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Abstract

Many recent experimental studies have shown that some subjects destroy other subjects' incomes without receiving any material benefit, and that they even incur costs to do so. In this paper, we study the boundary conditions of this phenomenon, which is referred to as anti-social behavior. We introduce a four-player destruction game, in which we vary the framing and the presence of another activity, running in parallel to the destruction game. We observe a substantial amount of destruction in the baseline condition without the parallel activity, and with a framing in the spirit of previous destruction experiments. Our results indicate that a parallel activity as well as a framing emphasizing joint ownership of the item that can be destroyed reduces destruction almost to zero. We therefore argue that the emergence of anti-social behavior is highly contingent on the contextual environment.

JEL codes: A13; C72; C91

Keywords: anti-social behavior; joy of destruction; experiment; framing; boredom.

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1. Introduction

Standard-economic theory usually assumes that agents are rational and purely self-interested. The latter assumption implies that players in economic games only care about their own monetary payoffs, and especially not about the payoffs of other players. In the history of modern economics, the assumption of purely self-interested agents was virtually undisputed until the early waves of behavioral and experimental economics (for an overview, see Roth 1995).

Many laboratory experiments have shown that the behavior of human subjects deviates systematically from the predictions of standard economic theory: Subjects give money to the receiver in dictator games (Forsythe et al. 1994, Hoffman et al. 1994), they contribute voluntarily in public goods games (Fehr and Gächter 2000), and they trust and reciprocate in trust games (Berg et al. 1995). Many subsequent experiments and behavioral theories have focused extensively on the nature and implications of pro-social preferences (see e.g. Rabin 1993, Fehr and Schmidt 1999, and Bolton and Ockenfels 2000). In the context of these studies, a strong focus has been on the positive domain of other-regarding preferences: Individuals are willing to give up part of their own incomes to increase the income of others (as in the dictator game).

Recently however, "anti-social preferences" (i.e. the negative domain of other-regarding preferences) have received the attention of experimental economics research as well. Several experimental studies (see for instance Abbink and Sadrieh 2009 or Zizzo and Oswald 2001) have shown that individuals are willing to destroy other individuals' income without obtaining any obvious material benefit for themselves – and are even incurring costs to do so.[1]

These results indicate that subjects deviating from purely self-interested behavior do not necessarily act exclusively pro-socially. Under certain circumstances, they also display anti-social behavior. This kind of behavior is often interpreted as representing some kind of "joy of destruction," and vandalism is named as a related example in the field.

We are interested in two aspects of the previous experiments and the extent to which they have an impact on the observed anti-social behavior in the laboratory. First, in many of these experiments, the decision of whether to destroy other individuals' incomes or not is the only payoff-relevant decision (besides a real-effort task to generate income in the beginning of the experiment). The lack of a meaningful activity in parallel to the destruction decision might lead to boredom or an experimenter demand effect, and could be an important driver of the observed

1 For a more detailed discussion of the relevant experiments, see section 2.

anti-social behavior. Second, most of the previous studies use a rather transactional framing, depicting the option to destroy income of other participants as a possibility to "buy destruction" (i.e. to pay a cost in order to reduce others' incomes). This cost can be interpreted as the negative impact that the act of destruction has on the destroyer: In the context of real-world vandalism, doing damage to public property affects also the person destroying it (think of vandalism in trains, which leads to worse conditions of the trains and also higher costs for all passengers, due to higher maintenance costs). By emphasizing the joint ownership of this public property, it might therefore be possible to reduce the amount of destructive behavior – as potential offenders realize that they are destroying something that also belongs to them.

The aim of our experiment is to understand the boundary conditions of anti-social behavior in the laboratory. In particular, we want to study the effects of boredom (or more precisely, the presence or absence of an alternative task) and framing on destructive behavior. For this purpose, we introduce a four-player game, which we call the *Point Destruction Game*, and we conduct it under different treatment conditions. The Point Destruction Game captures the most important elements of previous destruction games in the literature. Its new features, on the other hand, allow us to implement the treatment variations we are interested in. For these reasons, the baseline condition in our experiment is not an exact replication of one of the previous studies. It is, for instance, not possible to improve one's relative position compared to other players through destruction (i.e. competitive preferences can be ruled out as the motivation for destructive behavior in our experiment). In section 5, we discuss similarities and differences between our experiment and previous destruction experiments, as well as implications for the interpretation of our results.

As the first treatment variation, we introduce a parallel activity alongside the destruction game, in order to test whether this can reduce the amount of destruction. This seems particularly relevant in the context of related examples in the field as described in the psychological and sociological[2] literature (e.g. Csikszentmihalyi and Larson 1978 and Pani and Sagliaschi 2009), which generally identify boredom[3] as an important driver of vandalism.

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[2] For an economic example of the importance of a parallel activity, see Lei et al. (2001). They find that the size of a bubble in an experimental asset market can be dramatically reduced by introducing a parallel activity (in their experiment, the parallel activity is an additional market).

[3] Our experimental design cannot disentangle whether boredom, experimenter demand (see Zizzo 2010 for a discussion), or subjects' expectations to actively participate in the experiment (see Lei et al. 2001) is driving destruction in a setting without a parallel activity. We can only demonstrate that it is possible to reduce destructive behavior (or even to eliminate it almost completely) by introducing a parallel activity – indicating that

In the second treatment variation, we focus on the framing[4] of the destruction game: In previous destruction experiments, the decision task is arguably framed with an emphasis on the possibility to destroy. The harm subjects cause to themselves is neutrally presented in form of money they have to pay for the destruction (i.e. as a cost). In order to analyze the effect of framing, we conduct the experiment using both a baseline framing in the spirit of previous experiments, and a *joint* framing that emphasizes the joint ownership of the item that is subject to destruction. In the baseline framing, subjects might perceive the situation as a market interaction, where destruction (i.e. reduction of others' incomes) is a "good" that can be bought.[5] Subjects might therefore pay less attention to the social aspects of the interaction – including the negative consequences for themselves, (i.e. destroying something that also belongs to themselves). In the joint framing, the emphasis lies on the joint ownership of the common property (which is subject to destruction). Thus, the negative consequences that destruction implies for the destroyer should be more salient, possibly leading to a lower level of destruction.

By and large, we confirm our predictions in the experiment. The introduction of a parallel activity, as well as the joint framing, significantly reduce the amount of destructive behavior. We only observe significant amounts of destruction in the baseline treatment, which is framed with an emphasis on the possibility to destroy and lacks a parallel activity.

The remainder of the paper is structured as follows: section 2 gives a more detailed account of the relevant literature. In section 3 we describe the experimental design and derive hypotheses. Section 4 presents the results, and in section 5 we discuss differences and similarities to previous experimental studies, and their implication for the interpretation of our results. Finally, section 6 concludes. In appendix A we provide instructions, in appendix B screenshots, and in appendices C to E complementary tables, figures and analyses.

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anti-social behavior highly depends on the environment that individuals are facing. In our experimental design, we implement several features to minimize experimenter demand effects (see section 3.4). By additionally assuming that the (ideally low level of) experimenter demand should be comparable across treatment conditions, we think that the different levels of destruction should not be driven entirely by experimenter demand but to some extent also by boredom.

4 The impact of framing is well documented in the experimental literature, e.g. in the context of the prisoners' dilemma (Liberman et al. 2004) or the public goods game (Dufwenberg et al. 2011).

5 See Liberman et al. (2004) for a discussion of the idea that the construal of a situation matters.

2. Literature

In this section, we give an overview of previous research that is relevant to our experiment. We review the experimental[6] literature on anti-social behavior (in particular, the joy of destruction and money burning experiments), as well as the literature related to our treatment variations (the presence and absence of a parallel activity and framing).

Generally speaking, individual behavior that has a negative impact on other individuals can have different motivations. From the perspective of economic theory, the most prominent one is presumably self-interest. In the experimental literature, there is plenty of evidence that some individuals are willing to harm others for their own benefit (e.g. Falk and Fischbacher 2002, Abbink et al. 2000, Cox et al. 2008, Fochmann et al. 2014).

In this study, we are particularly interested in behavior that has a negative impact on the “victim” but offers no material benefit to the “offender.” Evidence for such behavior can be found in the literature on the measurement of social preferences (see Murphy and Ackermann 2012 for a literature survey). Even though the vast majority of subjects can be classified as either pro-social or self-interested, a small fraction exhibit competitive preferences and are willing to give up part of their income in order to maximize the difference between their own income and the income of their counterpart (e.g. Charness and Rabin 2002, Froehlich et al. 1984, MacCrimmon and Messick 1976).

Other examples providing evidence for anti-social behavior are (public goods) games with punishment opportunities. In contrast to altruistic punishment, which has been shown to be quite effective in enforcing norms of cooperation (see Fehr and Gächter 2002), anti-social punishment destroys existing norms and is hence harmful to all parties involved. Evidence for anti-social (third party) punishment can be found in the context of allocation decisions (Leibbrandt and López-Pérez 2011), but the most important examples are public good games with a decentralized punishment mechanism. In these games, punishment is targeted not only at free-riders, but also to some extent at full-contributors – with adverse effects on the overall level of cooperation (Bochet et al. 2006, Cinyabuguma et al. 2006, Herrmann et al. 2008). Moreover, the fear of counter-punishment can undermine the incentives for altruistic punishment, leading to low levels of cooperation (Denant-Boemont et al. 2007, Nikiforakis 2008).

[6] We focus here on the experimental literature, but there is also theoretical literature on anti-social and spiteful preferences (or behavior). See e.g. Saijo and Nakamura (1995), Dufwenberg and Güth (2000), Possajennikov (2000) or Hehenkamp et al. (2004).

With multiple punishment stages, dynamics of retaliation[7] can lead to feuds and vendettas (Nikiforakis and Engelmann 2011, Nikiforakis et al. 2012). Kamei and Putterman (2015) show that the effectiveness of higher-order punishment is highly sensitive to the institutional framework, i.e. to the exact design of the punishment mechanism.

Most closely related to our experiment are joy of destruction games (see e.g., Abbink and Sadrieh 2009, Abbink and Herrmann 2011), and money burning games (e.g., Zizzo and Oswald 2001, Zizzo 2002). In both of these games, subjects play in groups of two; they receive an initial endowment, and they can then destroy parts of the other player's endowment. In the money burning games (Zizzo and Oswald 2001, Zizzo 2002, Zizzo 2003a, Zizzo 2003b, Dawes et al. 2007), the initial endowments are determined randomly, i.e. subjects might have different endowments. Subjects then have the possibility to "burn" the other subject's money, i.e. to reduce the other player's initial endowment, which incurs a cost to themselves. The results show that almost 50 percent of subjects decide to reduce the other player's income. In most cases, this reduces inequality, i.e. the difference between the two players' payoffs is reduced.[8]

In contrast to the money burning games, initial endowments are equal in the joy of destruction games.[9] The reduction of inequality can therefore be ruled out as a motive for destructive behavior. Nonetheless, Abbink and Sadrieh (2009) observe substantial destruction rates. This result holds even if reducing others' incomes has a cost (Abbink and Herrmann 2011), and also in unilateral destruction games (Kessler et al. 2012). A common observation is that destruction rates are higher in what are called "hidden" treatments (Abbink and Sadrieh 2009, Abbink and Herrmann 2011). In these treatments, part of the endowment is destroyed with a certain probability, irrespective of the actual destruction decision. This means that subjects who destroy can "hide" behind this random device, as the victim does not know whether the endowment was destroyed by the other subject or by the random device.

Several qualitative and quantitative studies (most of them in the context of psychological and sociological literature) identify boredom as one of the underlying causes of vandalism, crime and violence (Csikszentmihalyi and Larson 1978, Farnworth 1998, Horowitz and Tobaly 2003, Pani

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[7] Dynamics of retaliation can also be observed in vendetta games without a preceding public good game (Abbink and Herrmann 2009, Bolle et al. 2014).

[8] Destruction does not always reduce inequality. In some cases, the player with the lower initial endowment also falls victim to destruction (Zizzo 2002, Abbink and Sadrieh 2009).

[9] In Abbink and Sadrieh (2009), initial endowments are only equal in expectation, but players are not informed about actual income differences.

and Sagliaschi 2009). In experimental economics, boredom (more specifically the presence or absence of a parallel activity) has been studied in the context of asset market experiments. Lei et al. (2001) argue that bubbles in experimental asset markets can to some extent be explained by the fact that it is optimal not to trade at all in these markets, which might feel unnatural for some subjects (the active participation hypothesis). They show that the size of the bubble is dramatically reduced by introducing a parallel activity (in their case a second market in which trading is beneficial). Lugovskyy et al. (2010) use a similar argument to investigate overdissipation in all-pay-auctions. Instead of a parallel activity, they rescale the strategy space in order to test the active participation hypothesis. They find that rescaling the strategy space in such a way that zero is no longer the optimal bid significantly reduces the amount of overdissipation. The importance of the form of the choice set is also confirmed by Zhang and Ortmann (2013) for joy of destructions games. They show that fewer subjects behave destructively if there is an additional option for increasing the counterpart's income, compared to a situation where only destruction is possible. Boredom, or the effect of a parallel activity, has to the best of our knowledge not yet been studied in the context of experiments on anti-social behavior.

Framing can have large effects on behavior, as has been shown in many studies (most prominently Tversky and Kahnemann 1981). However, the effect of framing depends on the situation studied, and the effects of framing are clearer in risky decision making than in most other situations. Kuhberger (1998) describes a taxonomy of situations and their proneness to framing effects. For public good/bad situations, the literature on framing is abundant (e.g. Andreoni 1995, Brewer and Kramer 1986, Cookson 2000, Dufwenberg et al. 2011), but not very conclusive (for an overview, see Brandts and Schwieren 2007). Liberman et al. (2004) is relatively similar to our framing of the situations as either an individual decision task where destruction can be "bought" (i.e., a "market" for destruction) or as a joint possession that can be destroyed. In their study, participants play a prisoner's dilemma game either under the framing of a "Wall-Street-Game" or as a "Community Game", thus making different possible "construals" of the situation salient. The authors find a dramatic effect of this simple manipulation. The importance of framing, in particular with respect to the position of the initial allocation in the strategy space, has also been shown in the context of destruction games. Abbink et al. (2011) for instance show that reference points (i.e. whether anti-social behavior implies an actual act of destruction or rather refraining from a mutually beneficial action) influence subjects' behavior patterns, for instance their reaction towards an exogenous variation of inequality. In a similar study, Hoyer et al. (2014) vary the initial allocation in a fragile public good game, where subjects can either choose to be destructive or cooperative. They find that a positive framing, in the sense that the initial allocation is the worst outcome so that not being destructive is framed as contribution, reduces destruction. A slight asymmetry, such that minimal destruction is individually optimal, on the other hand, increases destruction. In the context of anti-social behavior, we are not aware of any study that varies only the description of the game in the instructions – leaving everything else including the initial allocation constant.

3. Experimental Design

In the following section we describe the design and implementation of our experiment. We first introduce the *Point Destruction Game*, which is a four-player, real-time destruction game. It comprises important features of the joy of destruction and money burning games used in previous experiments, but also new features that are necessary to study our main research questions. After describing the game, we explain the two treatment variations designed to investigate possible effects of a parallel activity and framing. Finally, we describe the experimental procedure and the course of events within the laboratory.

Our experiment consists of two parts[10]: The first part is the Point Destruction Game combined with a real-effort task. The second part consists of two individual decision making tasks (a risky investment task and the Holt and Laury 2002 risk elicitation task). We are primarily interested in the first part of the experiment. The second part was mainly implemented to avoid experimenter demand effects (a more detailed description of part two can be found in section 3.4, and a short summary of the results in appendix C).

3.1 The Point Destruction Game

At the beginning of part one of the experiment, subjects are randomly assigned to groups of four and receive an initial endowment of 36 ET (experimental tokens). On each subject's computer screen, 36 rhombs ("points" henceforward) are displayed, each of them representing a value of one ET. The act of destroying income is implemented by giving subjects the possibility to delete these points by clicking on them. When a subject clicks on a point, the point immediately disappears from the subject's screen, as well as from the screens of all other members of the group. The deletion of a point reduces the income of all other group members as well as the

[10] Subjects were informed that the experiment consisted of two parts and that the money earned in the first part of the experiment would serve as their endowment for the second part of the experiment (see the beginning of the instructions, Appendix A).

subject's own income by one ET. In other words, the cost to reduce the income of each of the three other group members by one ET equals one ET. Reducing income is only possible as long as there are points left on the screen.[11]

The Point Destruction Game is divided into three phases, each lasting three minutes. Each new phase is a continuation of the previous phase, i.e. the number of points and the arrangement of deleted and non-deleted points on the screen at the beginning of a new phase are identical to the final arrangement of the previous phase. The group composition remains unchanged for all three phases of the Point Destruction Game.

The final payoff of the Point Destruction Game is the initial endowment of 36 ET minus the total number of deleted points over all phases in the respective group. This is equivalent to the number of points remaining on the subject's screen at the end of the Point Destruction Game. The final payoff of the Point Destruction Game is therefore identical for all members of one group.

3.2 Treatment variation 1: framing

Our first treatment variation refers to the phrasing of the instructions for the Point Destruction Game. In the previous literature on anti-social behavior, the destruction task is usually presented as the choice of whether or not to destroy parts of the other player's income at a cost to oneself. The negative consequences of the act of destruction for the destroyer are framed as a price that has to be paid. In the baseline condition, we use this type of framing – adapted for the context of the Point Destruction Game: The instructions state that subjects have an endowment of 36 ET and that they can reduce the income of all other members of their group by one ET which is connected with a cost of one ET.[12]

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[11] Note that in our design, destruction is only possible as long as there are points left on the screen. Assuming the (extreme) case that one subject immediately deletes all 36 points in the beginning of phase one, the other subjects would have no opportunity to destroy. It would have been possible to avoid this issue by limiting the number of points one subject can destroy (e.g. to the total number of points divided by the number of subjects in one group). We decided against this, however, as this would have restricted us in the formulation of the joint framing and contradicts the idea of joint ownership. If all points are destroyed in one group, the amount of observed destruction can be seen as a lower bound of the true level of destruction. As we are not interested in the absolute level of destruction but rather in treatment differences this does not conflict with the interpretation of our results.

[12] See appendix A for the entire set of instructions.

In order to investigate the impact of this particular framing, and to check whether it is possible to reduce the amount of destruction by using a different framing, we implement a second version of the instructions as a treatment variation.

As the deletion of a point reduces the payoff of the subject who deletes it by one ET, the act of destruction implies a negative payoff consequence for this subject. In the baseline framing presented above, this negative payoff consequence is presented as a cost. In the joint framing, however, this negative payoff consequence is described indirectly, as a negative consequence for all group members (including the subject who deletes the point). The deletion of a point is thus described as an action that can be taken that negatively influences everyone in the group (including the subject taking the action): The instructions state that each point represents a value of one ET for all members of the group, that points can be deleted by clicking on them, and that none of the group members ("neither you nor the other members of your group") receives a payoff for a deleted point. The instructions conclude with an explanation that each group member receives a payoff of one ET for each remaining point at the end of the experiment.

We interpret the second framing as a "joint" framing because the points are presented as a symbol representing the same value for all group members. We therefore expect the framing to induce an *awareness of joint ownership* in the sense that subjects realize that the points belong to all group members (including themselves) and that the destruction of a point harms all group members, in particular also themselves. Our treatment variation does not introduce some form of group identity, e.g. in the spirit of Chen and Li (2009); the only difference between the joint framing and the destruction framing is the description of the Point Destruction Game in the instructions.

Note that reducing the income of the other group members by one ET at a cost of one ET is equivalent to reducing all group members' incomes (including the subject's own income) by one ET. Therefore, the structure of the game as well as the resulting payoffs are identical in both treatments. The only variation is the framing of the instructions.

3.3 Treatment variation 2: parallel activity

The second treatment variation involves whether the Point Destruction Game takes place in parallel to another activity. In most of the previous experiments on anti-social behavior, the decision of whether or not to destroy parts of the other players' incomes is the only decision that is taken at this stage of the experiment.

We want to identify whether this has an impact on the observed level of anti-social behavior. Subjects therefore not only play the Point Destruction Game, but also participate in three real-effort tasks – depending on the treatment condition either in parallel to or between the three phases of the Point Destruction Game (see Table 1). In the real-effort part, subjects receive payment for correctly solved exercises. In phase one, the task is to count the frequency of a certain letter in a row of different letters. In phase two, subjects have to multiply two natural numbers (between 10 and 20), and in the third phase they have to add two natural numbers (between 100 and 999). Screenshots of the three different tasks and their description in the instruction can be found in appendices A and B. For each correctly solved task, subjects receive a payoff of one ET, while wrong answers have no impact on the payoff. Note that the payoff earned in the real-effort tasks is independent of the payoff in the Point Destruction Game. The total payoff earned in part one is the sum of the final payoff in the Point Destruction Game and the accumulated payoff during the real-effort tasks, which is determined by the total number of correctly solved exercises over all three real-effort tasks.

Table 1: Treament conditions and timing with and without parallel activity

Time	**Treatment conditions …**		**Time**
	… without parallel activity	**… with parallel activity**	
3 min.	real-effort task 1	real-effort task 1 & PDG (phase 1)	3 min.
3 min.	PDG (phase 1)		
3 min.	real-effort task 2	real-effort task 2 & PDG (phase 2)	3 min.
3 min.	PDG (phase 2)		
3 min.	real-effort task 3	real-effort task 3 & PDG (phase 3)	3 min.
3 min.	PDG (phase 3)		

Note: The abbrevation PDG denotes the Point Destruction Game**.**

Depending on the treatment condition, subjects play the Point Destruction Game either in parallel to the real-effort tasks (henceforward “treatment conditions with parallel activity”) or between the real-effort tasks (“treatment conditions without parallel activity”). In the treatment conditions with parallel activity, the first part of the experiment consists of three phases each lasting three minutes. In each phase, the Point Destruction Game and the real-effort tasks take place in parallel: The 36 points are displayed as a frame at the edge of the screen; the exercises as well as the input field for the real-effort task are shown in the middle of the screen (for a screenshot, see appendix B, figure B.1). In the treatment conditions without parallel activity, the first part of the experiment is divided into six phases each lasting three minutes. Subjects work on the real-effort task for three minutes (without points at the edge of the screen) and afterwards play the Point Destruction Game for three minutes (without a real-effort task in parallel). The points are thereby displayed on a screen between the real-effort tasks, which indicates that the previous task has finished and that the next task will start soon (see appendix B, figure B.2). This sequence is repeated three times: as in the treatment with parallel activity, subjects participate in all three phases of the real-effort tasks and they play the Point Destruction Game for nine minutes in total (divided into three phases each lasting three minutes).

The amount of time subjects spend for the Point Destruction Game as well as the real-effort tasks by itself is equal in the treatments with and without parallel activity (nine minutes divided into three phases of three minutes each). Nonetheless, the total time spent for the Point Destruction Game and the real-effort tasks amounts to nine minutes in the treatments with parallel activity and eighteen minutes in the treatments without parallel activity. Given that in some treatments the Point Destruction Game and the real-effort tasks take place in parallel and in some others sequentially, it is impossible to keep the length of time constant in all dimensions.[13]

Another issue in the treatment conditions with parallel activity is the fact that destruction might be associated with an opportunity cost. Assuming that a subject is not able to solve exercises while deleting points, the act of destruction has a negative impact on his earnings from the real-effort part.[14] In practice, this opportunity cost of destruction turns out to be small enough that we think it can be neglected without challenging our results. It takes less than a

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[13] Keeping the total time for the Point Destruction Game and real-effort tasks constant would require a reduction of the time available for the Point Destruction Game and the real-effort task individually. It would be possible to equalize the overall time in both treatments by introducing a three minutes waiting phase in the treatments with parallel activity. Still, the time available for PDG and real-effort tasks would differ. More importantly, the implementation of such a waiting phase would seem fairly artificial and probably create boredom and frustration, which might influence later destruction activities.

[14] A simple way to avoid this issue would have been to introduce a non-payoff-relevant parallel activity. However, also in case of a non-payoff relevant parallel activity, there might be an implicit opportunity cost of destruction if the parallel activity is to some extent joyful. If the parallel activity was neither joyful nor payoff-relevant, it is not clear why subjects should engage in the activity at all.

second to move the cursor to the point and to click on it. The analysis of subjects' performance in the real-effort part shows that they need on average 18 seconds to solve one task. Given that the payoff for a correctly solved task is one ET, the opportunity costs of destruction should be negligible.

3.4 Part two of the experiment

As mentioned before, our experiment consists of two parts. The first part is the Point Destruction Game and the real-effort tasks. The second part consists of two individual decision tasks. For the first task, subjects have to decide on how much of the money earned in part one to invest in a risky lottery. With a probability of $p = ½$ the lottery pays 2.5 times the amount invested and zero otherwise (we borrow this task from Gneezy and Potters 1997 taking the parameters used in Charness and Gneezy 2010). Hence, the final payoff after the investment task is the sum of the amount not invested plus the payment of the lottery. The second individual decision task is the risk elicitation task proposed by Holt and Laury (2002) with ten paired lottery choices (see appendix B for a detailed description of the task and for a screenshot).

Note that we are not particularly interested in subjects' risk preferences or in the relation between anti-social behavior and risk. The main reason for implementing the second part of the experiment is to avoid experimenter demand effects. As the earnings of part one are used as endowment for part two, subjects could reason that a purpose of the real-effort tasks is to generate an endowment for the individual decision tasks. In particular, we want to avoid that the only payoff-relevant decision subjects are facing (besides the real-effort tasks) is whether or not to reduce others' incomes (as this could potentially lead to an experimenter demand effect, see Zizzo 2010). A short summary of the results of the second part can be found in appendix C.

3.5 Summary of the treatment conditions and hypotheses

Table 2 summarizes the experimental design and the four treatment conditions. We use a between-subject 2 x 2 factorial design and label the treatment conditions as follows: BASE (baseline condition, i.e. no parallel activity and no joint framing), PARALLEL (with parallel activity but no joint framing), JOINT (joint framing, without parallel activity) and JOINT-PARALLEL (joint framing, with a parallel activity).

Based on the destruction rates observed in previous experiments (see section 2), we expect a positive amount of destruction in the baseline condition, which is in terms of the framing and the presence of a parallel activity most closely related to previous destruction experiments.[15] Regarding our first treatment variation, we expect the joint framing to make subjects aware of the joint ownership of the object of destruction and to emphasize the negative consequences destruction implies for themselves. In the baseline framing however, the act of destruction is described rather as a market interaction (i.e. pay something to reduce others' income) in which the negative consequences should not be as salient as with the joint framing. We therefore expect a lower level of destruction in the treatment conditions with the joint framing (i.e. JOINT and JOINT-PARALLEL) compared to the treatment conditions with the baseline framing in the spirit of previous destruction experiments (i.e. BASE and PARALELL).

Table 2: Treatment variations

		Activity in parallel to the destruction decision	
		No	Yes
Joint framing	No	**BASE** n = 56	**PARALLEL** n = 44
	Yes	**JOINT** n = 44	**JOINT-PARALLEL** n = 52

Notes: Activity in parallel to the destruction decision implies that subjects play the Point Destruction Game in parallel to the real-effort tasks. No activity in parallel to the destruction decision implies that the Point Destruction Game and the real-effort tasks take place sequentially (see section 3.3). For a detailed description of the framing, see section 3.2.

With respect to our second treatment variation, we expect a lower level of destruction in the treatments with parallel activity (i.e. PARALLEL and JOINT-PARALLEL) compared to the treatments without parallel activity (i.e. BASE and JOINT). This hypothesis is based on two related mechanisms: First, subjects might get bored in the treatments without parallel activity and therefore engage in destructive behavior (as mentioned before, there is evidence in the sociological and psychological literature that boredom is an important driver of destructive

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15 Note that a rational and strictly self-interested subject has no reason to destroy a point. Standard-economic theory would therefore predict no destruction in all four treatment conditions.

behavior, see Csikszentmihalyi and Larson 1978, Horowitz and Tobaly 2003). Second, subjects might have the expectation to actively participate in all relevant parts of the experiment (see Lei et al. 2001) and find it unnatural to look at the points for three minutes without taking any action. Our experimental design cannot distinguish between these two mechanisms; it can however show that destructive behavior is not necessarily related to spiteful preferences or a preference for destruction, but also depends on the circumstances and can be highly malleable.

3.6 Experimental procedures

The experiment was programmed in z-Tree (Fischbacher 2007) and conducted in sixteen sessions in the experimental laboratories at the Universities of Heidelberg and Mannheim (eight sessions in Heidelberg and eight in Mannheim).[16] The number of subjects participating in each session varied between eight and sixteen.

Subjects were recruited using ORSEE (Greiner 2015), and no subject participated in more than one session. All subjects within one session were confronted with the same treatment condition. In total, 196 subjects (mostly undergraduate students with various majors from the Universities of Heidelberg and Mannheim) participated in our experiment.[17] Each of the four treatment conditions was conducted at both locations (for an overview, see appendix D). On average, one session lasted about one hour and subjects earned €15.71 (Standard deviation 5.13, minimum 4.83, maximum 32.40).

In the beginning of the experiment, subjects were seated randomly and received written instructions explaining the procedures of the experiment (see appendix A). Subjects were informed about the course of events and that the money earned in the first part would be used as their endowment in the second part of the experiment. For the first part (the Point Destruction Game and the real-effort tasks), subjects were randomly assigned to groups of four. Subjects knew that the second part would involve only individual decision-making and that there would be no groups.

The payoffs in the Point Destruction Game, the real-effort tasks as well as the investment tasks were presented in Experimental Tokens (ET). The exchange rate between ET and Euro was

[16] The two cities are located at a distance of roughly 20 km apart. We conducted the experiment in two different laboratories to have access to a larger subject pool.

[17] 104 subjects participated in Heidelberg (59 male, 45 female) and 92 in Mannheim (43 male, 49 female).

1 ET = €0.10.[18] The payoffs in the Holt and Laury (2002) risk task were presented in Euro. At the end of the experiment, subjects privately received their payment in cash (including a show-up fee of €2).

4. Results

In the following section we present the results of the experiment and describe the respective statistical analyses. The section is organized as follows: First, we analyze treatment differences with respect to destruction on the group level. Second, we look at individual destruction decisions and analyze the number of points destroyed by a particular subject, as well as the distribution of destroyed points per group. Finally, we conduct a regression analysis to control for socio-demographic characteristics, performance in the real-effort tasks, and negative reciprocity on the group level.

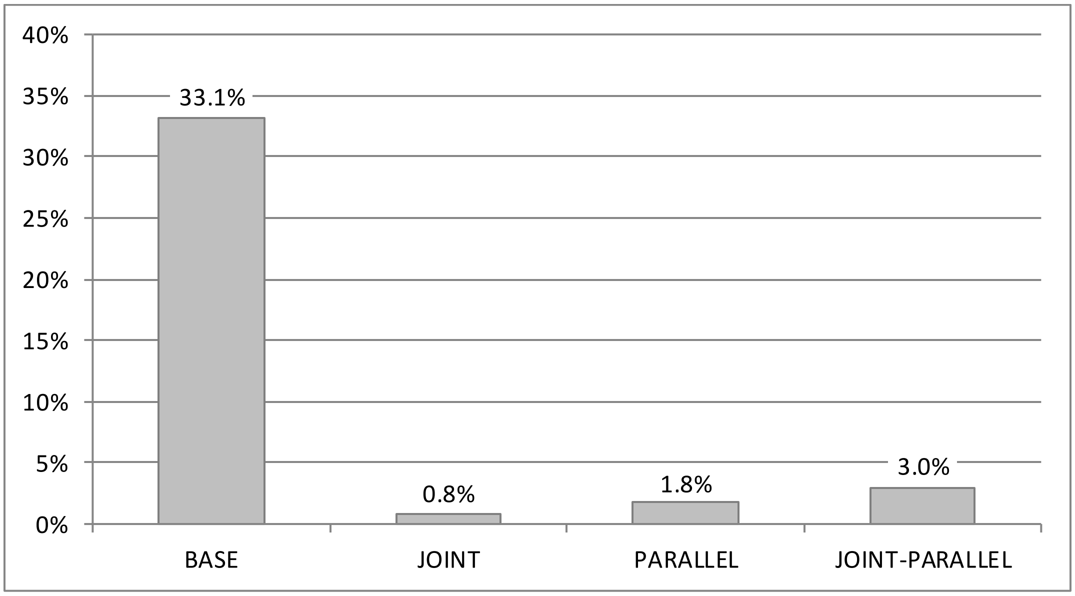
4.1 Aggregate destruction on the group level

Figure 1 shows the aggregate destruction rates for each treatment, i.e. the percentage of points destroyed per treatment. To calculate the destruction rate for a given group, we divide the total number of destroyed points at the end of the Point Destruction Game by the total number of points that are initially present, i.e. 36. To obtain the aggregate destruction rates presented in Figure 1, we take the average over all groups in a given treatment. Note that it is difficult to compare these aggregate destruction rates to destruction rates in previous experiments, as our destruction rates are defined on the group level. This implies for instance that a single group member can drive the destruction rate for their group up to 100 percent – even if the remaining three group members do not engage in destruction.

In the baseline condition (BASE) without a parallel activity and with a framing in the spirit of previous destruction experiments, we observe a high level of destruction (33.1 percent). In eight out of fourteen groups more than one point is destroyed; in three of these groups all 36 points are destroyed by the end of the Point Destruction Game.

[18] The exchange rate between euro and U.S. dollar was around €1 = $1.25 at the time when the experiment was conducted.

Figure 1: Percentage of destroyed points by treatment condition



The destruction rates in the remaining three treatments are substantially lower and lie between 0.8 and 3.0 percent. In JOINT, there is not a single group in which more than one point is destroyed. In PARALLEL as well as PARALLEL-JOINT we observe only one group in which more than one point is destroyed (in both of these groups, all destruction is caused by a single subject).

We conduct Wilcoxon-Mann-Whitney tests to assess whether the differences between treatment conditions are statistically significant. We find evidence that the destruction rates observed in BASE are significantly higher than in JOINT ($p = 0.017$) and in PARALLEL ($p = 0.007$). However, the differences between PARALLEL and JOINT-PARALLEL, as well as between JOINT and JOINT-PARALLEL, are not significant ($p = 0.075$ and $p = 0.306$).[19] This can be explained by the fact that the level of destruction in JOINT is already so low (almost zero) that no additional effect is possible when adding the parallel activity (the same holds for PARALLEL and adding the joint framing).

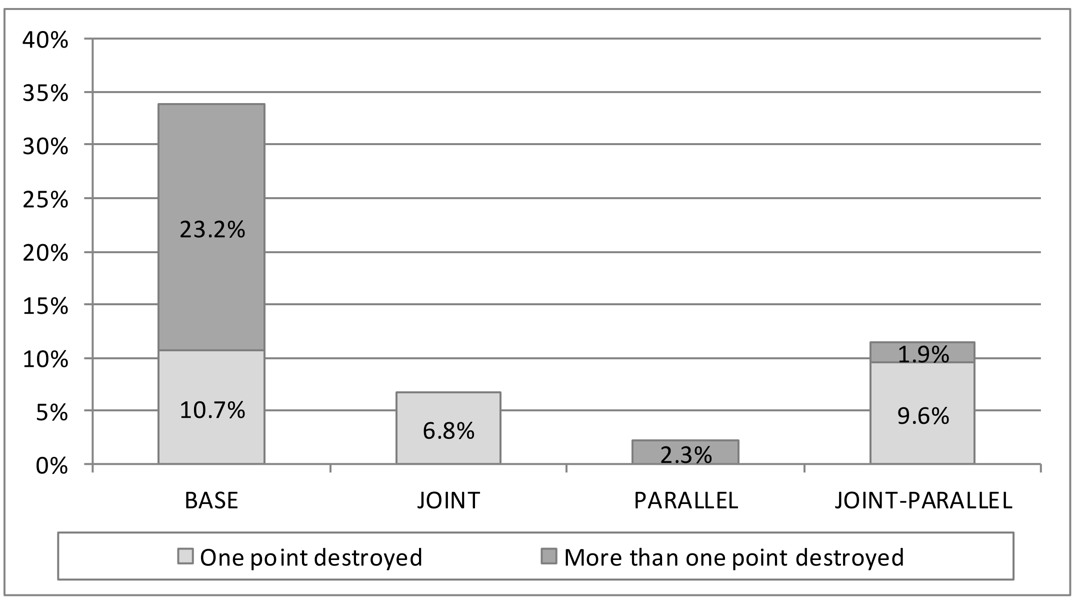
[19] The Wilcoxon-Mann-Whitney test assumes that the two distributions being tested are identical except for a shift. As this assumption might be violated (in particular with experimental data) we perform two additional tests as a robustness check: First, the robust rank order test (see Fligner and Policello 1981) that assumes neither equal variances, nor equal shape of the distributions. Second, the test for stochastic inequality (see Schlag 2008) that makes no distributional assumptions. The presented test results (as well as those in the next subsection) are all robust to using one of these two tests instead of the Wilcoxon-Mann-Whitney test. The detailed results of all tests can be found in appendix D.

Overall, we can conclude that, as expected, the introduction of a parallel activity as well as the joint framing reduce the amount of observed destruction significantly (compared to the baseline condition).

4.2 Destruction at the individual level

In the previous analysis, we examined the total number of points destroyed in a given group. In the next step, we investigate how many subjects of a given group engage in destructive behavior. Figure 2 displays the overall share of subjects who destroy exactly one point (in light grey) and the share of subjects who destroy more than one point (in dark grey) for each treatment condition.[20]

Figure 2: Subjects who destroy one point vs. more than one point



[20] Recall that subjects are matched in groups of four and that every group member has the possibility to destroy any of the displayed points. If a subject clicks on a point, the point disappears immediately from the screens of all four group members. It is nonetheless possible that two subjects click on the same point at the exact same time. Even though this is highly unlikely (as both subjects have to click on the same point at the exact same moment), this happened twice in our experiment. Both subjects could not realize this incident (they both clicked on the point and the point disappeared, and the final payoff was not affected). In the analysis, we proceed as follows: On the aggregate level (Figure 1), we count one destroyed point; on the individual level (Figure 2), we count one destroyed point for each of the two subjects (both subjects intended to destroy the point and from their perspective the intended destruction happened – including the payoff consequences). Note that our results do not change qualitatively when we proceed differently.

In BASE we observe that a substantial share (23.2 percent of the subjects) destroy more than one point. In JOINT however, not a single subject destroys more than one point, and in PARALLEL and JOINT-PARALLEL only one subject destroys more than one point. In all treatments conditions besides JOINT, we observe a certain number of subjects (between 6.8 and 10.7 percent) who destroy exactly one point. In the analysis, we distinguish between subjects who destroy exactly one point and subjects who destroy more than one point. Subjects who destroy exactly one point might do that out of curiosity, to observe what actually happens if they click on the point. We therefore check whether the number of subjects who destroy more than one point significantly varies between treatment conditions. As we cannot treat individual destruction decisions as independent observations, we calculate the number of subjects who destroy more than one point for each group, and take this as an independent observation.

According to the Wilcoxon-Mann-Whitney test, we find significant differences between BASE and JOINT (p = 0.008), as well as between BASE and PARALLEL (p = 0.026), but not between PARALLEL and JOINT-PARALLEL (p = 0.904), or between JOINT and JOINT-PARALLEL (p = 0.358). This is plausible as the number of subjects destroying more than one point is already quite low in the JOINT and PARALLEL treatments, with the result that the second treatment variation has no additional impact.

4.3 Regression analysis

Table 3 presents the results from an OLS regression. The dependent variable is the number of points destroyed by a subject over all three phases of the Point Destruction Game. The first two lines show that the parallel activity as well as the joint framing significantly reduce the amount of destruction. Note that the overall effect of both treatment variations is significant even though, according to the non-parametric test, it is significant only in comparison with the baseline treatment. The significant interaction term shows, in line with the non-parametric tests, that the negative effect of the parallel activity on the amount of destruction is weaker in the presence of the joint framing (and vice versa that the effect of the joint framing is weaker in the presence of the parallel activity).

The fourth line shows that the number of correctly solved exercises in the real-effort tasks has no effect on the number of points destroyed by a subject. This observation is consistent with the claim that the opportunity cost of destruction should be negligible. Ideally, we would want to conduct this analysis particularly for the treatment conditions with a parallel activity. However, this is difficult, as there is almost no destruction in these treatment conditions.

Table 3: Regression coefficients (ordinary least squares estimates)

	Dep. Variable	Number of destroyed points			
		(A)	(B)	(C)	(D)
1	PARALLEL	-1.34**	-1.21**	-1.95**	-1.49**
2	JOINT	-1.43**	-1.57**	-2.13**	-1.53**
3	PARALLEL x JOINT	-	-	1.94**	1.39**
4	# correctly solves tasks (RET)	-	-	-0.03	-0.03
5	# points destroyed by others	-	-	0.08**	-
6	Dummy destruction by others	-	-	-	2.95**
7	Intercept	2.33***	3.38**	3.93**	3.46**
	Controls	No	Yes	Yes	Yes
	No. of obs.	196	196	196	196
	AIC	5.402	5.419	5.399	5.364

Notes: Table 3 shows regression coefficients from an OLS regression. The dependent variable is the number of points destroyed by a subject over all three phases of the Point Destruction Game. PARALLEL and JOINT are dummies indicating the main treatments (see Table 2). # correctly solves tasks (RET) is the total number of correctly solved exercises in the three the real-effort tasks. # points destroyed by others is the total number of points destroyed by the other three group members. Dummy destruction by others = 1 if in total more than one point was destroyed by the other group members, and = 0 if one or zero points were destroyed by the other group members. Controls "Yes" indicates that the regression includes gender, age and field of study. Standard errors are clustered at the group level.

The fifth line shows that the number of points destroyed by the other members in the group has a positive effect on a subject's own likelihood to destroy.[21] This observation is somewhat in line with the broken windows theory (Wilson and Kelling 1982) stating that the occurrence of destructive behavior depends on whether the surrounding is in good condition or not, i.e. whether destruction has already happened beforehand or not. Note, however, that this result refers to the overall number of points destroyed. We do not record dynamics of destruction

[21] Note that the maximum value of the dependent variable (number of points destroyed by a subject) depends on the number of points destroyed by the other members of the group. This could potentially lead to problems in the third specification (C), where the number of point destroyed by the others is one of the independent variables. We therefore include an additional specification (D) where we replace the continuous variable by a dummy variable that takes the value one if more than one point was destroyed by other members of the group.

within a group; it is therefore difficult to make statements about how exactly destructive behavior of one subject influences the destructive behavior of the other group members. Therefore, and as we are primarily interested in the impact of our treatment variations on destructive behavior, this result should be seen as a side note.

5. Discussion

When setting up a new experiment, certain design choices have to be made, which could often have been made differently as well. In this study, we aim at understanding the boundary conditions of anti-social behavior, by testing alternative explanations for findings in the literature on anti-social preferences. Design-choices are therefore especially important. In the following, we discuss the choices we made (in particular, aspects in which our experiments deviates from previous studies) and in what way they affected the results and their interpretation.

5.1 Symmetric payoff structure

In our design, the cost-destruction ratio is 1:3, i.e., subjects have to pay one ET to reduce the income of three others by one ET each. In contrast to most of the previous experiments, destruction is equally distributed amongst the other group members, such that payoffs after the act of destruction are symmetric (everyone's payoff is reduced by one ET). It is therefore not possible to improve one's relative position towards others by destroying others' income. This symmetric payoff structure is crucial for implementing the treatment variation to study the effect of framing. With a cost-destruction ratio that implies a higher disutility for the victim of destruction than for the subject who destroys, we would not be able to implement a joint framing emphasizing the joint ownership of the good to be destroyed. Moreover, this aspect of joint ownership characterizes many of the field examples this research relates to, e.g. vandalism: The destruction of a common property, which is owned jointly by the community members, hurts the destroyer to the same extent as everyone else. In the case of an asymmetric cost-destruction ratio it is more plausible that the good is owned solely by the victim of destruction, resulting in a higher disutility from destruction for her than for the destroyer.[22] An additional advantage of the

[22] A concrete example from the field would be malicious scratching of cars. Here, the disutility of the scratching is clearly higher for the car owner than for the scratcher (in this case the disutility of the scratcher is rather indirect, e.g. the probability of being caught or having a guilty conscience). Considering the destruction of common

symmetric setup is that destruction cannot be driven by competitive preferences. Hence, the amount of destruction we observe in our experiment points rather to joy of destruction than to spite.

5.2 Observation without delay

In our experiment, destruction can be observed without delay. When a subject clicks on a point, the point immediately disappears from the screen of the other group members as well. This allows for negative reciprocity, i.e. subjects can react to observed destructive behavior by being destructive themselves. This could lead to a higher amount of destruction compared to a situation in which subjects decide whether or not to destroy or not without knowing the decisions of the other players. As the goal of our study is not to provide evidence for high levels of destruction but to show that destruction can be reduced by our treatment variations, we want to provide the best possible conditions for the occurrence of destruction.

This feature of the Point Destruction Game points to the question of how individuals react when they observe destructions by other individuals. We find some evidence for negative reciprocity as suggested by the broken window theory (Wilson and Kelling 1982), indicating that subjects destroy more if their group members engage in destruction as well. As this question is not the focus of our paper, and as we do not track the timing of individual destruction, we cannot see whether there is some kind of upward spiral as observed in Abbink and Herrmann (2009). The fact that the coefficient "# points destroyed by others" is significant in the regression suggests that some of the destruction might be driven by group dynamics, but we have no clear evidence for this, nor do we have evidence on how destruction later comes to a halt. A more systematic investigation of this issue would be an interesting focus for further research.

5.3 Destruction in form of an actual activity

Another aspect that differs from previous experiments is that the act of destruction is connected to an actual activity (clicking on the point) and has a physical effect (the point disappears). In most

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property (e.g. park benches, bus stops, youth clubs, etc.), the symmetric cost-destruction ratio seems more plausible.

previous studies, subjects just stated a number, i.e. by how much they want to reduce their counterpart's income.[23]

Our implementation of destruction is, first, necessary to introduce it in the context of a parallel activity, allowing subjects to play the Point Destruction Game while participating in the real-effort task at the same time. Second, it is a potentially more intuitive way of implementing the possibility to destroy than just stating a number. It might even allow for a small "joy of destruction" experience, like in the field example: An act of vandalism is usually connected to the activity of destruction (e.g. smashing the glass panel at a bus stop), which might be experienced as pleasant, and could be motivation enough for destruction without actually having the objective to harm others. This could (among other factors) explain the relatively high destruction rate we observe in our BASE treatment compared to previous studies.

One might wonder whether having two parallel tasks induces cognitive load. We do not expect this to be the case, for two reasons. We do not explicitly ask subjects to do two tasks at the same time, and there is no explicit time pressure – both of which are necessary conditions for cognitive load to influence behavior.

5.4 Open vs. hidden treatments

Several of the previous studies on anti-social behavior distinguish between open and hidden treatments. Abbink and Herrmann (2011), for instance, implement a hidden treatment with a random mechanism, which destroys part of the other player's income with a known probability, irrespective of the subject's decision on whether or not to destroy. Furthermore, the subject who was victim of destruction does not learn whether his income has been destroyed by the other player or by the random mechanism. The authors hypothesize that the destroyer could "hide" behind this random mechanism, arguing that the money would have been destroyed with some probability anyway. Indeed, the observed destruction rate in the hidden treatment is significantly higher than in the open treatment without the random mechanism.

In our design, destruction only happens if subjects decide to destroy (i.e. there is no random mechanism implemented). However, subjects cannot identify who of their group members was responsible for the deletion of points. Subjects who have destroyed a point can therefore "hide"

[23] It is therefore theoretically possible that some subjects click the point just out of curiosity, to find out what happens if they do. In the analysis, we therefore distinguish between subjects who destroy exactly one point and those who destroy more than one point. See section 4.2 for details.

behind the other group members in the sense that the point might have been destroyed by one of the other group members as well.

6. Conclusion

In this paper, we introduced a novel four-player destruction game – the Point Destruction Game – to study the boundary conditions of anti-social behavior in the laboratory. We used this game to analyze two aspects: the framing of the destruction game and the presence of an alternative task during the destruction decision. In order to study these aspects, we had to make several modifications compared to previous destruction experiments (as discussed in the previous section). These modifications, however, do not challenge the interpretation of our result, as they apply to all of our treatment conditions and hence cannot explain the treatment differences we observe.

In the baseline condition without parallel activity and with a framing that describes the negative consequences for the destroyer as a cost, we observe a substantial amount of destruction (33.1 percent of all points are destroyed). In all other treatments, destruction disappears almost completely (destruction rates between 0.8 and 3.0 percent), which implies that the joint framing (emphasizing the joint ownership of the points) as well as the activity in parallel to the destruction game can significantly reduce anti-social behavior. A substantial amount of the anti-social behavior observed in the baseline condition can therefore be attributed to the specific framing and the lack of a parallel activity.

These results might not come as a surprise to practitioners in the field of social work, where boredom or the lack of a meaningful activity is known to be an important driver of destructive and violent behavior. In addition, the argument, often used by kindergarten teachers, that children should not destroy a community toy, as this implies that they cannot play with it later themselves, relates to some extent to our framing variation.

Nonetheless, we think that the results of our experiment have important implications for the general interpretation of anti-social behavior. Our results suggest that anti-social behavior observed in the laboratory is not necessarily driven exclusively by spiteful or anti-social preferences, but is to some extent also influenced by the contextual environment individuals are facing. The most important implication of this finding is that anti-social behavior is not something we have to live with, but is something that can be prevented by providing individuals with the appropriate institutional environment.

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Appendix A – Instructions

(Original instructions were in German. They are available from the authors upon request.)

Information about the procedures of the experiment. Welcome to this experiment and thank you for your participation! The following instructions explain the rules and the procedures of the experiment. In this experiment, you can earn real money. You will receive €2 for arriving on time for the experiment. Any further earnings depend on your decisions and answers, and to some extent on the decisions of the other participants.

Every participant has received the same instructions as you. Please take your time to read these instructions carefully.

No communication with other participants. Throughout the entire experiment, you are not allowed to communicate with other participants. Please switch off your mobile phone now and store it together with any other personal items out of your reach underneath the table. To ensure a smooth progress of the experiment, you are not allowed to engage in any activity not related to the experiment. Please focus exclusively on the experiment. If you do not comply with these rules, we will have to exclude you from the experiment. In this case, you will not receive any payment.

If you have any questions, please raise your hand. Please do not shout out your question. The experimenter will come to your desk and answer your questions privately.

Procedures. The experiment is divided into three parts.[24] The instructions for experiment 1 are already on your desk. You will receive the instructions for experiment 2 and 3 once experiment 1 has been completed. During experiment 1, you will be divided into groups of four participants. Experiments 2 and 3 are individual decision making tasks (no groups). During the experiment, payments are always stated in the experimental currency "Experimentaltaler" (ET). At the end of the experiment, ETs are converted into Euro in the following exchange rate: 1 ET = € 0.10.

The end of the experiment. At the end of the experiment, you will learn how much you earned in total. Please remain seated until the number of your computer is called. You can then come to the counter and collect your earnings. Please leave all instructions on your desk and take your personal items with you when you leave.

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[24] In the description of the experimental design (see section 3), we refer to experiment 1 as "part one" and to experiment 2 and 3 as "part two."

Instructions: Experiment 1

[JOINT and PARALLEL-JOINT: Experiment 1 consists of three rounds.]

You are in a group with three other participants in the laboratory. Participants have been randomly assigned to groups. The groups will remain completely anonymous, i.e., you will never learn who the other members of your group are.

[BASE and PARALLEL] At the beginning of experiment 1, you will receive an endowment of 36 ET. You can reduce the payoff of all other members of your group. To reduce the payoff of the other group members by one ET each, you need to click on a point at the edge of your screen. This costs you one ET. The point then immediately disappears from your screen and from the screens of all other members of your group. You can click all the points, no points at all, or any number in between. The payoff of the other members of your group is reduced accordingly (by 1 ET per point). Please note that after all the points have disappeared, it is no longer possible to reduce the income of the other group members. All other members of your group have the same options as you.

[JOINT and PARALLEL-JOINT] In [PARALLEL-JOINT: between] every round, you will see 36 points at the edge of your screen. Each point has a value of 1 ET for you and all other members of your group. You have the possibility to delete points by clicking on them. If you click on a point, it disappears from your screen and from the screens of all other members of your group. You can click all the points, no points at all, or any number in between. For a deleted point, neither you nor any other member of your group receives any payment. For all remaining points that are not deleted at the end of experiment 1, you and each member of your group receives 1 ET.

Independent of that, [BASE and PARALLEL: experiment 1 consists of three rounds.] [Y]ou can earn money in each round by solving tasks on the computer. Each round lasts 3 minutes, and in each round you may solve as many tasks as you can. For each correctly solved task, you receive 1 ET. If you solve a task incorrectly, it has no effect on your payoff, i.e., only correctly solved tasks count. You can find the exact description of the three different types of tasks (counting letters, multiplication, and addition) in a separate instruction.

The aforementioned points appear between [PARALLEL and PARALLEL-JOINT: during] the rounds. They are independent of the tasks in the rounds, i.e., the constellation of points appears without changes again after [PARALLEL and PARALLEL-JOINT: in] the next round.

[PARALLEL and PARALLEL-JOINT] The above-mentioned points appear during the rounds, but they are not influenced by the rounds, i.e., the constellation of points appears again after each round, without changes.

The ETs you have earned in experiment 1 serve as the initial endowment for experiment 2. The instructions for experiment 2 will be distributed after experiment 1.

If you have any questions, please raise your hand! The experimenter will come to your desk and answer your questions privately.

Tasks in experiment 1

Task 1: Counting letters: In task 1, you have to count how often a specific letter occurs in a row of letters. Each task has the following form:

> *Please count how often the following letter appears in the row below: o*
> *Row of letters: obooboobobobbboobobobobbbbooobob oobbboobbbbobbobob*

You need to carefully go through the row of letters and count how often the letter o appears. The correct answer in this example would be 23.

Task 2: Multiplication: In task 2, you have to multiply two numbers:

> *Please calculate the product of 17 and 13*

The correct answer in this example would be 221.

Task 3: Addition: In task 3, you have to add two numbers:

> *Please calculate the sum of 578 and 187*

The correct answer in this example would be 765.

Please insert your result in the appropriate field and press "OK." The next task will then appear on your screen. In addition, the number of tasks you have already worked on will be displayed in each round. Please note that you may not use pencil and paper!

Instructions: Experiment 2

Experiment 2 consists of an individual decision task. The endowment at the beginning of experiment 2 is the amount of money you earned in experiment 1. You already saw the amount of money on the previous screen, and it will be displayed again when you make your decision.

You have to decide how much of your income (between 0 to 100 percent) you want to invest in a lottery. You may keep the non-invested share in any case.

The lottery: With a probability of 50%, your investment is a success. In this case, you receive 2.5 times the money you invested as payoff from the lottery. If the investment is not successful, you lose the amount invested, i.e., the payoff from the lottery is zero.

Your total payoff after experiment 2 is thus the sum of the part you did not invest and the payoff from the lottery.

Instructions: Experiment 3

You will see the instructions for experiment 3 on your computer screen after experiment 2 has finished.

Experiment 3 is independent of experiments 1 and 2. The payoff from experiment 3 will be added to the payoff after experiment 2.

Appendix B – Screenshots

Figure B1: Screenshot phase one in PARALLEL and PARALLEL-JOINT

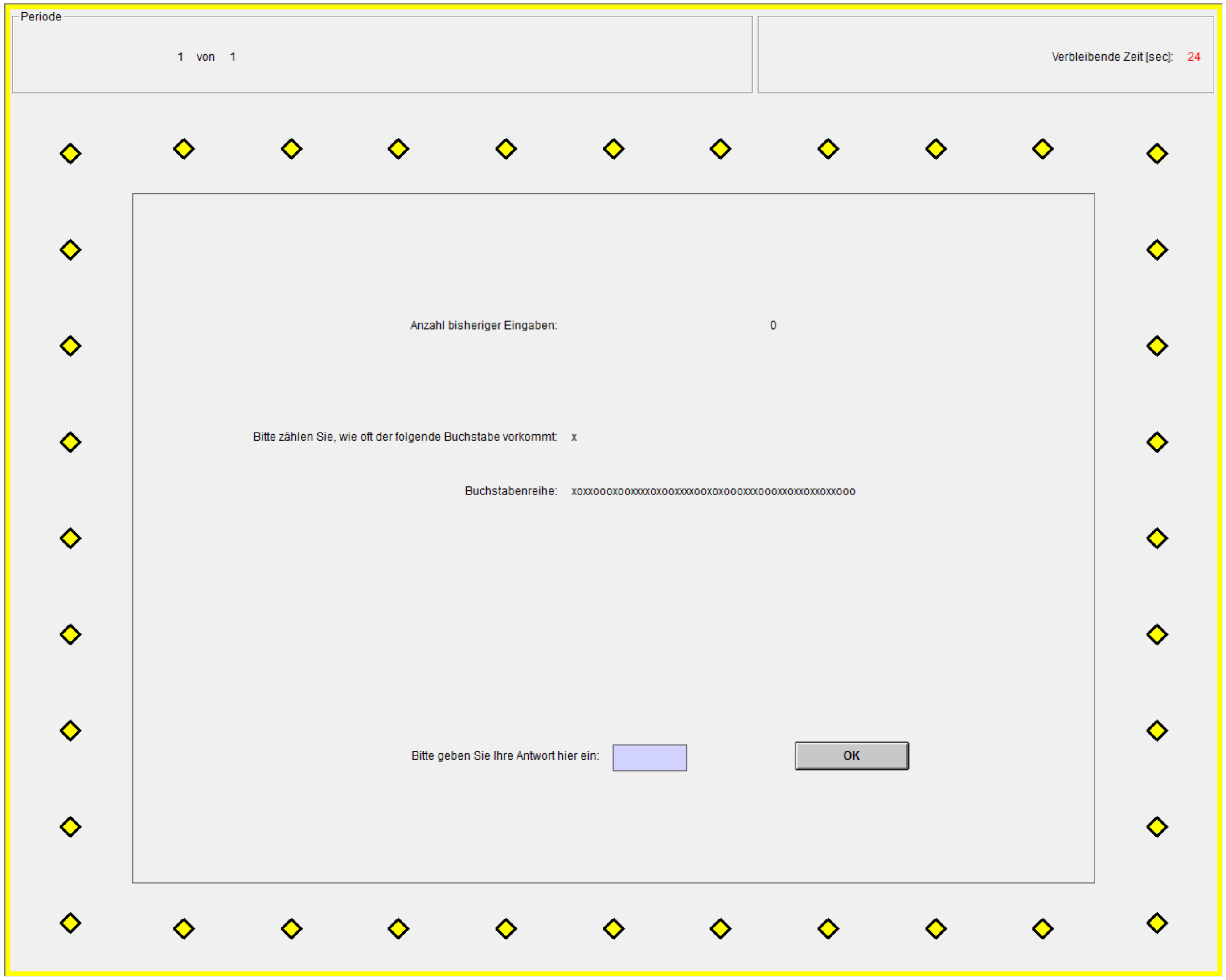


Figure B2: Screenshot phase one in BASE and JOINT

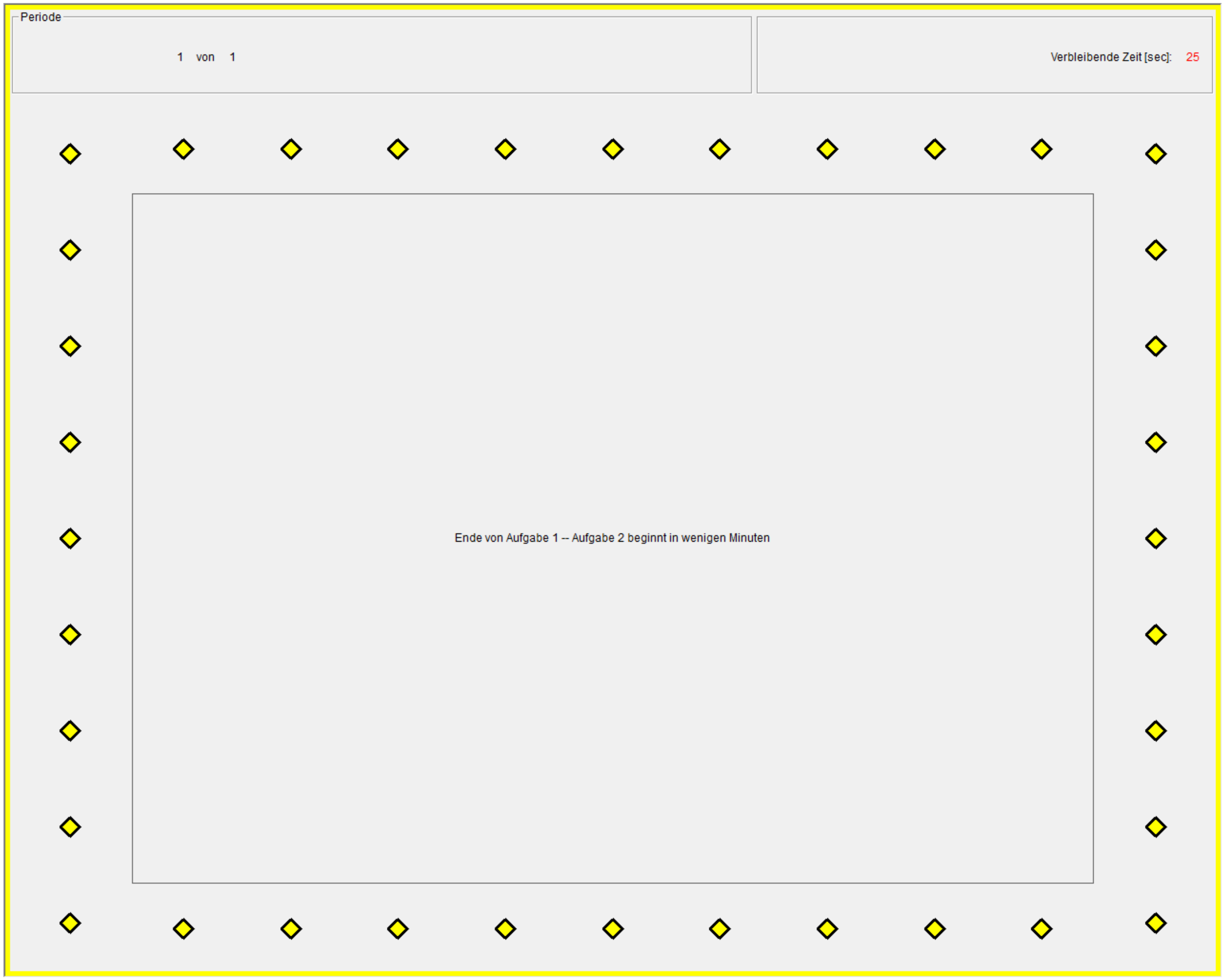


Figure B3: Screenshot Task 1 in BASE and JOINT

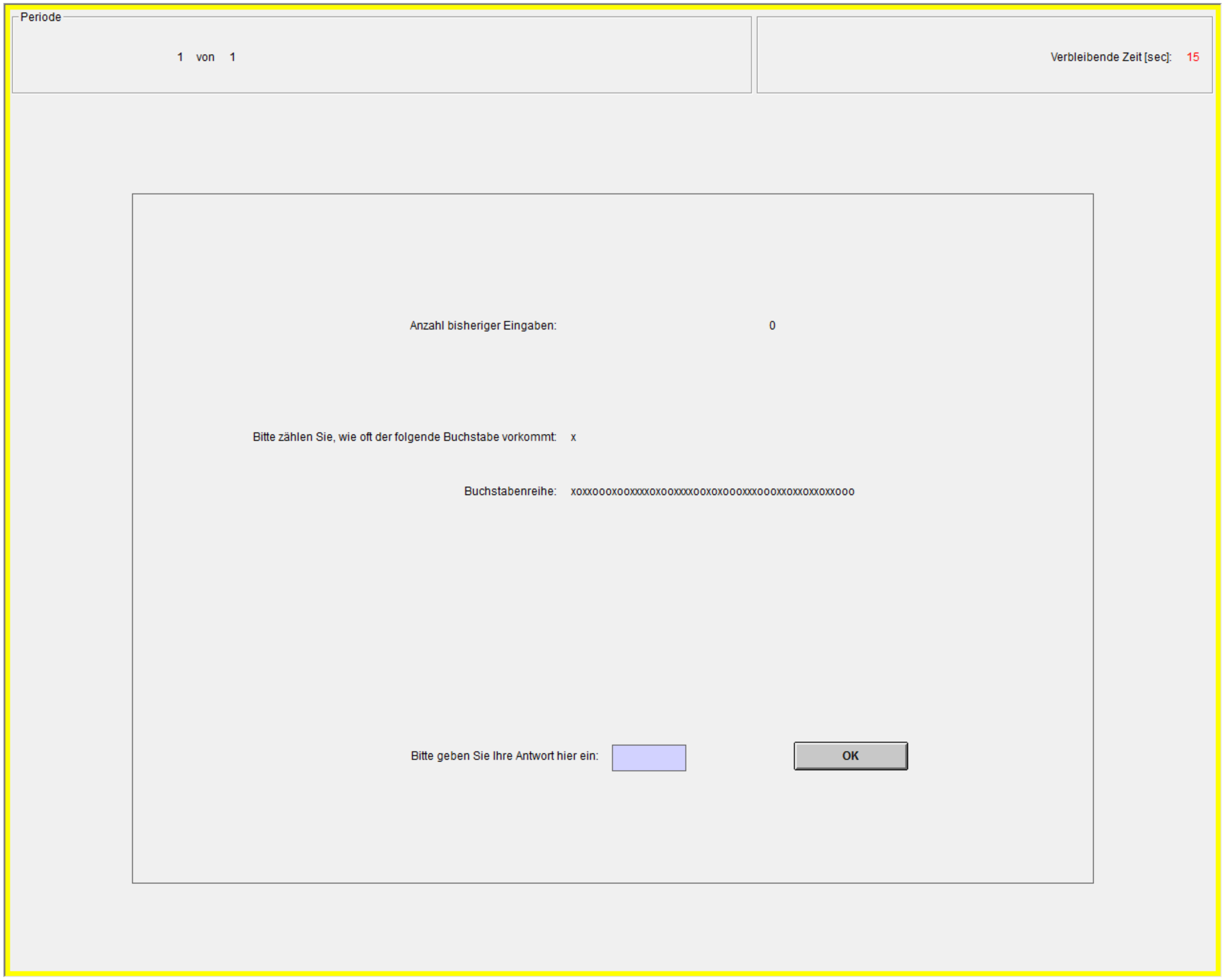
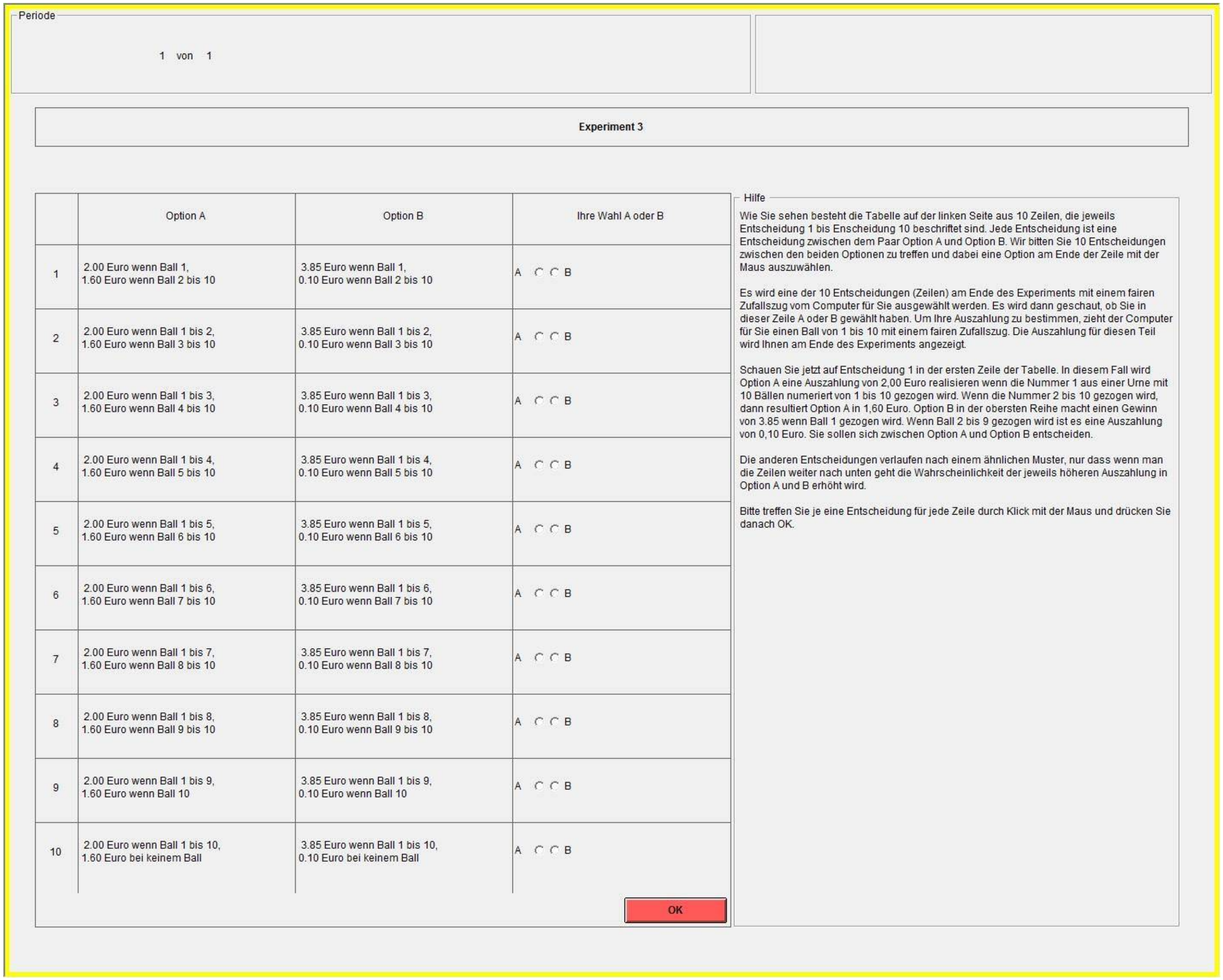


Figure B4: Screenshot of the Holt and Laury (2002) risk elicitation task (second task in the second part of the experiement)



Appendix C – Results risk tasks (2nd part of the experiment)

As mentioned in section 3, our experiment consists of two parts. The first part is the Point Destruction Game and the real-effort tasks (as described in section 3.1 - 3.3). The second part consists of two individual risk elicitation tasks.

Recall that we are not specifically interested in subjects' risk preferences or in the relationship between anti-social behavior and risk preferences. The main reason for implementing the second part of the experiment is to avoid experimenter demand effects. As the earnings of part one are used as the endowment for part two, subjects could reason that the purpose of the real-effort tasks is to generate an endowment for the individual decision tasks in part two. By including a second part, we avoid a situation where the only payoff-relevant decision (other than the real-effort tasks) is whether or not to reduce others' incomes, which could potentially lead to an experimenter demand effect, see Zizzo (2010).

In the first task, subjects have to decide how much of the money earned in part one they are willing to invest in a risky lottery. This lottery pays 2.5 times the amount invested with a probability of p = ½, and zero otherwise. We borrow this task from Gneezy and Potters (1997), taking the parameter values from Charness and Gneezy (2010). The final payoff after the investment task is the sum of the amount not invested in the lottery plus the payoff from the lottery.

In the experiment, subjects invest on average 36.3 percent of their endowments. A small number of subjects (4.0 percent) invest nothing, while 9.2 percent of subjects invest their entire endowments. The mean investments in the four treatment conditions are relatively close to the overall mean investment and they are not significantly different from each other (with one exception: in BASE, the mean investment is higher than in PARALLEL and this difference is marginally significant).

The second individual decision task is the risk elicitation task proposed by Holt and Laury (2002), comprising ten paired lottery choices (see appendix B, figure B4 for a screenshot). Subjects have to make ten decisions (row 1 – row 10) between two lotteries that are labelled "option A" and "option B." Option A is always the lottery with the lower variance (the two possible outcomes are €1.60 and €2.00), and is therefore the safer option. Option B is always the lottery with the higher variance (here the two possible outcomes are €0.10 and €3.85), and therefore the riskier option. For the first decision (row 1), the probability of receiving the higher payoff in both lotteries is 0.1, hence the probability of receiving the lower payoff is 0.9. The probability of receiving the higher payoff increases by 0.1 per row, up to row 10, where the probability for receiving the higher payoff is one.

A rational subject should switch exactly once from choosing option A to option B, i.e. they should not choose option A if they have chosen option B in a previous row. In the experiment, 92.9 percent of subjects follow this pattern and switch only once from option A to option B.

In row 10, every subject should choose option B, as this guarantees a certain payoff of €3.85, which is higher than the certain payoff of €2.00 resulting from option A. The vast majority of subjects choose accordingly, and only eight subjects (4.2 percent) choose option A in the last row.

A subject's degree of risk aversion can be estimated by the row in which they switch from option A to option B. The later the subject switches from option A to option B, the higher the degree of risk aversion. Note that a risk neutral subject should switch to option B in row 5, as this is the first row in which the expected payoff of option B is higher than the expected payoff of option A.

In the experiment, the mean switching point (restricted to the 182 consistent choices with a unique switching point) is 6.5, indicating that our subjects are, on average, slightly risk averse. As expected, the share of the endowment invested in the investment task is negatively correlated to the switching point (Pearson correlation coefficient of -0.166, $p \leq 0.05$). The mean switching points in the four treatment conditions are relatively close to and not significantly different from each other (with one exception: in BASE, the switching point is significantly higher than in PARALLEL).

Appendix D – Detailed test results, summary of experimental sessions

Table D1: Detailed test results

	Impact of joint framing		Impact of a parallel activity	
	Without parallel activity	With parallel activity	With baseline framing	With joint framing
	BASE vs. JOINT	PARALLEL vs. JOINT-PARALLEL	BASE vs. PARALLEL	JOINT vs. JOINT-PARALLEL
Number of destroyed points per group (group level) – section 4.1				
Empirical z-values (Wilcoxon-Mann-Whitney test)	2.398**	-1.779*	2.722***	-1.024
Empirical Û-values (Robust rank order test)	2.533**	-1.403*	2.765***	-0.861
Stochastic difference (Test for stochastic inequality)	-0.5260**	0.3427	-0.5714**	0.2098
Number of subjects that destroyed more than one point (individual level) – section 4.2				
Empirical z-values (Wilcoxon-Mann-Whitney test)	2.666***	0.121	2.221**	-0.920
Empirical Û-values (Robust rank order test)	2.318**	0.055	1.984**	-0.309
Stochastic difference (Test for stochastic inequality)	-0.5000**	-0.0140	-0.4351**	0.0769

Note: Positive numbers indicate that the value of the variable is larger in the treatment condition named first, and vice versa for negative values. * $p \leq 0.1$; ** $p \leq 0.05$; *** $p \leq 0.01$

Table D2: Summary of the experimental sessions

		Activity in parallel to the destruction decision: No	Activity in parallel to the destruction decision: Yes
Joint framing	No	**BASE** 56 subjects in 14 groups 7 groups in Heidelberg 7 groups in Mannheim Average earnings: €8.9	**PARALLEL** 44 subject in 11 groups 4 groups in Heidelberg 7 groups in Mannheim Average earnings: €10.4
	Yes	**JOINT** 44 subjects in 11 groups 7 groups in Heidelberg 4 groups in Mannheim Average earnings: €11.8	**JOINT-PARALLEL** 52 subjects in 13 groups 8 groups in Heidelberg 5 groups in Mannheim Average earnings: €10.1

Notes: For a detailed description of the treatment variations, see section 3.2, 3.3 and 3.5 (in particular, Table 2)