in decision efficiency. The intuition is that too little emotional intensity is sub-optimal because it inhibits decisions, while too much emotional arousal is also detrimental to efficiency because it induces loss of control and excessive reactions.

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 a treatment without the opportunity to vent emotions. The reduction in punishment leads to reduced contributions, which highlights the deterrence value of punishment, but we find that the net effect of a simple cooling-off period to vent emotions can still be an increase in overall long-run 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. 2014). 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 been found to increase positive self-reported emotional states satisfaction (Joffily et al., 2014), and 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, Andreoni's (1990) concept of a "warm glow" from giving implies that cooperation should also trigger reward center activation. Indeed, striatum activation has been associated with mutually cooperative behavior in prisoner's dilemma games (Rilling et al., 2002; Rilling et al., 2004). In recent work, Drouvelis and Grosskopf (2014) used short video clips to induce happiness and anger in a one-shot VCM environment. They found that angry subjects punished more than others, while happy subjects contributed more than angry subjects.

The originality of our paper is fourfold. First, we investigate the impact of venting emotions on punishment. While several studies have investigated the behavioral impact of emotions on punishment decisions, only a few studies have investigated the behavioral impact of venting emotions on punishment (Bushman et al. 1999; Bushman, 2002; Bolle et al 2014; Xiao and Houser; 2005), and the results are somewhat mixed. Some studies found no effect of venting emotions (Bushman et al. 1999; Bushman, 2002)[4] while others observed a positive effect of venting (e.g. Bolle et al. 2014; Xiao and Houser, 2005).[5] Our design better isolates the emotion venting effect, which is somewhat confounded in these previous studies given how they involve shared venting information. The purpose of this experiment is therefore to contribute to the resolution of the debate about whether venting emotions has an effect on punishment decisions. Secondly, our design allows us to vary the level of venting emotions from a simple cooling off period to more complete emotion venting that includes self-reporting one's emotional state and assigning virtual punishment points. We can therefore study whether some venting treatments affect punishment/contribution decisions more than others. To our knowledge no previous study has done this.

Thirdly, we investigate not only the effect of venting emotions on punishment but also its effect on welfare (i.e., efficiency). Indeed we conjecture that there may exist an

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[4] Our paper is related to Bushman et al. (1999) who investigated whether reading cathartic messages and hitting a punching bag were effective means to vent anger. The authors observed that individuals were even more aggressive after reading the cathartic messages and hitting a punching bag compared to the control group, which directly contradict catharsis theory. Bushman (2002) also showed that doing nothing seems to be the most effective way to reduce the intensity of anger. Our current paper differs from these two experiments in psychology in the way we control the environment in the laboratory, our introduction of monetary incentives, and our generation of emotion data using a simple elicitation procedure.

[5] Our paper is most closely related to Bolle et al. (2014), who observe that venting emotions reduces aggression in a vendetta game. Our paper differs from this previous study in our investigation of the effects of venting emotions in a context of a social dilemma and not the occurrence of vendetta (i.e., personally-directed retaliatory punishment, which is precluded in our design given blind subject identities). Furthermore our study differs from this previous study in our use of multiple ways to vent emotions, which allows us to compare the relative effectiveness of different ways to vent emotions. Our paper is also closely related to Xiao and Houser (2005). Xiao and Houser (2005) find that cooperation is higher when individuals are given the opportunity to express their emotions in less expensive ways than through punishment. In Xiao and Houser (2005), responders in an ultimatum game can express emotions by sending a message to proposers at no cost, and they find that this significantly reduces the rejection rates on unfair offers. However, their paper does not implement "virtual punishment" in the same sense we do, given the information communicated to other subjects in their design. Our current paper differs from theirs in the way our message venting remains private information. All of this helps us to isolate the pure emotion venting effect. It is also the case that sending written messages may convey a nonpecuniary punishment that may influence decisions. For instance, one may reasonably argue that written messages in Xiao and Houser (2005) may increase the proposer's offer as a result of, or in anticipation of, the social cost of disapproval of unfair offers (see Masclet et al. 2003).

optimal interior level of venting emotions corresponding to higher efficiency. Our intuition is that too little venting of emotions may lead to excessive and costly emotion-based punishment. In contrast, venting too much emotion may harm welfare if it limits the use of punishment as a deterrent. This intuition is based on the Yerkes-Dodson law in psychology—first identified in Yerkes and Dodson (1908)—that posits a non-linear relationship between emotional arousal and performance. Finally, our findings suggest that the existence of an optimal level of punishment requires an optimal level of emotions. Indeed when emotions are very low or even absent, the individuals behave as homoeconomicus who never punish, which is inefficient. In the opposite, excess of emotions leads to overreaction and therefore excessive punishment, which is also inefficient.

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.[6] Each period of the *Baseline* treatment has two stages.

[6] 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.

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				

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:

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

where c_i is player *i*'s contribution to the group account. The more ECUs an individual allocates to the group account, the lower her own earnings but the greater the group's earnings. For this reason, allocations to the group account are referred to as contributions and are considered a proxy for 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. Players could not 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. We use a fine:punishment ratio of 1:3, whereby 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 3 (note also that superscripts 1 and 2 refer to stages 1 and 2).[7]

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 the opportunity to express his/her emotions during the 5-minute wait period by indicating (on a scale of 1-7) their self-reported level 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, but with the common knowledge that these messages are never sent (i.e., these messages cannot have any implications for behavior, in contrast to other studies).

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 were assigned, the players were required to wait five minutes. Participants gave self-

[7] This punishment price is common in the literature and reflects an intermediate punishment price among those studied in Anderson and Putterman (2006).

reported emotions ratings during this 5-minute wait period, and afterwards were required to 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, because virtual punishment points are non-binding, private information, and the equilibrium is unique. Equilibrium in all treatments involves zero costly punishment because assigning punishment always reduces the payoff of the punisher (see online Appendix for experimental instructions).

2.2. Behavioral Predictions

Our key hypothesis is based on the conjecture that allowing people to vent their emotions will reduce excessive sanctions, and thus reduce punishment levels. A suitable framework to describe our predictions must recognize the impact of emotion as well as rational deliberation in decision making. For example, a dual-systems framework considers that both a more automatic (system 1) and more deliberate (system 2) decision process can play a role in decision making.[8] System 1 would be responsible for impulsive decisions of the sort that may result from a hot emotional state. Excessive emotion-based punishment would be this sort of impulsive decision in our experiments. On the other hand, deliberate thought, which may include input from non-impulsive emotion, would be responsible for the rest of one's punishment choice.

[8] Such frameworks in the literature include: Schneider & Shiffrin (1977), Camerer et al. (2005), and Kahneman (2011), and neural evidence shows that different parts of the brain activate with system 1 versus system 2 thinking (Goel et al., 2000).

Emotion venting is aimed at reducing the emotional impulse to punish excessively. This may be accomplished by forcing the decision maker to wait beyond the impulsive time frame when making a punishment decision. Alternatively, allowing one to express or release emotions (rather than letting them dissipate over time) may also reduce the emotions prior to one's punishment decision. What remains an empirical question is whether venting may also reduce emotions to an extent that the remaining decisions are too close to *homo economicus* decisions, which in our experiments would imply inefficiently low punishment. Nevertheless, this framework applied to our experiment predicts less punishment compared to the baseline in each of the treatments that allow emotion venting, with the greatest reduction in punishment in instances where there exist the most opportunities to vent emotions. This is described in H1.

H1: *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*

Our second conjecture is that individuals may experience emotions when observing the others' contributions relative to one's own contributions. Based on previous studies identified in Section 1, we hypothesize that observing high contributions may induce positive emotions in the anticipation of higher own-payoffs. In contrast, observing free-riding may induce negative emotion. This is stated as our second hypothesis:

H2: *Observing free riding induces negative emotions, while observing cooperative behavior induces positive emotions.*

Our next hypothesis 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 negatively emotionally aroused when learning of others' low contributions may be more willing to punish free-riders. This conjecture is summarized in H3.

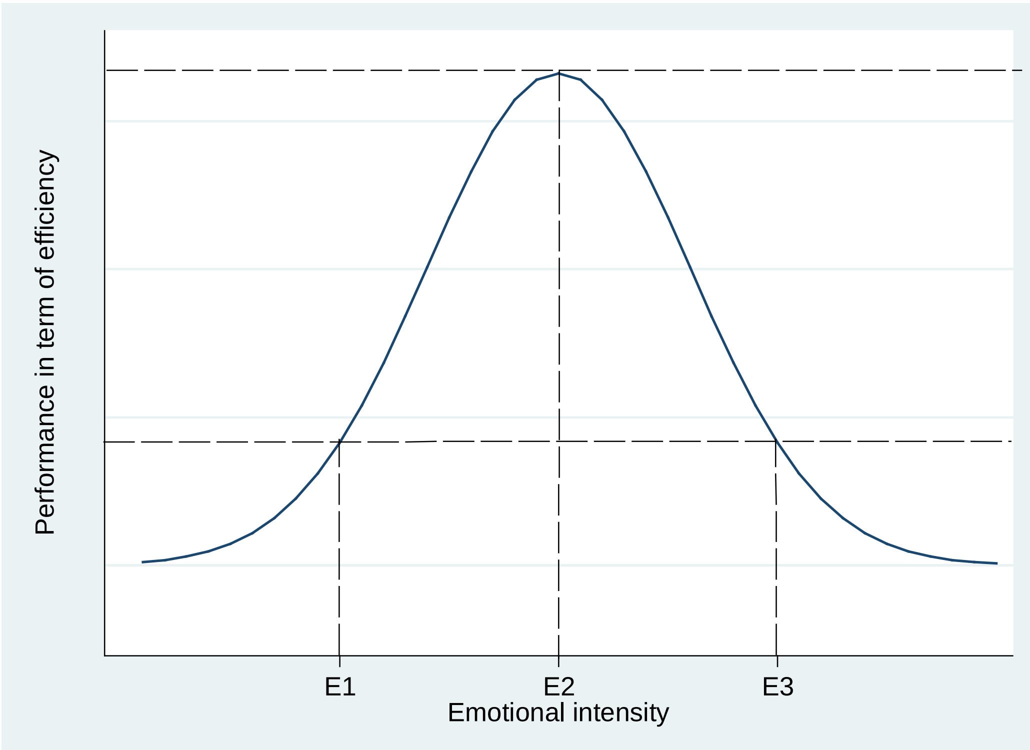
H3: *The more individuals are (negatively) emotionally aroused when learning free riding, the more punishment points they will assign.*

Finally our last hypothesis concerns the effects of venting emotions on welfare. We conjecture that the relationship between venting emotions and efficiency may be non-linear. Specifically, in the absence of venting (i.e., *Baseline*) excessive emotion-based punishment may induce important welfare costs. This may be consistent with previous studies that have shown that being in a negative mood is detrimental for subject's overall welfare as measured by average net earnings (e.g. Drouvelis and Grosskopf, 2014).

In contrast, venting too much emotions, which may be the case in a treatment like *Virtual Punishment*, may also lead to inefficiency by inducing too little punishment (i.e. inefficiently low deterrence). Consequently we conjecture that there may exist an optimal level of venting emotions in term of welfare corresponding to the moderate venting treatments (i.e. *Waiting* and *Waiting & Emotion* treatments). We cannot predict which of these two venting treatments will be the most efficient, only that intermediate levels of venting may be more efficient that either extreme. Our conjecture is based on the Yerkes-Dodson (Y-K) law in psychology that posits an inverted U-shape relationship between emotional arousal (i.e. the intensity level of a specific emotion, such as anger) and performance (i.e. performance in a particular task or decision). This relationship is depicted in Figure 1 (the "Hebbian" version of the law: Hebb, 1955).[9]

[9] The original Y-K law (Yerkes and Dodson, 1908) considers that *simple* task performance may still benefit from high levels of arousal. However, the VCM-punishment environment we study would be sufficiently complex as to relate to the complex task version of the Y-K law that posits a non-monotonic arousal-performance relationship, as is typically shown in textbooks.

Figure 1. Emotional arousal and efficiency



According to this law, too little emotional intensity would be inefficient as it leads to absence of reaction due to inhibition which may be detrimental (see E1 in Fig. 1). As emotional intensity increases, performance improves until an optimal point is reached (E2). Beyond this optimal point, additional emotional intensity becomes counterproductive to performance due to loss of control and excessive reactions of violence and/or aggression (E3). Several laboratory experiments confirm the existence of this inverted U-shape relationship (e.g., Ascraft and Faust, 1994). Some economists have also introduced the

Yerkes-Dodson law into economic theory (e.g., Leibenstein, 1997; Kaufman, 1999).[10] This leads to our fourth hypothesis.

> **H4:** *Welfare, net of punishment costs, will be maximized when emotions are vented to an intermediate level. That is, we hypothesize lower efficiency in Baseline and Virtual Punishment than our intermediate venting treatments*

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 (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, which involves just one treatment of 10 periods. Thus, this is a between-subjects design regarding the emotion venting treatments. 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. Punishment Choice and Intensity of Punishment

Figure 2 displays the frequency of total punishment points assigned by each individual subject towards the three other group members in each treatments.[11] Though the modal

[10] Psychologists have attempted to identify the different factors that may explain the inverted U-shape between emotional arousal and performance (e.g. Forgas, 1995). Inhibition that prevents expression of emotion may be inimical to quality decision making. When emotional intensity increases (at least up to some point), emotions may reduce the barriers of inhibition and enhance engagement. However, beyond some point increased emotional intensity may be counterproductive as it causes a deterioration of decision making. The reason may be that excessive emotions may disrupt the agent's ability to determine optimal outcomes, may block out rational cost-benefit considerations, or may cause some relative loss of control and promote acts of excessive aggression and violence (e.g. Lazarus, 1991; see also Kaufman, 1999, for a discussion).

punishment is zero, punishment is nevertheless widely employed in all treatments. Compared to *Baseline*, it also appears that individuals punish less when they 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 (91/240 observations), and punishment is even lower when one can additionally express emotions: 27.91% (67/240) and 30.41% (73/240) of the time 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 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 3 displays the evolution of average punishment points across treatments over the course of the 10 decision rounds.

[11] See the online Appendix for full distributions of individual punishment points pooled across periods (Fig. A1), and for average subject contributions and punishment choices in a given period separated by experiment group (Tables A1 and A2). These tables show the heterogeneity of behavior across groups, and this heterogeneity remains even in the final 5 periods of play.

Figure 2. Frequency of punishment in each treatment

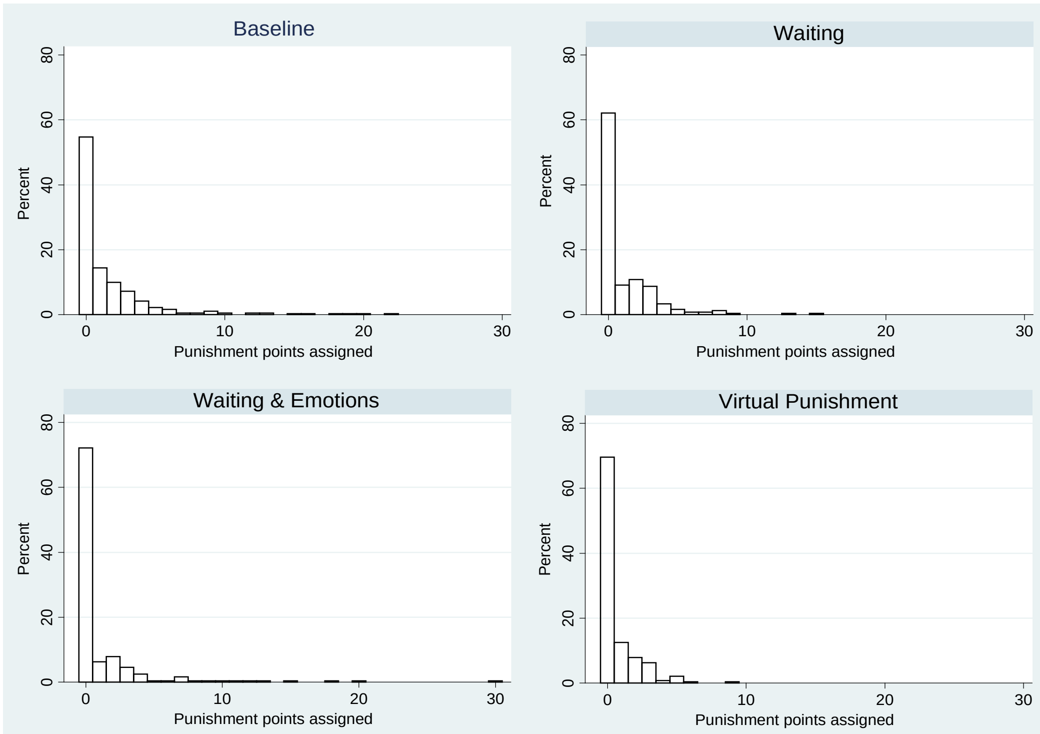
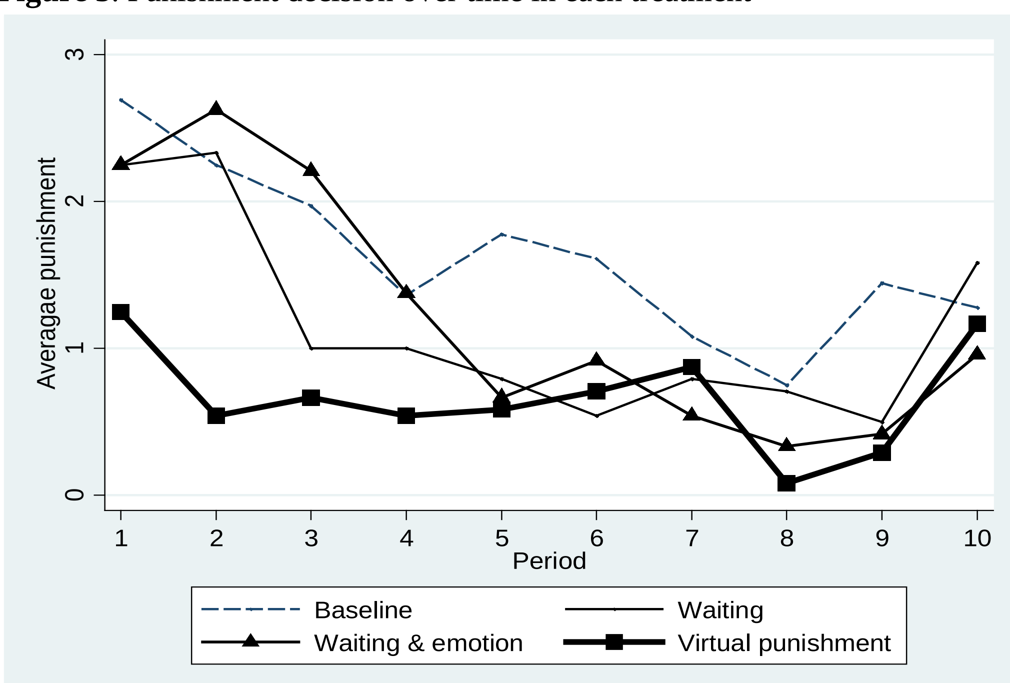


Figure 3. Punishment decision over time in each treatment



Both Fig. 2 and 3 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 in each treatment is: 1.62 *Baseline*), 1.15 (*Waiting*), 1.23 (*Waiting & Emotion*), and 0.67 (*Virtual Punishment*). Pooling all periods, nonparametric tests on average punishment levels of each group (Mann-Whitney tests, unless otherwise specified) indicate significantly lower levels of punishment in *Virtual Punishment* compared to *Baseline* (p=.06), but no significant differences otherwise (p >.10). If one focuses on the final five periods of behavior, non-parametric tests indicate significantly fewer average punishment points assigned in the *Waiting & Emotions* versus *Baseline* (p=.07) and *Virtual Punishment* versus *Baseline* (p=.07). Average punishment points in *Waiting* are less than *Baseline*, but the difference is statistically insignificant (p>.10). We supplement these tests with controlled analysis below to justify our first result, which largely supports H1.

RESULT 1: *Punishment is 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 the dependent variable is the punishment points assigned by a subject to all other group members combined. We use random effects Tobit models to account for censoring at zero and multiple observations per subjects. In addition to treatment dummies, we include a variable for the decision period, a dummy for the final decision period, and column (2) estimates in include demographic controls (gender, education level, dummies for University and economics students).

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

Dep Var=Costly Punishment Points assigned

Variable	(1)	(2)
Waiting	-0.92	-1.16
	(0.99)	(0.98)
Waiting & Emotion	-1.78*	-1.78*
	(1.012)	(1.02)
Virtual Punishment	-1.88*	-2.11**
	(1.00)	(1.01)
Period	-0.59***	-0.59***
	(0.06)	(0.06)
Final Period	2.77***	2.78***
	(0.60)	(0.60)
Demographics	No	Yes
Constant	2.01**	8.25**
	(0.687)	(2.61)
Observations	1080	1080
Log likelihood	-985.52	-1437.02
Lef cens. Obs.	686	686

Notes: *** Significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level.
Standard errors in parenthesis.

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. Consistent with hypothesis H1, 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. Overall average levels of virtual punishment points are greater than average actual punishment levels in six of ten periods (and they are equal in the other four).

We also model the choice to punish each individual member of one's group in a series of estimations in Table 3, where the dependent variable, $P_{i,j}$, measures the punishment points player *i* assigns to player *j* in her group in each period. In addition to the independent variables used in Table 2, we also include variables to measure the effect of positive or negative deviations (measured in absolute value) of player *j*'s contribution from the remaining group average, and we control for the average contribution level of the entire group. Column (2) replicates column (1) using only *Period*=1 data, where concerns of endogeniety are completely absent (i.e., no previous history of contribution or punishment). Columns (1) and (2) of Table 2 are estimated as random effects Tobit models.

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

Treatments Included →	*All*	*All (Period 1 Only)*	*All*		*Emotion Venting Treatments*	*Emotion Venting Treatments*	
			HECKIT			***HECKIT***	
	RE Tobit	*Tobit*	*Intensity*	*Probit Selection*	*RE Tobit*	*Intensity*	*Probit selection*
Dep Var →	$P_{i,j}$	$P_{i,j}$	$P_{i,j}$	$P_{i,j}$ =0,1	$P_{i,j}$	$P_{i,j}$	$P_{i,j}$ =0,1
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Waiting	-0.35 (0.57)	-0.62 (0.49)	-0.64 (0.43)	-0.06 (0.23)	----	----	----
Waiting & Emotion	-0.52 (0.59)	-0.46 (0.50)	-0.02 (0.45)	-0.10 (0.24)	Ref. Group	Ref. Group	Ref. Group
Virtual Punishment	-1.27** (0.60)	-2.06*** (0.56)	-0.95* (0.50)	-0.49** (0.223)	-0.86 (0.74)	-0.74** (0.31)	-0.38 (0.24)
Anger	----	----	----	----	0.33*** (0.07)	-0.03 (0.06)	0.14*** (0.04)
Surprise	----	----	----	----	0.04 (0.06)	0.07 (0.04)	-0.01*** (0.03)
Pos Dev Avg	-0.10*** (0.031)	-0.17*** (0.06)	----	-0.01 (0.02)	-0.05 (0.06)	----	0.00 (0.03)
|Neg Dev| Avg	0.39*** (0.02)	0.31*** (0.05)	----	0.17*** (0.02)	0.30*** (0.05)	----	0.10*** (0.02)
Average Contribution	-0.01 (0.02)	-0.12* (0.06)	----	0.01 (0.01)	-0.02 (0.04)	----	0.03*** (0.02)
Period	-0.21*** (0.03)	----	-0.02 (0.03)	-0.06*** (0.02)	-0.31*** (0.06)	-0.02 (0.07)	-0.09*** (0.03)
Final Period	0.814*** (0.27)	----	0.63* (0.36)	0.24 (0.15)	1.60*** (0.53)	1.56* (0.84)	0.35 (0.28)
Constant	2.01 (1.57)	5.70*** (1.60)	4.17*** (1.19)	0.48 (0.473)	1.87 (2.43)	3.57** (1.14)	0.11 (0.76)
Observations	3240	324	3240	3240	1440	1440	1440

Notes: *** Significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level. Standard errors in parenthesis.
Errors in the Heckit models are clustered at the individual level. In estimates 5-7, we did not include "Joy" due to colinearity with Anger and Surprise.

Columns (1) and (2) show 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* are statistically significant, which confirms that extra avenues for venting emotions reduce punishment more. The coefficient estimates on the venting emotions treatment in Table 3 can be thought of as a way to distinguish emotional from rational punishment, though we cannot go so far as to say *Virtual Punishment* all but rational punishment because some level of emotion likely still remains even in this treatment.

The variables *Period* and *Final Period* estimate similar effects as in Table 2—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 H3 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.

The estimations in columns (3) and (4) of Table 3 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)). For these estimations, we include the contribution level and differences variables in the selection equation but not the punishment intensity equation. The Heckit estimates results are qualitatively similar to the previous Tobit results, and they indicate that the most comprehensive emotion venting treatment, *Virtual Punishment*, decreases punishment on both the extensive and intensive margins. The remaining estimates in Table 3 included self-reported emotions as co-variates, which we discuss in the next section.

Altogether, these findings in columns (1)-(4) of Table 3, along with Table 2, indicate that venting emotions seems to play a role in reducing punishment. We therefore turn our attention to an analysis of the self-reported emotion data generated in the *Waiting & Emotion* and *Virtual Punishment* treatments.

3.2. The Effects of Contributions on Emotions

In this subsection we investigate whether observing contributions of others may trigger negative or positive emotions. If we consider that other individuals' contribution levels are what determine varied levels of self-reported emotions, one might more properly analyze emotions as dependent variables. In doing so, we find that contributions of a group member *j* relative to the remaining group members, *-j*, or relative to subject *i* are significant determinants of self-reported anger and joy, consistent with our hypothesis H2. This is our second result:

RESULT 2. *Individuals experience less joy and more anger when others free ride. Surprise results when a group member contributes differently from the group average.*

For statistical support of Result 2, Table 4 shows estimates of separate random effects Tobit models for each of the three self-reported emotion levels experienced at the moment of observing others' contributions in the *Emotion & Waiting* and *Virtual Punishment* treatments. The dependent variable in model (1) is the anger player *i* feels toward player *j*. The independent variables include the average contribution of others (not including player *i*), the positive difference between player *j*'s contribution and the average contribution of all others, or the absolute value of the negative difference between player *j*'s contribution and the average contributions of others (i.e., if player *j* contributes less than the remaining group average). The treatment dummy for *Virtual Punishment* captures any difference between the two treatments where emotions are elicited. As before, the regressions also include a time trend, a control for end-game effects, and several demographics (not reported here but available upon request). Columns (2) and (3) in Table 4 represent similar models where joy and surprise, respectively, are the dependent variables. Finally, models (4)-(6) replicate (1)-(3) using "contribution of player *i* " as an alternative point of reference for the contribution level and difference variables. All results are robust when using either player *i*'s contribution levels or the average of all players except *j* as the reference contribution level for determining player *i*'s emotions.

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

Variable	(1) Anger$_{i,j}$	(2) Joy$_{i,j}$	(3) Surprise$_{i,j}$	(4) Anger$_{i,j}$	(5) Joy$_{i,j}$	(6) Surprise$_{i,j}$
Waiting & Emotion	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*
Virtual Punishment	0.61	0.71	0.46	0.37	0.81	0.57
	(0.99)	(0.66)	(1.08)	(0.98)	(0.68)	(1.09)
Period	-0.08*	-0.08***	-0.46***	-0.06	-0.08***	-0.47***
	(0.05)	(0.03)	(0.05)	(0.05)	(0.03)	(0.05)
Final Period	-0.34	0.39	-0.36	-0.46	0.50**	-0.36
	(0.45)	(0.25)	(0.57)	(0.43)	(0.25)	(0.57)
|Neg Dev| Avg	0.66***	-0.74***	0.15***			
	(0.04)	(0.04)	(0.04)			
Pos Dev Avg	-0.61***	0.44***	0.35***			
	(0.06)	(0.02)	(0.04)			
Average Contribution	-0.34***	0.41***	0.16***			
	(0.04)	(0.02)	(0.04)			
Pos Dev *i to j*				-0.55***	0.45***	0.28***
				(0.05)	(0.02)	(0.04)
|Neg| Dev *i to j*				0.69***	-0.71***	0.07**
				(0.04)	(0.03)	(0.04)
Contribution of *i*				-0.38***	0.44***	0.19***
				(0.03)	(0.02)	(0.03)
Constant	4.89	-4.84**	-3.32	6.04*	-5.56**	-3.78
	(3.28)	(2.17)	(3.55)	(3.22)	(2.19)	(3.54)
Observations	1,440	1,440	1,440	1,440	1,440	1,440
Number of subjects	48	48	48	48	48	48

Notes: *** Significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level. Standard errors in parenthesis.

Model (1) shows that the more another group member contributes relative to the remainder of the group, 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 generate surprise. All results are replicated in models (4)-(6). Table 4 also shows evidence of a "warm glow" of contributing given the positive and statistically significant coefficient on *Contribution of i* in model (5), and a warm glow of contributions in general as seen in the *Average Contribution*" coefficient estimate in model (2). The statistically insignificant coefficient on *Virtual Punishment*, indicates a common level of emotion in these two treatments at the time of reporting, holding all else equal.

3.3. The Relationship Between Emotions and Punishment

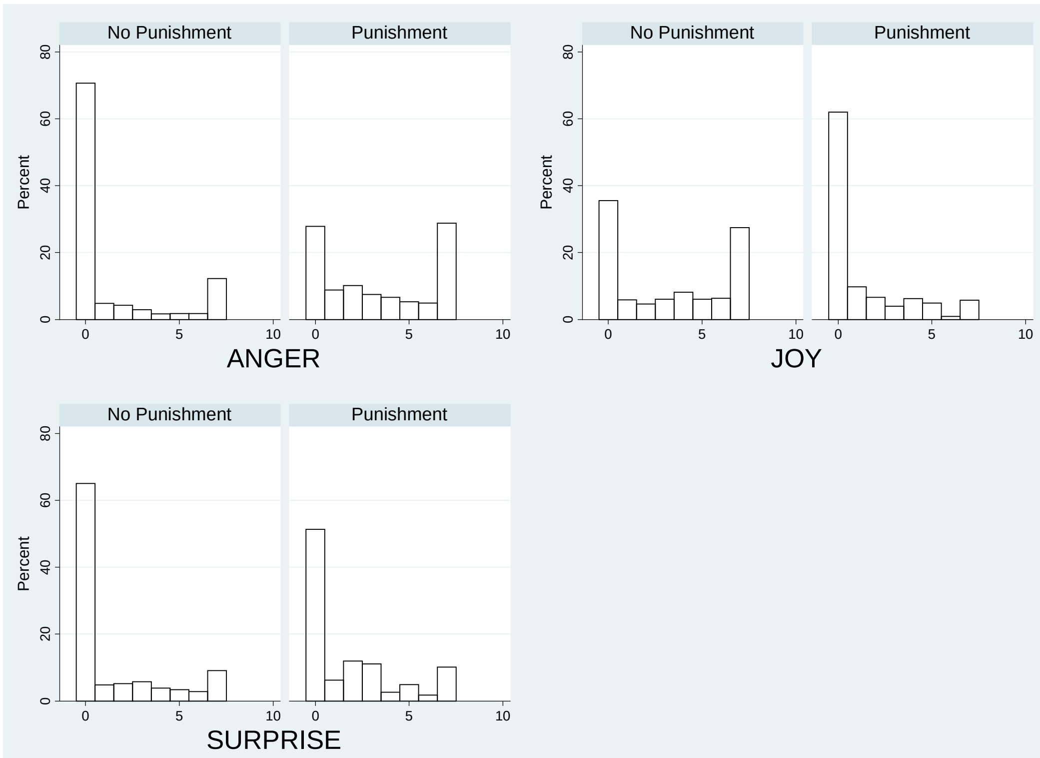
Having shown support for H2, we now examine the role of emotions in the decision to punish. Figure 4 compares the difference in frequency of self-reported emotion levels for individuals choosing to punish or not punish other group members. Recall that self-reported emotions are elicited *after* contribution 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 ratings of "surprise" and particularly "anger" are associated with punishment decisions. These findings are consistent with H3, and lead to result 3:

RESULT 3: *Self-reported emotions predict punishment decisions.*

Support for Result 3 is found in Figure 4 and columns (5)-(7) of 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 is negatively correlated with punishment decisions—those reporting positive levels of joy represent 64.11% of the non-punisher subjects compared to 39.47% of those choosing to punish. Anger and joy are significantly negatively correlated (Spearman's rho= -.60, $p<.01$), joy and surprise are significantly positively correlated (Spearman's rho=

.19, p<.01), but anger and surprise are not significantly correlated (Spearman's rho= .015, p>.10).

Figure 4. Punishment decision and intensity of emotion (Waiting Emotion and Virtual Punishment treatments)



More rigorously, we analyse how self-reported emotions impact punishment intensity in the context of the Table 3 models. The estimation in column (5) is similar to the model in column (1). The difference is that we use only the treatments allowing self-reported emotions (*Waiting & Emotions* and *Virtual Punishment*). Due to the significant correlations noted above, we include only self-reported anger and surprise ratings as co-variates in model (5). Recall that these emotion ratings are specific to each other member of one's group. The final two columns (6) and (7) report Heckit model estimates of the model (5) to separate the effects of emotions on the decision to punish versus the level of punishment.[12] Note that emotion ratings are not endogenous in this specification of punishment choices given the timeline of choice in each period (contributions, then emotion ratings when applicable, then punishment choices). In columns (5)-(7), we use the *Waiting & Emotion* treatment as the omitted category such that the estimates are to be interpreted as effects on individual punishment choices relative to the *Waiting & Emotion* treatment.

Results from the models in (5)-(7) of Table 3 indicate that anger felt by *i* towards *j* significantly increases *i's* punishment of *j*. The Heckit estimates indicate that anger increases the probability of punishing but not the level of punishment. The level of punishment is, however, significantly reduced in *Virtual Punishment* relative to *Waiting & Emotion* (column (6)), which again offers evidence in support of H1. Because we control for the emotional effect of anger on contributions, the fact that subjects still punish those who contribute less than the remaining group average (i.e. free riders) is evidence of non-impulsive punishment.[13] This type of punishment may be considered rational, although it may contain a non-impulsive but still emotional component.

3.4. The Effects of Venting Emotions on Contributions and Welfare

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[12] A reviewer noted that individuals who enjoy contributing (unconditional cooperators) or receiving contributions (unconditional cooperators) may generate a systematic downward trend in punishment in a partners design, unrelated to emotion venting effects. While this may be true, we control for any such effects by virtue of our *Period* variable that captures and time-specific trend in the punishment data. Additionally, these arguments would apply to all of our treatments, and so our estimated significant effects across treatments are still meaningful as seen Figs. 3 and 5. In a similar vein, the reviewer noted that time spent in the experiment differs significantly between treatments that include a wait period versus the baseline, and this may result in fatigue that affects punishment choice independent of emotion venting. While there is an overall time difference in treatments (emotion venting adds a 5-min wait to each period compared to Baseline), when comparing results of *Waiting* and *Emotion & Waiting*—these two treatments are identical in time per period—we still find significant differences as noted in Table 2 (and later in Table 5).

[13] In additional estimations (not reported here but available on request) we replicated estimate (5) of Table 3 by including interaction variables "*Virtual Punishment * Anger*" and "*Virtual Punishment * Surprise*". Our findings our unchanged (consistent with the lack of significant difference in emotion ratings across treatment in Table 4).

Finally, we now turn to treatment differences in contribution levels to examine whether venting emotions influences cooperation and, ultimately, efficiency (payoffs). Figure 5 displays 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. Average individual contributions are 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). Nonparametric tests show a significantly lower level of contributions in *Virtual Punishment* compared to *Baseline* for the final five periods (p=.06). Other significant differences emerge with the more controlled econometric analysis below to support our next result:

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

As support for this result, we estimate several regressions in Table 5 in which the dependent variable is the individual contribution of player *i*. The independent variables include treatment dummies, a time trend, a *Final Period* dummy, period*treatment interactions in models (4)-(6), and demographic controls (suppressed for space considerations). Models (1) and (2) do not account for censored data, while (3)-(4) do. Models (2) and (4) replicate models (1) and (3), respectively, using only the emotion venting treatments. Results in models (1)-(4) tell a consistent story of reduced contributions in the emotion venting treatments, with the greatest reduction in *Virtual Punishment*. Recall that the venting emotions treatments also 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.

Figure 5: Contribution over time per treatment

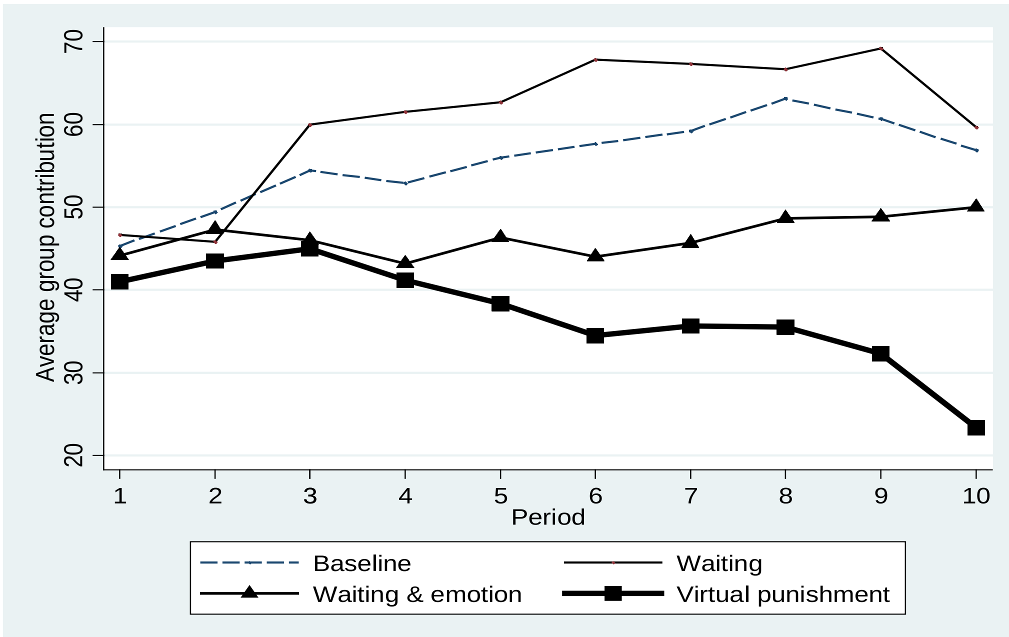
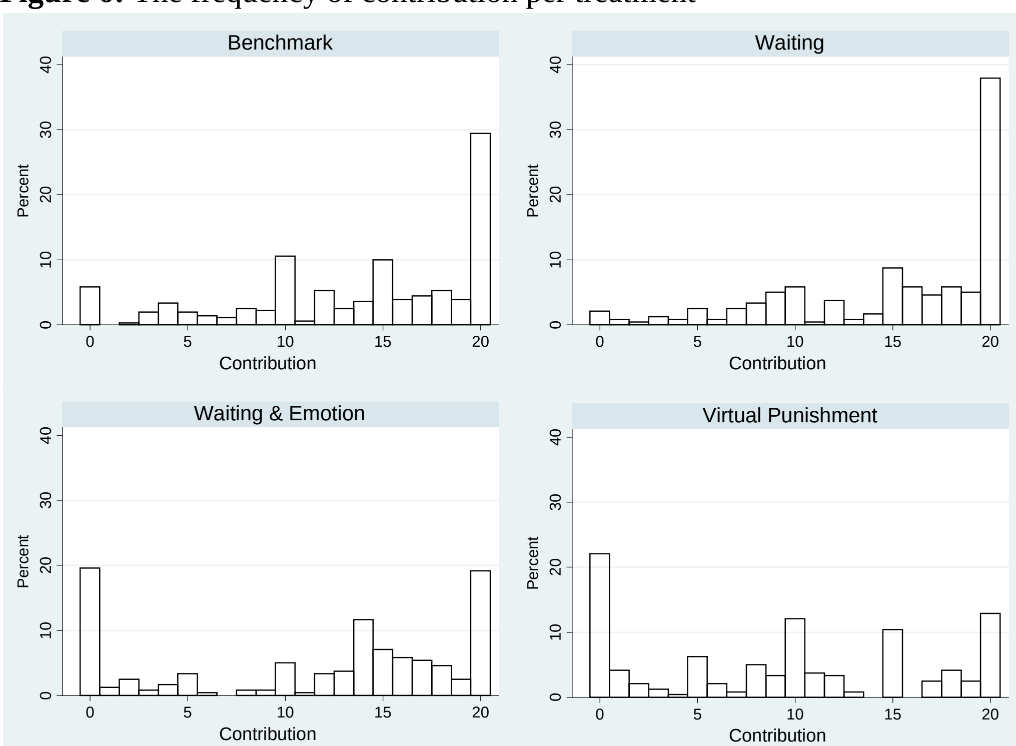


Figure 6: The frequency of contribution per treatment



The estimates in model (5) of Table 5 examine significance of the possible nonlinear effects across periods. We interact *Period* and *Period-squared* with each of the emotion venting treatments and find evidence of nonlinear effects in *Waiting* and *Waiting & Emotion*. Contributions are estimated to initially increase but then decrease, while the opposite pattern is estimated for *Waiting & Emotion*. The decline in contributions across periods is linear for *Virtual Punishment*. While we have no formal explanation for these differences in contributions across periods for each of the emotion venting treatments, we note that the coefficients in model (5) imply a lower level of contributions in *Wait & Emotion* and *Virtual Punishment* compared to *Baseline.* These effects on contributions due to emotion venting are nevertheless only part of what determines efficiency, as we will see.

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 and the dynamics of contributions, we estimated the magnitude of some influences on changes in individual contributions between periods *t* and *t*+1, ($c_{it+1} - c_{it}$), in separate random-effects GLS regressions (see online Appendix, Table A3). The difference in contributions is used instead of the level of contributions in *t+1* to avoid autocorrelation and endogeneity concerns. We conducted the estimations separately for the participants who contribute less than average of the other players *–i* (designated as low contributors), and for those who contribute more than the players *–i* average (high contributors) in period *t*. We control for the difference between *i*'s own and others' average contributions as well as level of contribution of player *i* in period *t.* Finally, we control for punishment given and received in period *t,* as well as interactions between the punishment points received and emotion venting treatments.

Table 5: Determinants of Contributions

Models	*RE GLS*[a]	*RE GLS*[a]	*RE Tobit*[b]	*RE Tobit*[b]	*RE Tobit*[b]
Treatments →	***All***	***All except Baseline***	***All***	***All except Baseline***	***All***
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Waiting	1.30 (1.38)	----	1.47 (1.56)	----	-1.17 (2.01)
Waiting & Emotion	-2.61* (1.42)	-3.74** (1.62)	-3.03* (1.56)	-4.27** (1.83)	1.20 (2.03)
Virtual Punishment	-4.81*** (1.50)	-5.89*** (1.60)	-5.45*** (1.58)	-6.76*** (1.81)	-0.23 (1.92)
Period	0.27*** (0.05)	0.16** (0.07)	0.25*** (0.06)	0.11 (0.08)	0.89** (0.37)
Period-squared					-0.04 (0.03)
Period**Waiting***					1.07* (0.55)
Period-squared ****Waiting*					-0.08* (0.05)
Period**Waiting & Emotion***					-1.58*** (0.56)
Period-squared* *Waiting & Emotion*					0.12** (0.05)
Period ****Virtual Punishment*					-0.88*** (0.34)
Period-squared ****Virtual Punishment*					-0.001 (0.003)
Final period	-1.90*** (0.57)	-1.82** (0.73)	-2.14*** (0.55)	-2.20*** (0.73)	-1.513** (0.68)
Constant	20.57*** (4.55)	22.74*** (4.80)	21.69*** (4.83)	24.94*** (5.54)	19.64*** (4.89)
Observations	1080	720	1080	720	1080

*** significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level. Demographics are included. Robust standard errors in parenthesis.

Significant predictors of $(c_{it+1} - c_{it})$ in these estimations include a robust negative and significant coefficient across models on the deviation between one's own contribution and the remaining group average in period *t*, $(c_{it} - \bar{c}_{-it})$. Secondly, the estimates show that punishment points received in period *t* significantly increase subsequent contributions but only for designated low contributors.[14] This impact of punishment on subsequent contributions is similar across treatments except in *Waiting* where it is even higher, but again the effect is limited to low contributors. Together these findings indicate that the lower (or at least similar) contribution levels in the emotion-venting treatments cannot be explained by lower punishment impact. Rather, they result from the fact that individuals punish less when emotion venting is present.

Given that emotion venting is associated with reduced punishment as well as reduced contributions, it is of interest to examine the net effect of emotion venting on welfare or payoffs. In other words, does the reduction in costly punishment from emotion venting treatments offset the reduced earnings due to lower contribution levels? Final mean payoff amounts are: 21.95 ± 8.7 ECU (*Baseline*); 24.51 ± 7.19 (*Waiting*); 22.12 ± 8.41 ECU (*Waiting & Emotion*); 22.87± 5.40 ECU (*Virtual Punishment*). While these differences are not statistically significant in simple nonparametric tests ($p>.10$), we further explore the possibility that the nonlinear effects of emotion venting on contributions may lead to differential welfare effects in the early versus the later periods of play.

In Table 6, the dependent variable in each random effects model is the final payoff of subject *i* in the decision period, which is net of punishment costs. Model (2) includes period*treatment interaction terms. Rather than estimate similar models with nonlinear period effects, we include models (3) and (4), which simply re-estimate the model in (1) for the initial four periods (model (3)) and for the final 6 periods (model (4)). The selection of period 4 as the cutoff point to separate models (3) and (4) was to highlight the point in the 10-round treatment where we estimate a switch away from a net welfare improvement in *Virtual Punishment* (i.e., the early periods only) to a net welfare improvement in *Waiting*.[15] In other words, a curious result in Table 6, model (2) is that both the *Waiting* and *Virtual Punishment* improve welfare in the punishment VCM games. However, the negative and significant *Period*Virtual Punishment* interaction indicates that the positive welfare effect is short-lived.

[14]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. Our estimations include additional control variables that others' do not (e.g., controlling for the level of contributions). However, when we re-estimate our Table 3 models using only co-variates typical in other studies in the literature, our results still differ. We have no explanation of this difference, but we do note that the effect on high contributors in the previous literature is generally not as robust as the effect on low contributors.

[15] In other words, the choice of where to divide the sample for this analysis is arbitrary and we use period 4 mainly for illustrative purposes. A graph of average payoff differences between venting treatments and the *Baseline* across periods clearly shows the systematic decline in the welfare improvements of *Virtual Punishment* across periods. This is not meant to imply that period 4 is somehow special in all VCM punishment games. The illustration of this point is less clear if one uses nonlinear interaction terms in the model (as in Table 5 with contributions).

While the model (2) *Period*Waiting* interaction does not indicate a period-specific welfare improvement in *Waiting*, the estimates in models (3) and (4) indicate that its welfare effects are strongest after the initial rounds. Our final result is:

RESULT 4b: *Net welfare improvements are significant in Waiting and Virtual Punishment. However, the welfare improvement in Virtual Punishment is only in the initial periods, while it is in the later periods in the Waiting treatment.*

Table 6: Determinants of Final Payoffs (random-effects GLS models)

	All periods	**All periods**	**Periods 1-4**	**Periods 5-10**
Variable	**(1)**	**(2)**	**(3)**	**(4)**
Baseline	*Ref*	*Ref*	*Ref*	*Ref*
Waiting	2.14*	2.47*	1.66	2.45*
	(1.27)	(1.37)	(1.33)	(1.36)
Waiting & Emotion	0.83	-0.48	-0.65	1.77
	(1.35)	(1.92)	(1.73)	(1.43)
Virtual Punishment	2.26*	6.30***	4.27***	0.89
	(1.16)	(1.43)	(1.22)	(1.41)
Period*Waiting		-0.048		
		(0.14)		
Period*Waiting & Emotion		0.22		
		(0.25)		
Period*Virtual Punishment		-0.78***		
		(0.19)		
Contribution	0.32***	0.27***	0.18***	0.35***
	(0.06)	(0.06)	(0.07)	(0.089)
Period	0.83***	0.98***	1.67***	0.50***
	(0.09)	(0.12)	(0.25)	(0.13)
Last Period	-4.5***	-4.59***		-3.44***
	(0.73)	(0.73)		(0.77)
Constant	14.32***	14.54***	12.05***	17.85***
	(2.74)	(2.76)	(3.81)	(4.16)
Observations	1,080	1,080	432	648
Number of subjects	108	108	108	108

Note: *** significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level. Robust standard errors are in parentheses.

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. Our results do indicate, however, that the long run benefits of emotion venting are more likely with a simple cooling off period rather than allowing too much emotion to vent. Too much emotion venting may overly limit the initial punishment investments necessary to promote sustained contributions in the long run. Consistent with hypothesis H4 (and the Yerkes-Dodson law), there appears to be a welfare benefit to venting some, but not all, emotions prior to making a punishment choice. The retention of some emotion may be necessary to preserve an individual desire to personally punish (Duersch and Müller, 2013) that is separate from desire for free riders to be punished, in general (i.e., by someone else who will incur the deterrence costs).

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 contributions 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 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 whereby emotion venting both reduces punishment and increases contributions levels compared to our *Baseline* with no emotion venting. Because these effects impact final payoffs differentially, the net welfare effect of emotion venting is of particular interest. In short, our results indicate that it may be most efficient to allow a cooling off period so that emotions, which can lead to inefficient levels of irrational punishment, may dissipate. Emotions in the VCM environment are generated by generous contributions or free riding of others (Table 4), and this causally impacts one's own contribution and punishment choices (Drouvelis and Grosskopf, 2014; Joffily et al., 2014).

Punishment is at its lowest when multiple avenues are present to vent emotions in *Virtual Punishment*, but this may not be welfare improving, in general. Here, net improvements to welfare are only present in the initial decision periods as low punishment levels seem to precipitate a drop in contributions in later periods. Thus, implementing emotion venting in a way similar to *Virtual Punishment* may only be effective in limited or one-shot interactions. We find longer term welfare benefits of emotion venting in the most simple emotion venting treatment that uses a cooling off period (*Waiting*). Some, but not all, emotions (e.g., anger at free-riding) are vented in this treatment. Perhaps most importantly, the cooling off period results are consistent with the elimination of impulsive and excessive punishment, which is likely the least desirable type of punishment from a welfare perspective. Our more complete emotion venting treatments may vent too much emotion, leading to inefficiently low levels of punishment (i.e., inefficiently low deterrence).

These results are consistent with existing theories and discussions of the arousal-performance relationship (e.g., Yates, 1990; Lazarus, 1991; Kaufman, 1999; Forgas, 1995). In general, the probable mechanism behind the Yerkes-Dodson law suggests that emotion is necessary for engagement and motivation (Forgas, 1995), but excessive emotions impede rational decision making (Kaufman, 1999; Lazarus, 1991). Our results also highlight the importance of the performance horizon. We find that the highest level of emotion venting may be optimal only for short-term (one-shot?) environments, which suggests that longer-run social dilemma interactions may benefit from a higher level of emotions so that punishment is not overly limited. Future research on punishment in VCM environments may wish to directly test whether the transition point for net welfare gains varies predictably with emotion levels.

We do not vary punishment prices in our design, and so a limitation of our study is that we do know to what extent our results may be sensitive to punishment prices. Lower punishment prices may increase the punishment threat in a way similar to higher emotion levels (for a fixed punishment price). This likely benefits net welfare over longer time horizons. Also, results in Anderson and Putterman (2006) indicate that the demand for punishment may be more elastic for lower punishment prices than for high punishment prices (and the punishment price we use would be considered intermediate). Thus, high punishment prices may imply relatively little room for reduced punishment, but it is unclear how venting emotion may interact with punishment price changes. Future research may wish to examine these interaction effects.

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 an overly hot emotional state implies that choices are more likely to be tempered with deliberate and rational thought. Such findings have several implications. For example, norm or law enforcement with immediate punishment is not advisable, even when the party is clearly guilty. Behavioral compliance of children may also provide some public good benefits, but parents themselves may often need the "time out" before discipline is handed out. The implications are not restricted to the realm of public goods provision. Consider an emotion-based email that is regrettably sent in the heat of the moment. The use of a forced waiting period prior to sending the email can be beneficial. Some email programs currently allow the user to establish rules that include the ability to wait several minutes after clicking "send" before the message is actually sent.[16] In other words, optimal responses or optimal punishment require an optimal level of emotion, which may require some venting.

Regarding theoretical implications, it appears relevant to continue the trend of formalizing how emotions may impact choice. For example, dual systems frameworks for choice allow for both rational and emotional inputs to a decision (e.g., Schneider and Shiffrin, 1977; Camerer et al, 2005; Kahneman, 2011). Whether any differences exist between positive versus negative emotional arousal and performance, and how emotion levels may interact with other theoretical parameters (e.g., beliefs, trust, fairness parameters, etc) would be useful avenues for future theoretical research on the relationship between emotions and reason. Our research also has experimental methodology implications for related public goods research—both the time lag between contributions and punishment decisions, as well as formal or informal (or unintentional) opportunities to express emotion will likely decrease punishment significantly.

[16] Additionally, Thaler and Sunstein (2009) suggest an addition to email that is currently in use whereby a message sent without an attachment is recognized when keywords appear in the text, and the user is prompted that he/she forgot to include the attachment. (i.e., the word "attachment" in the message text, but no attachment to the email is found). A modification of this concept might allow email to recognize emotion-laden terms or keywords in a message text and hold the message for several minutes prior to sending when it is apparent the message is rife with emotion.

We do not wish to imply that emotions are irrational, but impulsive decisions dominated by emotions may be rash or regrettable or lead to inefficiencies. This research suggests that there is value to preserving the level of emotion necessary to retain a personal preference for justice against free-riders, because costly punishment may be otherwise underprovided relative to efficient levels. 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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