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Conference Paper

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Beiträge zur Jahrestagung des Vereins für Socialpolitik 2021: Climate Economics

Provided in Cooperation with:

Verein für Socialpolitik / German Economic Association

Suggested Citation: Stehr, Frauke; Werner, Peter (2021) : Making Up for Harming Others — An Experiment on Voluntary Compensation Behavior, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2021: Climate Economics, ZBW - Leibniz Information Centre for Economics, Kiel, Hamburg

This Version is available at:

<https://hdl.handle.net/10419/242396>

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Making Up for Harming Others — An Experiment on Voluntary Compensation Behavior*

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February 26, 2021

Abstract

We study to what extent consumers forego personal gains to avoid or reduce the harm their choices impose on others. In the absence of regulation, such voluntary compensation provides a way for consumers to internalize negative externalities on their own. However, the tangibility of consumption externalities is often reduced by diffusion of both the harm created and the responsibility in creating the externality. We conduct a laboratory experiment to investigate how the presence of diffusion affects voluntary compensation. We find that subjects are generally willing to compensate at least some of the harm their consumption creates for other subjects. Diffused responsibility for the externality, however, reduces compensation levels and leads to larger overall net externalities as compared to a baseline condition without diffusion. Diffusion of the harm caused by consumption, on the other hand, does not change compensation choices and externalities. Overall, while the introduction of voluntary compensation reduces the harm created by consumption, the net externality still remains high across all treatments.

Keywords: voluntary compensation, diffused responsibility, diffused harm, socially-responsible consumption

JEL Codes: D91, D62, H41, Q58

*Financial support by the Graduate School of Business and Economics of Maastricht University is gratefully acknowledged. Ethics approval was obtained from the Ethics Review Committee Inner City Faculties (ERCIC) at Maastricht University. We thank colleagues and seminar participants in Maastricht and Münster for valuable comments. The authors declare no conflict of interest.

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1 Introduction

How is voluntary compensation for negative consumption externalities affected by the tangibility of these externalities? Specifically, how do the diffusion of the harm and the diffused responsibility in creating an externality affect voluntary compensation? We employ a laboratory experiment to analyze the causal effects of such diffusion on voluntary compensation. Our results show that diffused responsibility reduces compensation amounts, which leads to a 23% larger net externality compared to the situation without diffusion. Diffusion of harm, on the other hand, does not significantly affect compensation and externality levels.

Voluntary offsetting tools rely on individuals' willingness to pay to reduce externalities that are caused by their behavior, for example by financing emission reductions elsewhere. Especially in the absence of regulation, they can form an efficient tool to internalize externalities for individuals who wish to diminish their contribution to a public bad (Kotchen, 2009). They may even be welfare enhancing, as they allow individuals, who otherwise would have abstained from the consumption of certain goods, to consume because they can now offset the externality. The relevance of voluntary (carbon) offsetting tools is evidenced by their global market volume, which was estimated to be \$190 million in 2016, offsetting around 63 Mt CO₂ equivalents (Forest Trends Ecosystem Marketplace, 2017).¹

While there is evidence from the field that there generally is demand for voluntary compensation (e.g., Kesternich et al., 2016, 2019), it remains unclear to what extent compensation is affected by the tangibility of the externality. In many applications, the tangibility of externalities from a consumer perspective may be reduced by two common factors: diffusion of the harm across many people, and diffusion of responsibility in creating the externality. As both of those factors have been shown to reduce prosocial behavior (Butts et al., 2019, Falk et al., 2020), it is important to understand better how they shape compensation behavior in order to evaluate the role voluntary measures can take in reducing negative externalities. Since offsetting tools have also been criticized as modern day indulgences which simply allow consumers to walk away guilt-free (Sandel, 2012), we move on to investigate if the availability of compensation tools changes the consumption decision

¹Next to airlines themselves, a myriad of organizations offer consumers the possibility to compensate negative environmental externalities. Besides private organizations (e.g., Carbon Footprint Ltd. (UK), Atmosfair (DE), myclimate (CH)), there are also publicly funded organizations (e.g., climateneutralnow.org by the UN) as well as organizations funded by the church (e.g., Klimakollekte (DE)).

in the first place, leading to larger net externalities.

We conduct an experiment in which participants take the role of consumers, who cause a negative externality on another participant in the laboratory when purchasing a fictitious good. In particular, harmed subjects have to stay longer in the lab and work on a tedious real-effort task in order to receive their payments. After having decided to buy the good, consumers are offered the possibility to use some of their earnings to reduce the externality they caused by reducing the workload for the harmed subject. In our baseline condition *NoDiffusion*, one consumer is matched with one harmed subject. We manipulate diffusion of harm and responsibility by changing the matching structure in two between-subject treatments. In *DiffusedHarm*, one buyer is matched with two harmed parties whereas in *DiffusedResponsibility* two buyers are matched with one harmed party. Importantly, we hold the total externality created in each matching group constant across treatments. Finally, to test the effect of compensation on the buying decision and the net externality, we manipulate within subject whether compensation is available or not.

Our results are as follows: First, diffusion of harm or responsibility does not change the likelihood of compensating relative to our baseline condition without diffusion. We do, however, find an effect on the intensive margin in the *DiffusedResponsibility* treatment: conditional on compensating at all, buyers compensate significantly less than in *NoDiffusion*. In addition, externality-sensitive subjects are significantly more likely to buy in both diffusion treatments than in the baseline condition. Overall, the introduction of voluntary compensation significantly reduces the net externality in all treatments by between 13 and 18%. Average net externalities, however, remain on a high level, still accounting for 64 to 79% of the maximum possible externality. Finally, net externalities in the *DiffusedResponsibility* treatment are generally higher than in the baseline condition.

We contribute to the literature by isolating the causal effects of diffusion of harm and responsibility on consumption and compensation behavior. By conducting a laboratory experiment, we isolate these effects cleanly, which is very difficult using field data. In our experiment, we hold the size and severity of the externality constant and only vary the matching structure across treatments. By this, we also have more control over subjects' beliefs of the size and severity of the externality, which might vary widely in field settings. Moreover, it is nearly impossible to isolate the extent to which the introduction of compensation changes individual consumption patterns, since consumers cannot easily be tracked according to their choices of similar products with and without the possi-

bility of compensation. Among other things, this is due to the fact that the consumption and the compensation choices may often be separated from each other. Our experimental design allows us to introduce the possibility of compensation exogenously in order to cleanly compare consumption behavior and net externalities in the situation without and with compensation.

Our study also contributes to the literature of moral behavior in markets by studying an environment in which consumers have the possibility to eliminate the externality ex-post, which is a central characteristic of the voluntary compensation of real-world environmental externalities. In contrast, previous studies on the nature of moral concerns in markets have focused on settings in which subjects' decisions to trade or consume either were associated with the creation of an irreversible externality or in which subjects had to choose ex-ante between fair products and products with an externality. Consumers in our experiment can express their concerns about externalities in two dimensions – either in the ex-ante abstention from buying or in choosing to compensate, making the net effect of moral concerns for the creation of externalities unclear.² Moreover, in our setting, consumers are able to determine the degree of their social responsibility endogenously as they have the possibility to compensate fully or only partially for the harm they created. Finally, by varying the surplus available to consumers from their buying decisions, we can gain insights into the trade-off between material gains and externalities.³

The remainder of our paper is organized as follows: In Section 2, we review the literature relevant to our study. In Section 3, we describe our experimental design and the hypotheses. We present the experimental results in detail in Section 4; Section 5 briefly discusses the results and concludes.

2 Related Literature

First, our study relates to literature on moral behavior in market settings. Following Falk and Szech (2013), a large experimental literature has emerged investigating social responsibility in markets. Some papers address how markets per se and their characteristics in particular affect

²The buyer's decision to compensate is also different from simple donation choices or contributions in social dilemma problems, as here the harm caused by consumption is salient, which may trigger an additional motivation to forego personal payoffs in order to reduce harm. Indeed, Kuhn and Uler's (2019) results show that compensation choices depend on the individual contributions to the creation of the externality.

³There is, for example, no conclusive evidence yet, whether social responsibility is a normal good (see Friedrichsen, 2017, Bartling et al., 2019a).

decision-makers' willingness to impose externalities. One common finding is that subjects are more likely to trade and thus create negative externalities in market environments as opposed to similar individual-choice contexts (Falk and Szech, 2013, Bartling et al., 2015). At the same time, there is substantial heterogeneity in the willingness to cause and to reduce negative externalities. This heterogeneity can affect the level of the negative market externality and interact with the precise characteristics of the market mechanism (e.g., Kirchler et al., 2016, Jakob et al., 2017, Ockenfels et al., 2020, Riehm et al., 2020, Sutter et al., 2020).

Several papers have investigated underlying motivations for immoral behavior in markets. Falk et al. (2020) test whether diffusion of responsibility in simultaneous and sequential decision making in groups leads to a higher willingness to impose negative externalities. They observe that individuals who decide in groups are significantly more likely to choose the selfish option regardless of the nature of the externality. Irlenbusch and Saxler (2019) find no significant difference in the willingness to accept a negative externality when an individual's decision is compared to the case when two decision-makers share responsibility. Looking at a similar mechanism, Bartling and Özdemir (2017) find subjects make use of a "replacement excuse" only in situations where no clear social norm exists that classifies behavior causing an externality as immoral.

A number of studies have focused on consumers' selection process when there are both fair goods without a negative externality and goods with a negative externality. In general, the fair good has a significant positive market share, despite coming at a higher price (Bartling et al., 2015, Pigors and Rockenbach, 2016a,b, Bartling and Özdemir, 2017, Friedrichsen, 2017, Bartling et al., 2019a). Bartling et al. (2019b) investigate the effect of diffused harm (between six recipients) on market outcomes. In their setting, experimental participants in the roles of buyers and sellers are matched in markets where goods with and without externality can be traded (which of them is offered is decided by the sellers). Holding the absolute magnitude of the externality constant, the authors vary how many subjects are harmed by the externality (one versus six subjects). Their results suggest that diffused harm only weakly affect the market share of fair goods.

Finally, our study also relates to research in the field of environmental economics that investigates individual motivations to engage in carbon offsetting. Unlike the experiments discussed above, these papers typically use evidence from surveys and vignette studies to uncover the nature of individual motivations behind compensation (Blasch and Farsi, 2014, Blasch and Ohndorf, 2015,

Schwirplies and Ziegler, 2016, Lange and Ziegler, 2017).⁴ To the best of our knowledge, only one study has analyzed the determinants of ex-post offsetting using incentivized decision tasks: Kuhn and Uler (2019) conduct a laboratory experiment in which subjects first trade in double auction markets. Whenever a buyer and a seller agree on a price, trade occurs and a negative monetary externality is imposed on all market participants. After the double auction markets, former traders play a public goods game where contributions are used to offset the negative externalities created in the markets. The authors find that there is demand for offsets that depends on their prices. Moreover, they do not find an effect of the introduction of compensation on the traded quantity.

3 Experimental Design and Hypotheses

3.1 Basic Setup

We employed a 2×3 experimental design. To assess the effect of the introduction of compensation all subjects participated in the two conditions *NoCompensation* and *Compensation*. Between subjects, our three main treatments then varied the degree of diffusion of the negative externality: *NoDiffusion*, *DiffusedHarm* and *DiffusedResponsibility*.

We first describe our baseline condition *NoDiffusion* before we move to the treatment variations in the next subsection. The structure of the basic decision situation in the *NoCompensation* \times *NoDiffusion* condition was as follows: There were two players, one buyer and one harmed party. Both the buyer and the harmed party received an endowment of 75 Experimental Currency Units (ECU). The buyer then could decide whether she wanted to buy a fictitious good at price p from the experimenter. This price was randomly drawn from a uniform distribution with $p \in \{1, 2, \dots, 100\}$ ECU. If the buyer decided not to buy the good, both players kept their endowment and no externality was created. When buying the good, on the other hand, the buyer received a payoff equal to her valuation of the good, which was fixed throughout the experiment at 100 ECU. The gains from buying were thus between 0 (if the price was 100) and 99 (if the price was 1) ECU. At the same time, buying imposed a real-world negative externality on the harmed party. In our setting, the externality referred to the obligation for the harmed party to work on a tedious effort task after the

⁴In particular, three factors are commonly found to correlate with stated demand for carbon offsets: environmental preferences, warm glow and the perceived responsibility in the creation of the externality.

end of the experiment. In case a buyer decided to buy the good and the externality was created, harmed parties had to correctly place 240 sliders in the slider task (Gill and Prowse, 2012) in order to receive their payment, after all other subjects who did not have to work on any sliders had left.⁵ We chose the parameters of the experimental decision task such that it was optimal for a buyer not concerned about the externality to buy the good at all price realizations; a profit-maximizing buyer would only be indifferent between buying and not buying at the highest possible price (100 ECU).

In the *Compensation* \times *NoDiffusion* treatment, we added a second stage after the buying decision. If a buyer decided not to buy the product, the consequences stayed the same as in the *NoCompensation* condition, i.e., both buyer and harmed party kept their endowment and no externality was created. Yet, once a buyer bought the good, she moved to the second stage and had the opportunity to use between 0 and 30 ECU of her experimental payoff to reduce the externality on the harmed player with whom she was matched. This decision resembles the choice of a consumer to compensate for the negative externality created by her purchase. In particular, each ECU spent by the buyer reduced the workload for the harmed player by eight sliders. Note that for prices lower than 70 ECU, a buyer would obtain positive profits from purchasing even after fully compensating the externality. In addition, we allowed buyers to spend money from their endowment to compensate the harmed party for the negative externality when the surplus created from buying was not sufficient to fully compensate. Full compensation (reducing the externality to zero) was therefore always feasible for any realization of the prize. Moreover, the parameters in our experiment ensured that at least for price realizations below 70 ECU buying and fully compensating was Pareto-efficient.⁶

After playing 12 rounds of the game in the *NoCompensation* condition, participants in all treatments played the game for another 12 rounds in the *Compensation* condition. In each round, prices were drawn randomly and independently for each buyer. To rule out hedging, one round was randomly determined for payment at the end of a session. Furthermore, we did not give any

⁵In this task, subjects were confronted with a number of movable sliders which could be dragged to all possible positions between 0 and 100. The computer randomly allocated the starting position of the slider. The subjects' task was then to drag all sliders to the middle position (in our case 50). Solving 240 sliders took between 10 and 18 minutes in our experiment.

⁶For prices between 70 and 100 ECU the evaluation of the efficiency of buying and compensating depends on the (unknown) social costs of the externality, in our setting the individual disutility of working on the sliders task.

feedback in between rounds and roles were fixed throughout the experiment. It was made clear in the instructions that harmed parties were subjects participating in the same session as buyers. Moreover, subjects knew that buyers and harmed parties would be re-matched in every round, ensuring that no subjects would be matched to each other in two consecutive rounds. We used a market frame labeling the players as Person A and Person B, with Person A being described as a buyer who had to decide whether to buy a good. Example instructions can be found in the Appendix.

3.2 Treatments

To manipulate diffusion of the consumption externalities, we changed the matching structure in the treatments *DiffusedHarm* and *DiffusedResponsibility* holding the total size of the externality constant. While in *NoDiffusion* one buyer was matched with one harmed party, we varied the number of buyers and harmed parties in *DiffusedResponsibility* and *DiffusedHarm*, respectively. In *DiffusedHarm*, one buyer was matched with two harmed parties who had to solve 120 sliders each if the good was bought. In the *Compensation* condition, each point spent as compensation would then reduce the number of sliders each harmed party had to solve by four so that the efficiency of the compensation technology was identical to the other treatments. To keep things comparable across treatments, buyers were not allowed to allocate compensation freely between the two harmed parties. In *DiffusedResponsibility*, two buyers were matched with one harmed party who had to solve 240 sliders whenever at least one of the two buyers bought the good, which is similar to the implementation rule in Falk et al. (2020). Each point spent as compensation reduced the number of sliders by eight. However, if the two buyers together spent more than 30 ECU in total, excess points expired, as the externality could not be reduced to less than zero. We did not give any feedback to buyers at the end of a round, in order to prevent updating of beliefs about the distribution of buyers' preferences, which would have influenced the incentives to buy and to compensate in the first place. Again, we made sure that in any consecutive round buyers were not matched with the same subjects (harmed parties and/or buyers).

3.3 Hypotheses

Our first hypothesis concerns the effect of the availability of compensation on buying behavior. One argument against compensation tools that is often brought up is that they could be used as modern indulgences, i.e., a relatively “painless mechanism to buy our way out of the more fundamental changes (...) that are required to address the climate problem” (Sandel, 2012, p.77). If buyers experience moral costs as a result of creating the externality on the third party, compensation provides a possibility to assuage this moral cost. Hence, buyers who experience disutility due to their moral concerns can be expected to choose positive compensation levels to reduce the moral costs of consumption. This pattern would be in line with the positive voluntary compensation levels observed in the field (e.g., Kesternich et al., 2019).

At the same time, the possibility of compensating the externality (at least partially) may have the undesired side effect of increasing buying frequencies. Such an effect has been found in the context of household energy, where consumers increased their energy consumption by 1-3% after signing up for a green energy program that would offset the CO₂ effects (Harding and Rapson, 2019). A similar effect has been found in various other contexts such as picking up children at the daycare center (Gneezy and Rustichini, 2000), or dishonest behavior in the laboratory (Gneezy et al., 2014).⁷ This leads us to a two-part hypothesis:

Hypothesis 1

- a) *Buyers choose positive compensation levels on average.*
- b) *The introduction of compensation leads to a higher buying frequency than when compensation is not possible.*

Transferred to real-world settings, it is important to note that increased frequency of buying after the introduction of the compensation possibility would only be a problem (in the sense of a larger net externality) if subjects compensate too little or if compensation is not effective in reducing the externality. To keep things simple, we exclude the latter scenario in our experimental design and look only at the case where each monetary unit given to compensation also effectively reduces

⁷A related phenomenon is the rebound effect from energy economics, which is defined as an increase in energy consumption after an increase in energy efficiency, which may even offset efficiency driven energy savings (Sorrell and Dimitropoulos, 2008). While the size of the rebound effect is still debated in the literature, its existence is well-documented (Gillingham et al., 2016).

the externality by a given amount. This allows us to test whether the net effect of compensation on the externality created is positive or negative.

Our treatment variations focus on two additional factors, which may hamper social responsibility by reducing the tangibility of the externality: diffusion of harm and diffusion of responsibility. First, many negative externalities share the characteristic that their harm is borne by many people at the same time, e.g., carbon emissions, water pollution or noise pollution all affect many people simultaneously. That many are harmed at once reduces the identifiability of victims and hence may lead to “compassion fade”, the psychological phenomenon that the likelihood to help decreases when the number of victims increases. This effect has been found in many studies in humanitarian contexts (see Butts et al. (2019) for a meta-analysis), and was also confirmed in an environmental study which comprises vignette and behavioral results for a group of non-environmentalist subjects (Markowitz et al., 2013). Transferred to our setting, this leads us to hypothesize that diffusion of harm reduces social responsibility.⁸

Similarly, diffusion of responsibility is a frequent characteristic of markets where negative externalities are created, especially in the transport sector where voluntary offsetting schemes are currently often implemented. Diffusion of responsibility may increase the moral wiggle room and has been shown to reduce prosocial behavior for example in dictator games (e.g., Dana et al. (2007); see Dana et al. (2012) for a literature review). As discussed above, Falk et al. (2020) show in a series of experiments that diffusion of responsibility also increases the willingness to impose a negative externality. These findings lead us to hypothesize that diffusion of responsibility also decreases social responsibility in the context of voluntary compensation.

Importantly, as described above, decision-makers in our setting can respond to the reduction of tangibility along two dimensions. They can either buy the good more frequently or reduce voluntary compensation. As it is difficult to predict ex-ante on which dimension the behavioral response should be stronger pronounced, we formulate our hypothesis about the effect of the treatments in terms of social responsibility, integrating both buying and compensation choices.

⁸We note that in the field of experimental economics, the evidence is not conclusive so far. The study by Bartling et al. (2019b) discussed above does not find a significant effect on the market share of a fair product when comparing markets that differ in the degree of diffusion of harm. In a series of distributional games by (Schumacher et al., 2017), participants decide about whether or not a good is provided that imposes a certain cost for each payer in a group of payers. Here, a large fraction of subjects are insensitive to the size of the group who is bearing costs, which results in ignorance of large provision costs when these are spread among many payers.

Hypothesis 2

Diffusion of harm/responsibility reduces social responsibility: It increases buying and decreases compensation (conditional on buying), relative to the situation without diffusion.

3.4 Experimental Procedures

The experiment was run in June 2019 at the BEELab at Maastricht University, after we conducted a pilot in April 2019 to calibrate experimental parameters. In total, seven experimental sessions were conducted with altogether 150 subjects. Subjects were recruited using ORSEE (Greiner, 2015) and the experiment was programmed in oTree (Chen et al., 2016). The experiment lasted on average for 1 hour 45 minutes and payments were made in Euro with the exchange rate 10 ECU = EUR 2.50. Average earnings were EUR 24.14 (SD 7.75), with buyers earning on average EUR 29.48 (SD 7.95) and harmed parties earning EUR 18.80 (SD 0). When all subjects who were registered for a session showed up, all experimental treatments were conducted in this session. Upon arrival, subjects were randomly assigned to their seats in the lab by drawing a numbered card from a shuffled deck. In a session with full participation, we had 6 participants in the *NoCompensation* treatment (3 buyers, 3 harmed parties) and 9 participants in either of the diffusion treatments (3 buyers and 6 harmed parties in *DiffusedHarm*, 6 buyers and 3 harmed parties in *DiffusedResponsibility*). We call each of these treatment groups a cohort. Subjects were re-matched within their cohort, making sure that no one interacted repeatedly in two consecutive rounds. When not all registered subjects showed up for a session, we dropped one of these cohorts and consequentially conducted the session only with the remaining two treatment cohorts.

The structure of a session is depicted in Figure 1. At the beginning of the experiment, subjects received general instructions about the procedure of the session. All instructions were handed out on paper. We then explained the slider task and subjects had to solve 120 trial sliders in order for all of them to become familiar with what would later become the externality. For working on the slider task, they received 100 ECU. With the help of the Becker-DeGroot-Marschak (BDM) mechanism (Becker et al., 1964), we elicited subjects' willingness to pay to avoid having to solve another set of sliders at the end of the experiment. Subjects had to state their willingness to pay for four different numbers of sliders (60, 120, 180, and 240) to be able to account for potential individual differences in perceived effort functions; they could bid up to their endowment of 100 ECU. After the willingness

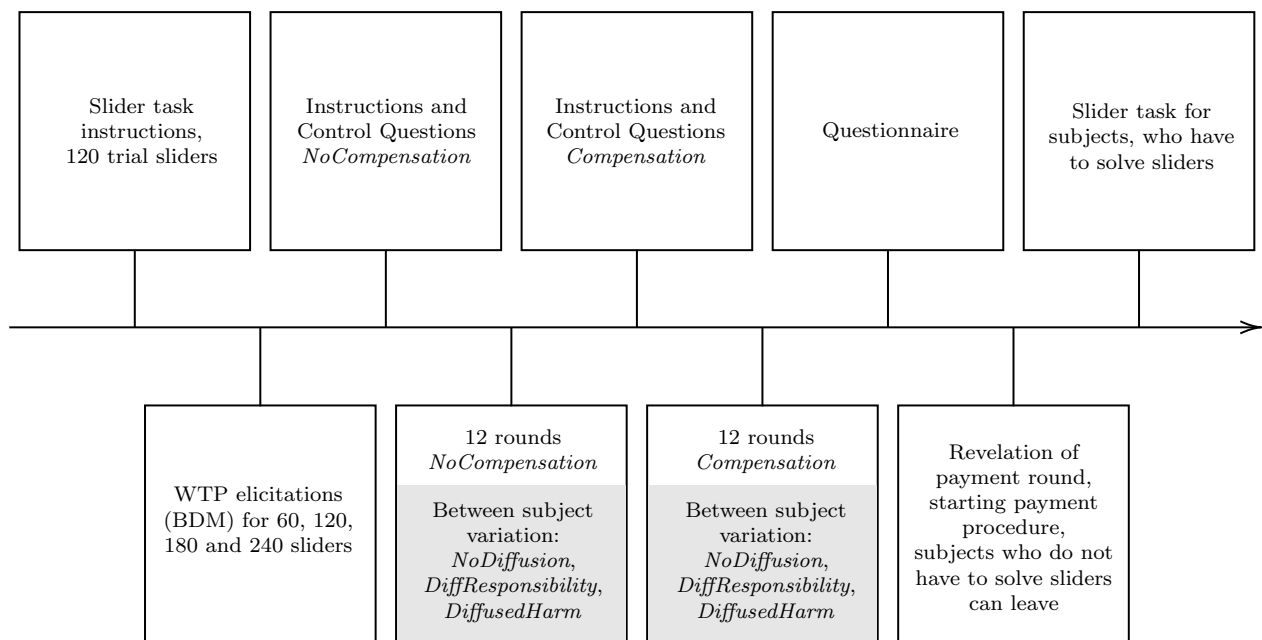


Figure 1 – Structure of an experimental session, which was the same for all subjects. Differences stemming from between subject treatments are indicated in shaded boxes. WTP refers to the willingness to pay to avoid having to solve sliders.

to pay elicitation, subjects received the instructions for *NoCompensation* and then had to answer control questions with example calculations. They could only proceed to the 12 rounds of the main experiment once they had correctly answered each of the control questions. Only then, subjects were informed of their role (buyer or harmed party). At the end of the *NoCompensation* part, this procedure was repeated with the instructions for the *Compensation* condition. One round was randomly chosen to determine the payoffs for the subjects and possibly the externalities. Here, each of the BDM rounds was as likely to be implemented for payments as each of the decision rounds in *NoCompensation* and *Compensation*. Before the payment round was revealed, every subject had to fill in a questionnaire with demographics and other potential control variables. Subjects who had to work on the slider task then had to solve the sliders before they would receive their payments, while we already started handing out the payments of subjects who did not have to work.

4 Results

We start our analysis with average buying behavior. Table 1 depicts buying frequencies in the different treatment conditions. First, we observe that in all treatments buyers are willing to forego

	Buying rate (SD)		Wilcoxon signed-rank test
	<i>NoCompensation</i>	<i>Compensation</i>	
<i>NoDiffusion</i>	73.81% (0.31)	80.95% (0.21)	0.059
<i>DiffusedHarm</i>	83.33% (0.24)	88.43% (0.13)	0.666
<i>DiffusedResponsibility</i>	87.04% (0.21)	88.43% (0.18)	0.198
Mann-Whitney U tests			
<i>DiffusedHarm</i>	0.396	0.398	
<i>DiffusedResponsibility</i>	0.105	0.121	

Table 1 – Average buying rates per treatment using subject mean buying rates across rounds, standard deviation in parentheses. The bottom two rows give the p-values of Mann-Whitney U tests, comparing buying rates in *NoDiffusion* with the respective treatments. The fourth column reports the p-values for a Wilcoxon signed-rank test of differences in buying rates between the *NoCompensation* and *Compensation* condition.

private earnings by refraining from buying i.e., the buying frequency significantly differs from one in all treatments ($p < 0.003$ in all two-sided Wilcoxon signed-rank tests comparing individual buying rates without or with compensation; Unless otherwise stated, all statistical tests are two sided). Once compensation is available, subjects use on average around 6 ECU to voluntarily reduce the harm they created, which is about 20% of the 30 ECU required to compensate for the full externality. In all treatments, this amount differs significantly from zero ($p < 0.001$, Wilcoxon signed-rank test comparing mean individual compensation amounts), confirming our Hypothesis 1.a).

To test whether abstaining from buying in the *NoCompensation* condition can indeed be interpreted as taking social responsibility rather than as errors of subjects who do not care about the externality, we look at the correlation between an individual’s buying frequency in *NoCompensation* and an individual’s compensation behavior in the second part of our experiment. We find that average compensation in the second part is highly negatively correlated with an individual’s average frequency of buying in the first part when compensation is unavailable (Spearman’s rho = -0.6504, $p < 0.001$). Hence, subjects who choose relatively high amounts for compensation are less likely to buy when the possibility to compensate does not exist. This result suggests that these subjects indeed account for the externality in their buying decisions.

As described in subsection 3.3, we expected the introduction of compensation to increase the

likelihood of buying (Hypothesis 1.b)). When we compare buying frequencies in *NoCompensation* and *Compensation*, we find evidence for this hypothesis in our *NoDiffusion* condition. In this treatment, the availability of compensation increases buying (marginally) significantly ($p = 0.059$, Wilcoxon signed-rank test comparing individual buying rates between *NoCompensation* and *Compensation*). At the same time, we do not find an effect of *Compensation* on the frequency of buying in the two diffusion conditions *DiffusedHarm* and *DiffusedResponsibility* where the probability of buying is already very high in the first part of the experiment (around 85%).

Next, we conduct parametric analyses in which we also take into account the individual heterogeneity of experimental buyers (see Table 2). We estimate Probit models with the decision to buy as the binary dependent variable, including buyer-level random effects, separately for each of the three experimental conditions. As independent variables, we include a dummy variable equal to one if the compensation technology was available to the buyers, the price realized in the specific round, and the round number to control for (linear) time trends. Also here, we find evidence that the introduction of compensation leads to an increased likelihood of buying in *NoDiffusion* (Model 1). The coefficient of the *Compensation* dummy is positive and significant at the 1% level. For models concerning the other two treatments (Models 2 and 3), however, we do not find such an effect.⁹

Moreover, across all models we observe a negative and highly significant price coefficient, suggesting that the lower the price, the higher the probability to buy. Note that given our experimental design, it is a weakly dominant strategy for a profit-maximizing subject always to buy, irrespective of the price realization. This is because the price can be at most 100 ECU, which is exactly equal to the induced valuation. Yet, the fact that subjects are price sensitive in all treatments seems to suggest that buyers bear a moral cost of imposing a negative externality on the harmed party on top of their individual consumption utility. This leads to a trade-off between their own monetary benefits and the moral costs, which can explain why subjects are less likely to buy the good at a high price (low potential gain from buying).¹⁰ Finally, we do not observe a robust effect of rounds in the treatments. Taken together, this leads us to our first result:

⁹Generally, results are similar when using a linear model instead. The *Compensation* dummy in the *NoDiffusion* treatment is, however, not significant anymore.

¹⁰Indeed, our results from the willingness-to-pay elicitation reveal that subjects perceived the externality as painful. The mean willingness to pay to avoid having to solve 240 sliders at the end of the experiment is around 21 ECU, which is equivalent to EUR 5.25, a substantial share of the experiment earnings.

	<i>NoDiffusion</i> (1)	<i>DiffusedHarm</i> (2)	<i>DiffResponsibility</i> (3)
<i>Compensation</i>	1.768*** (0.573)	-0.194 (0.563)	0.271 (0.385)
Price	-0.100*** (0.016)	-0.070*** (0.013)	-0.063*** (0.018)
Round number	-0.034 (0.034)	0.073** (0.035)	0.021 (0.025)
Constant	8.837*** (1.741)	6.031*** (1.521)	5.961** (2.621)
Observations	504	432	864
# buyers	21	18	36
Session dummies	Yes	Yes	Yes

Table 2 – RE-Probit models using a binary dependent variable equal to one if the decision-maker chooses to buy the good in a particular round. *Compensation* treatment dummy takes the value of one in part 2 of the experiment, when compensation is available. Robust standard errors (clustered by subject) in parentheses, *** p=0.01, ** p=0.05

Result 1

Subjects make use of the compensation technology, but its availability only significantly increases buying in the NoDiffusion treatment.

In the next step, we compare buying rates across treatments. As apparent from Table 1, both *DiffusedHarm* and *DiffusedResponsibility* lead to higher buying rates compared to *NoDiffusion* when compensation is not possible (83% or 87%, respectively vs. 73%) as well as when it becomes possible (both 88% vs. 81%). Yet, the differences between either of the diffusion treatments and *NoDiffusion* are not significant when comparing observations from the entire sample ($p > 0.100$, Mann-Whitney U tests comparing individual mean buying rates). We therefore take a closer look at the potential heterogeneity of moral concerns across decision-makers. To do so, we divide our sample into subjects who do not consider the externality when making their buying decisions and subjects who seemingly face moral costs and thus potentially respond to the treatment conditions that vary the tangibility of the externality.

We classify subjects as being sensitive to the externality, when they compensate at least once in the second part, and concentrate only on these subjects for the following analysis. This leaves us with the decisions of 13 buyers (62% of the sample) in *NoDiffusion*, 14 buyers (78%) in *DiffusedHarm*, and 23 buyers (64%) in *DiffusedResponsibility*. Importantly, there is no significant difference

	Only externality-sensitive subjects			
	<i>NoCompensation</i>		<i>Compensation</i>	
	(1)	(2)	(3)	(4)
<i>DiffusedHarm</i>	1.391*** (0.488)	4.199*** (1.374)	0.729*** (0.275)	1.594** (0.684)
<i>DiffResponsibility</i>	0.871** (0.357)	2.560** (1.006)	0.484* (0.279)	1.136 (0.701)
Price		-0.103*** (0.022)		-0.076*** (0.026)
Round number		0.024 (0.039)		0.020 (0.029)
Constant	0.363 (0.466)	6.344*** (2.067)	0.772** (0.339)	5.665** (2.740)
Observations	600	600	600	600
# buyers	50	50	50	50
Session dummies	Yes	Yes	Yes	Yes

Table 3 – RE-Probit models using a binary dependent variable equal to one if the decision-maker chooses to buy the good in a particular round. *DiffusedHarm* and *DiffusedResponsibility* are dummy variables taking value 1 for the respective treatments. Subjects are classified as externality sensitive when they have compensated at least once. Model 1 and 2 (3 and 4) refer to the first (second) part of the experiment where compensation is not available (is available). Robust standard errors (clustered by subject) in parentheses. *** $p=0.01$, ** $p=0.05$, * $p=0.1$

between treatments in the share of subjects who are sensitive to the externality ($p > 0.200$, two sample tests of proportions comparing either of the diffusion treatments to *NoDiffusion*). It turns out that the differences across treatments become more pronounced when we focus only on subjects who are sensitive to the externality. Comparing these subjects in the first part of the experiment when compensation is not possible, we find that buyers in *NoDiffusion* buy significantly less often (60% of the rounds on average) than in *DiffusedHarm* (84%, $p = 0.027$, subject level Mann-Whitney U test) and *DiffusedResponsibility* (81%, $p = 0.030$, subject level Mann-Whitney U test). In addition, when compensation becomes available this difference in the buying rates is still weakly significant (*NoDiffusion* (71%) vs. *DiffusedHarm* (86%), $p = 0.053$; *NoDiffusion* vs. *DiffusedResponsibility* (83%), $p = 0.052$, both using a subject level Mann-Whitney U test).¹¹

In Table 3, we report the results of random effects Probit models that confirm these findings. It shows that for externality-sensitive subjects, the decreased tangibility of the externality in both

¹¹It is noteworthy here that dropping selfish subjects who are not sensitive to the externality mainly leads to a reduction in the buying frequency in the *NoDiffusion* treatment, while the buying rates in *DiffusedHarm* and *DiffusedResponsibility* stay at the same level of around 85%.

treatments in most cases leads to a higher probability that the good is bought, both in the absence (Model 1 and 2) and the presence (Model 3 and 4) of the possibility to compensate.¹² This brings us to our second result:

Result 2

Diffusion of harm/responsibility increase buying significantly compared to NoDiffusion for subjects who are sensitive to the externality.

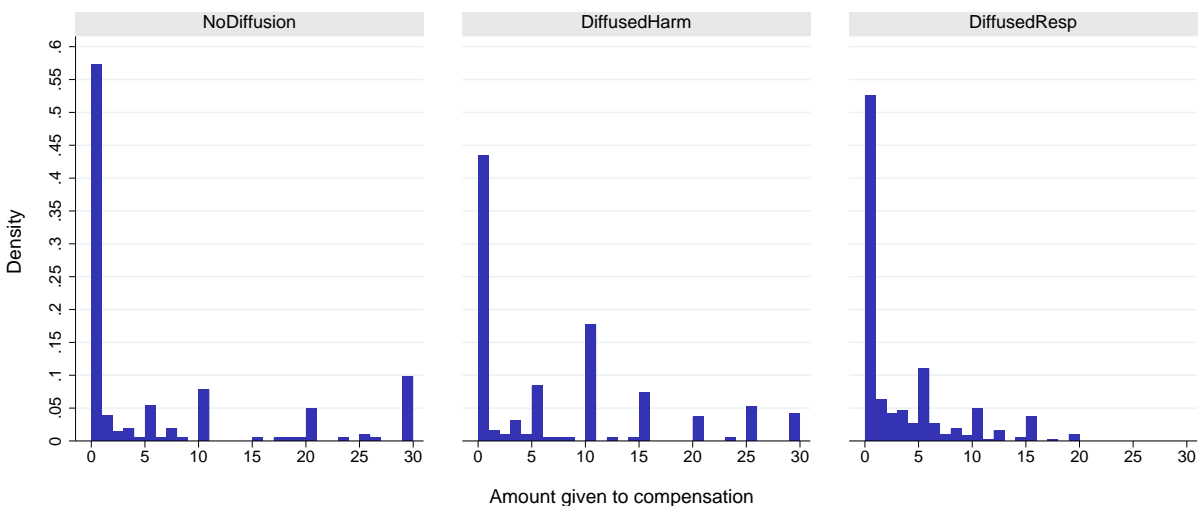


Figure 2 – Histograms of amounts given to compensation in all rounds by treatment conditional on having bought the good. Full compensation of the externality costs 30 ECU.

We now turn towards a more detailed analysis of compensation behavior. Comparing subject means of compensation across treatments, we find that subjects give on average 8.12 ECU (SD 10.83) in *NoDiffusion*, 7.78 ECU (SD 7.77) in *DiffusedHarm* and 3.71 ECU (SD 4.81) in *DiffusedResponsibility*. These differences are, however, not significant at conventional levels ($p > 0.200$ Mann-Whitney U test comparing subject means of diffusion treatments to *NoDiffusion*). In the next step, we test whether there are treatment differences in compensation for those subjects who seem to care about the externality (i.e., who compensate at least once). We find that while there is still no significant effect of *DiffusedHarm* ($p = 0.645$), compensation is (weakly) significantly lower in *DiffusedResponsibility* ($p = 0.068$, Mann-Whitney U test comparing mean compensation for externality sensitive subjects).

¹²The exception here is Model 4 in which the dummy variable for treatment *DiffusedResponsibility* is insignificant.

When looking at the distributions of the amounts given to compensation, compensation patterns seem to differ across treatments (Figure 2): In the *NoDiffusion* treatment, the externality is fully offset in 10% of the cases, while in the *DiffusedResponsibility* treatment the maximum amount that is ever given to compensation is 20 ECU (extinguishing two thirds of the externality). We therefore test whether there are treatment differences on the extensive and intensive margin.

The average propensity to compensate accounts for 50.10%, 59.24% and 51.44% in treatments *NoDiffusion*, *DiffusedHarm*, and *DiffusedResponsibility*, respectively (taking means of the subject averages across all rounds). These differences are descriptively small and statistically not significant ($p > 0.200$, Mann-Whitney U tests comparing subject means between the diffusion treatments and the *NoDiffusion* treatment). Looking at the subject means of the amounts, however, we observe that buyers who choose to compensate, give on average 14.80 ECU (SD 10.49) in the *NoDiffusion* treatment, 11.42 ECU (SD 6.70) in *DiffusedHarm*, and 6.51 ECU (SD 4.62) in *DiffusedResponsibility*. The reduction of amounts paid for compensation between *NoDiffusion* and *DiffusedResponsibility* is in line with Hypothesis 2. Indeed, the difference between *NoDiffusion* and *DiffusedResponsibility* is significant ($p = 0.023$, Mann-Whitney U test). At the same time, Hypothesis 2 is not supported by the data in case of the *DiffusedHarm* treatment. Here, while compensation amounts are on average lower than in *NoDiffusion*, this difference is not significant ($p = 0.528$, Mann-Whitney U test).

Result 3

Neither diffusion of harm nor diffusion of responsibility affects the propensity to compensate. Diffusion of responsibility significantly reduces the amount of compensation.

Table 4 provides a parametric analysis of the determinants of compensation behavior and corroborates our previous conclusions. First, we do not find significant effects of the treatments on compensation generally (Model 1, random effects Tobit-model). When looking closer at the extensive margin (Models 2, random effects Probit-model) and the intensive margin (Models 3, linear models with random effects), however, our results from the non-parametric tests are supported. Both treatments have no effect on the likelihood to compensate. However *DiffusedResponsibility* significantly lowers the amount paid to reduce the externality, conditionally on compensating at all. Moreover, the models reveal a negative price effect on both the propensity to compensate and

	Amount given (1)	Compensate (yes/no) (2)	Amount given (if compensated) (3)
<i>DiffusedHarm</i>	0.061 (5.973)	0.978 (38.184)	-4.299 (3.237)
<i>DiffResponsibility</i>	-5.542 (4.612)	-0.324 (45.300)	-7.242*** (2.753)
Price	-0.134*** (0.009)	-0.030*** (0.011)	-0.107*** (0.020)
Round number	-0.137** (0.063)	-0.072* (0.043)	-0.082 (0.065)
Constant	12.965** (6.280)	3.485 (51.830)	20.254*** (3.779)
Observations	777	777	376
# buyers	75	75	50
Session dummies	Y	Y	Y
Model	Tobit	Probit	Linear
Clustered SE	N	Y	Y

Table 4 – RE-regressions with standard errors in parentheses. In model (2) and (3) robust standard errors (clustered by subject) are reported. The dependent variable in column (1) is the amount given for compensation, which is zero or positive whenever a subject bought a good. The dependent variable in column (2) is a dummy taking the value 1 when a subject, conditional on having bought the good, gave a positive amount to compensation. In column (3), the dependent variable is the amount given, when compensation was larger than zero. *** p=0.01, ** p=0.05, * p=0.1

the amount given when compensating. This can be interpreted as an income effect, where a lower price implies a larger gain to the buyer, which then leads to both a higher likelihood and a larger amount of compensation.

The fact that subjects in *DiffusedResponsibility* give lower amounts to compensation raises the question how the net externality that is created is affected. Since the points, which the two buyers in a matching group give to compensation, are added together to determine the reduction in the externality for the harmed party, the total effect of shared responsibility on the net externality created is ex-ante not clear. To evaluate the effects of the treatments on the net externality after compensation, we convert the average number of sliders the harmed parties have to solve into the ECU amount necessary to offset them. In order to compare independent observations, we then calculate the mean net externality in ECU on cohort level where a cohort is composed of all the buyers in the same treatment within a session. As can be seen in Table 5, diffusion of responsibility leads to a significantly larger net externality both without and with the possibility of

	Net externality (SD)		Wilcoxon signed-rank test
	<i>NoCompensation</i>	<i>Compensation</i>	
<i>NoDiffusion</i>	22.14 (4.33)	19.31 (3.86)	0.022
<i>DiffusedHarm</i>	25.00 (3.84)	20.22 (2.00)	0.046
<i>DiffResponsibility</i>	29.03 (0.82)	23.78 (2.89)	0.028
Mann-Whitney U tests			
<i>DiffusedHarm</i>	0.196	0.721	
<i>DiffResponsibility</i>	0.012	0.046	

Table 5 – Cohort means of net externality (after compensation) in ECU equivalents by treatment, standard deviation in parentheses. The bottom two rows give the p-values of Mann-Whitney U tests, comparing net externalities in *NoDiffusion* with the respective treatments. The last column reports p-values of a Wilcoxon signed-rank test comparing net externalities between *NoCompensation* and *Compensation* for each treatment.

compensation ($p = 0.012$, and $p = 0.046$ respectively, cohort level Mann-Whitney U test) relative to the *NoDiffusion* treatment.

What is, however, also noteworthy from the descriptive results is that the introduction of compensation reduces the externality created substantially and significantly in all treatments. In *DiffusedHarm*, this effect is the strongest, reducing the externality by 19% ($p = 0.046$, cohort level Wilcoxon signed-rank test), while in *DiffusedResponsibility* the externality is reduced by 18% ($p = 0.028$), and in *NoDiffusion* the externality is reduced by 13% ($p = 0.022$). Yet, despite this non-negligible reduction, it is important to notice that in absolute terms, the externality remains at a high level. Across all treatments, two thirds or more of the maximum possible externality are still imposed on the harmed parties (64% in *NoDiffusion*, 67% in *DiffusedHarm* and finally, 79% in *DiffusedResponsibility*). Hence, the possibility to compensate on a voluntary basis does not remove the bulk of the negative externality in our setting.

Result 4

In all treatments, compensation significantly reduces the total externalities. DiffusedResponsibility leads to significantly higher externalities both without and with compensation.

The negative effect of *DiffusedResponsibility* can also be observed in parametric analyses. Table 6 reports the results of linear models with the mean net externality in ECU per cohort and round

	<i>NoCompensation</i>		<i>Compensation</i>	
	(1)	(2)	(3)	(4)
<i>DiffusedHarm</i>	3.164*	3.046**	1.708	1.686
	(1.626)	(1.538)	(1.253)	(1.250)
<i>DiffResponsibility</i>	6.195***	6.089***	4.416***	4.448***
	(1.313)	(1.168)	(1.095)	(1.116)
Price		-0.153***		-0.040*
		(0.035)		(0.020)
Round number		0.086		0.115
		(0.088)		(0.096)
Constant	23.547***	30.467***	19.866***	19.766***
	(1.069)	(2.096)	(1.197)	(2.249)
Observations	228	228	228	228
# cohorts	19	19	19	19
Session dummies	Y	Y	Y	Y
Model	Linear	Linear	Linear	Linear

Table 6 – RE- Regressions on cohort level with robust standard errors (clustered by cohort) in parentheses. A cohort is the group of subjects within a session who were assigned to the same treatment and who interacted with each other repeatedly. The dependent variable is the mean net externality (after compensation) in ECU that is created in a cohort in a given round. *** p=0.01, ** p=0.05, * p=0.1

including random effects on the cohort level. Models 1 and 2 (3 and 4) refer to the first (second) part of the experiment. Across all models, we find that the net externality in *DiffusedResponsibility* is larger than in *NoDiffusion* which is consistent with the previous results. Moreover, when controlling for differences in prices (Models 2 and 4), it is interesting to see that the overall effect of prices on the net externality is negative in our setting. Given the previous analyses, the effect of prices is unclear ex-ante: While fewer goods are bought at higher prices (reducing the externality), higher prices also reduce both the likelihood and the amount of compensation conditional on buying (increasing the externality). The analysis in Table 6 suggests that the effect of prices is stronger for the propensity to buy, leading to an overall negative effect of prices for the creation of the externality in our setting.

Finally, we try to disentangle what drives the effect of *DiffusedResponsibility* on the net externality. As we have seen in our previous analysis, buyers on average compensated lower amounts. At the same time, given our implementation rule in this treatment, the net externality is not purely determined by compensation behavior. Rather, the fact that the externality is created whenever at least one of the buyers buys the good already mechanically leads to a larger probability of the

externality being created in the first place.¹³ This can also be seen in the data: While the externality is created in the *NoDiffusion* treatment in 74% (81%) of the cases in the part without (with) compensation, this share accounts for 97% in *DiffusedResponsibility* in both parts taking cohort level averages. These differences are also statistically significant ($p = 0.012$ in part 1, $p = 0.002$ in part 2, cohort-level Mann-Whitney U test). To see whether the reduction in the amount individuals gave to compensation in the *DiffusedResponsibility* condition also (partially) drives the result of the larger net externality, we look at the amount of compensation that was received by a given harmed player in *NoDiffusion* and *DiffusedResponsibility*. Using a cohort-level Mann-Whitney U test, we fail to find a significant difference between the amount of compensation that is received by a given harmed person ($p = 0.886$; 6.22 ECU on average in *NoDiffusion* and 5.48 ECU in *DiffusedResponsibility*). Hence, it seems that the individual reductions in compensation level out such that the overall compensation received by the harmed person is similar to the *NoDiffusion* treatment.

5 Conclusion

We conduct a laboratory experiment to test the effect of reduced tangibility of consumption externalities on voluntary compensation. We find that diffused responsibility significantly reduces the amount given to compensation. This result may in principle be driven either by beliefs about the level of the other buyer’s compensation or by feelings of shared guilt in the sense that buyers might feel less guilty for having created the negative externality if they believe their buying decision was not pivotal. Interpreting our results in the light of the existing literature suggests that beliefs about not being pivotal seem to be the more important driver to explain behavioral responses to diffused responsibility (Falk et al., 2020). In particular, Falk et al. (2020) show that subjects fail to have correct beliefs about pivotality even when being incentivized to be correct. If wrong beliefs about pivotality drive the reduction of compensation also in our experiment, the specific design of the diffusion of responsibility treatment would likely constitute a lower bound of the effect compared to real-world settings. In our experiment, any buyer knows with how many other buyers she is matched. In real-world interactions, not knowing the number of decision-makers with whom

¹³Even when assuming that there are no treatment differences in the propensity to buy, it is still more likely in *DiffusedResponsibility* that the externality is created. To see this note that $Pr(\text{externality created}) = Pr(\text{at least one player buys}) = 1 - Pr(\text{no player buys}) = 1 - (1 - Pr(\text{buying}))^2 \geq Pr(\text{buying})$.

responsibility is shared creates additional uncertainty and scope for moral wiggle room, which in turn might drive down compensation levels further.

Contrary to our initial hypothesis, we do not find a significant effect of diffused harm – neither on the propensity to buy nor on compensation behavior relative to the control condition. A speculative interpretation is that buyers in our setting focus on the total damage (which is the same as in the *NoDiffusion* condition), rather than the per capita damage that their behavior creates. Another reason might be that the harm in our experiment is not diffused enough to induce “compassion fade”. Still, our findings are in line with the results of Bartling et al. (2019b) who find only weak evidence for diffusion of harm on the market share of a good without an externality.

Our finding that buyers voluntarily compensate in all treatments suggests that compensation tools can be an effective tool to reduce negative consumption externalities. However, the fact that the net externality after compensation is still substantial in all treatments (between 64% and 79% of the maximum possible externality) indicates that it may not be enough to rely on voluntary compensation only to internalize negative externalities. This finding parallels results from the field showing that the willingness of customers to compensate their carbon footprints seems to be relatively low (Kesternich et al., 2016, 2019). It is furthermore in line with the results from Kuhn and Uler (2019), who find that although there is positive demand for compensation in their experiment, it is inefficiently low as subjects free ride extensively.

One limitation of our study is that subjects first experience the externality themselves. While this is important in order to have control over subjects’ beliefs about the severity of the externality, it takes away the mechanism of plausible deniability of not knowing how the externality affects others. In reality, this could play an important role in driving compensation levels down (Dana et al., 2007). Finally, our experimental design rules out that consumption might hurt also the decision-maker. Many environmental externalities related to consumption decisions (such as environmental pollution and global warming) not only affect third parties, but in the end also impose harm on consumers. This might obviously influence the decision to reduce the externality and motivate lower consumption and higher compensation. Therefore, an interesting question for further research would be to explore the determinants of the willingness to reduce harm from consumption when the consumer has a (partial) self-interest in the reduction.

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Appendix A. Experimental Instructions

Below we include the full experimental instructions for the treatment condition *NoDiffusion*. Instructions for the other treatments were formulated in a similar way. We handed out the different parts of the instructions only once they were relevant.

General Instructions

Welcome to this experiment! In this experiment, you can earn money depending on the choices that are made by you and/or the other participants during the experiment. Therefore, please read the instructions carefully to make sure that you understand what decisions you can take and what the consequences of these decisions are. Your decisions during the experiment are entirely anonymous. If you have any questions about the instructions or during the experiment, please raise your hand and the experimenter will come to you to answer your question in private.

During the study, you are not allowed to talk to the other participants. Please also respect that no drinks or food are allowed inside the lab. Please switch off your mobile phone now.

Throughout the experiment, we will not talk of Euros but instead of points, you can earn. This means that your entire earnings will be, at first, calculated in points. At the end of the experiment, we will calculate your earnings in Euros, according to the following exchange rate

10 points = 2,50 Euro.

The experiment consists of three parts. The first part consists of one work task, which is followed by four rounds of a decision task. The second and third part then consist of twelve rounds each. In each of these rounds, you will face one decision task. At the end of the experiment, one of these 28 rounds (4 rounds from part 1 + 12 rounds from part 2 + 12 rounds from part 3) will be randomly selected, with each round being equally likely. The points resulting from the choices of the participants in this randomly selected round will be converted to Euro and paid out to you. No other participant will be informed about what you earn.

In the following, you find the instructions for the working task of the first part of the experiment. At the end of the work task, we will distribute the instructions for the decision task of part 1. The instructions for the second part of the experiment will be distributed after the end of the first part. At the end of the second part of the experiment, you will receive the instructions for the third part.

If you have understood this part of the instructions, please go on to the next page to read the instructions for the work task of part 1.

Instructions Part 1

The work task

The work task you have to solve is called slider task. In the slider task, a set of sliders is presented on your screen. You can adjust the slider to any number between 0 and 100 by clicking on the slider with your mouse and dragging it to the desired position. Your task is to drag the slider to the target position. The target position for each slider is the number 50. The red number on the right hand side of the slider tells you the current position of your slider. A slider is correctly adjusted when the current position is equal to 50.



Figure 1 Two example sliders

For example, in the upper slider, the current position of the slider is 27. The slider is therefore not correctly placed yet. In the second example, you can see that the slider is correctly placed, as the position of the slider is directly at the target position. All sliders you have to solve will be displayed on one screen.

In the first part of the experiment, we ask you to solve 120 sliders to proceed to the next part of the experiment. You receive an initial payment of 100 points for working on the task.

Depending on the decisions you make in the four rounds of the decision task, your payment for part 1 of the experiment might differ from these 100 points, as will be explained after you have finished the slider task.

Do you still have any questions? If so, please raise your hand. We will then come to your seat to answer your question in private. If all the instructions are clear, please wait until we give you the password, which allows you to proceed.

Instructions Part 1

The decision task

Your initial payment for working on the slider task is 100 points.

In four rounds, we ask you now to state **the maximum number of points (between 0 points and 100 points) you are willing to pay** in order to avoid that you have to solve even more sliders at the end of the experiment.

In each round, a number X between 0 and 100 is drawn at random for each participant. Each number is equally likely to be drawn.

- If the number of points you stated is **greater than or equal to this randomly drawn number X , then you will pay X points**. In this case, you will not have to solve extra sliders at the end of the experiment. Instead, if the particular round is selected, we will give you your payoff for this round and you can leave the laboratory early. Your payoff for the round will then be:

$$100 \text{ points} - X \text{ points}$$

- If the number of points you stated is **smaller than this randomly drawn number X , then you will keep the full 100 points from the working task**. However, you will then have to solve extra sliders at the end of the experiment, if the particular round is selected. Your payoff for the round will then be:

$$100 \text{ points}$$

Thus, the higher your answer in a given round, the lower the probability that you will have to solve additional sliders at the end of the experiment.

- In the first round, we ask for the maximum number of points you are willing to pay to avoid 60 more sliders.
- In the second round, we ask for the maximum number of points you are willing to pay to avoid 120 more sliders.
- In the third round, we ask for the maximum number of points you are willing to pay to avoid 180 more sliders.
- Finally, in the fourth round, we ask for the maximum number of points you are willing to pay to avoid 240 more sliders.

Note that your answer in a given round must be at least as high as or higher than the number, you stated in the round before.

Do you still have any questions? If so, please raise your hand. We will then come to your seat to answer your question in private. If all the instructions are clear, please wait until we give you the password, which allows you to proceed.

Instructions Part 2

There are two types of participants in part 2: Person A and Person B. The roles of Person A and Person B will be randomly assigned prior to the start of this part of the experiment. Each participant will keep her role throughout the second part.

Person A acts in the role of a buyer. Person B does not make a decision herself but can be affected by the buying decision of Person A.

Part 2 comprises 12 rounds. In every round, one Person A will be randomly matched with one Person B. It is ensured that the same Person As and Person Bs will never interact with each other in two consecutive rounds.

The decision task

Person A's decision

In each round, Person A and Person B are endowed with 75 points. Person A must then decide whether or not she wants to buy a fictitious product. Getting the product is worth 100 points to Person A. This means that when Person A decides to buy the product, she will receive an additional 100 points.

If Person A decides to buy the product, she has to pay the price for the product. The price is randomly determined in every round and can range between 1 and 100 points. Every price is equally likely.

If Person A decides to buy the product, this has consequences for the Person B she is matched with. If Person A buys the product, Person B will have to work on a task: At the very end of the experiment, after Person A has received her payoff for the experiment and left the laboratory, Person B will have to stay longer in the laboratory and solve altogether 240 sliders of the slider task in order to receive her payoff. The slider task will work exactly like in the first part of the experiment.

If, on the other hand, Person A decides not to buy the product, both Person A and Person B will keep their 75 points endowment, and Person B does not have to work on the slider task at the end of the experiment.

Payoffs

The payoffs in points in each round are determined as follows:

Person A's payoff:

If Person A decides to buy the product,

- Person A will get the 75 points she was endowed with. Additionally, she will get the 100 points the product is worth to her and pay the price of the product. Hence, Person A's payoff is

$$75 + 100 - \text{price}$$

If Person A decides not to buy the product,

- Person A will get the 75 points she was endowed with.

Person B's payoff:

If Person A decides to buy the product,

- Person B will get the 75 points endowment only if she solves 240 sliders in the slider task at the end of the experiment, after Person A has left the laboratory. If she does not solve 240 sliders in the slider task, she will not get any payoff.

If Person A decides not to buy the product,

- Person B will get the 75 points she was endowed with.

Once Person A has made her choice, a round ends and Person B is informed of the choice of Person A in the current round. After that, Person A is matched to a different Person B and the next round starts.

At the end of the experiment, we will start with the payment of those participants who do not have to solve any sliders. Every participant who has received her payment can leave the laboratory. Participants, who have to solve sliders, will work on the task and be paid afterwards.

Illustrative Example 1

Suppose the price of the product is 30 points in a given round. Person A decides to buy the product for the current price of 30 points. The final payoff in this round for Person A is therefore 145 points (= 75 points endowment + 100 points value of the good - 30 points price of the good). The final payoff in this round for Person B is 75 points. Additionally, Person B has to solve 240 sliders in the slider task at the end of the experiment to receive her payoff.

Illustrative Example 2

Assume now that the price of the product is 57 points in a given round. Person A decides not to buy the product. The final payoff in this round for Person A is therefore 75 points (= endowment). Person B's final payoff will be 75 points and she does not have to solve any sliders at the end of the experiment.

Do you still have any questions? If so, please raise your hand. We will then come to your seat to answer your question in private. If all the instructions are clear, please wait until we give you the password, which allows you to proceed with a few comprehension questions on the screen.

Instructions Part 3

Part 3 comprises 12 rounds. You keep the role you were assigned in part 2 (Person A or Person B) also in this part.

In every round, one Person A will be randomly matched with one Person B. It is ensured that the same Person As and Person Bs will never interact with each other in two consecutive rounds.

The decision task

In this part of the experiment, the decision task consists of two stages. The first stage is the same as the decision task in part 2. In this part of the experiment, however, there will be a second stage if Person A decides to buy the product in the first stage.

Person A's decision

Stage 1

As in part 2, Person A and Person B will be endowed with 75 points in each round. Person A must then decide whether or not she wants to buy a fictitious product. Getting the product is, again, worth 100 points to Person A. This means that when Person A decides to buy the product, she will receive an additional 100 points.

If Person A decides to buy the product, she has to pay the price for the product. The price is randomly determined in every round and can range between 1 and 100 points. Every price is equally likely.

As in part 2, if Person A decides to buy the product, this has consequences for the Person B she is matched with. If Person A buys the product, Person B will have to work on a task: At the very end of the experiment, after Person A has received her payoff for the experiment and left the laboratory, Person B will have to stay longer in the laboratory and solve altogether 240 sliders of the slider task in order to receive her payoff.

If, on the other hand, Person A decides not to buy the product, both Person A and Person B will get their 75 points endowment, and Person B does not have to work on the slider task at the end of the experiment.

Stage 2

If Person A decided to buy the good in stage 1, she enters stage 2. In stage 2, Person A can decide to use points of her payoff to reduce the number of sliders Person B has solve at the end of the experiment. Specifically, for each point Person A spends, Person B has to solve 8 fewer sliders.

Payoffs

The final payoff in one round depends on Person A's choice in stage 1 and stage 2. The payoffs in points in each round are determined as follows:

Person A's payoff:

If Person A decides to buy the product,

- Person A will get the 75 points she was endowed with. Additionally, she will get the 100 points the product is worth to her and pay the price of the product. Moreover, she has to pay the points she decided to spend in order to reduce the number of sliders for Person B. Hence, Person A's payoff is

$$75 + 100 - \text{price} - \text{points spent to reduce number of sliders for Person B}$$

If Person A decides not to buy the product,

- Person A will get the 75 points she was endowed with.

Person B's payoff:

If Person A decides to buy the product,

- Person B will get the 75 points endowment only if she solves

$$(240 - 8 \times \text{points spent by Person A})$$

sliders in the slider task at the end of the experiment, after Person A has left the laboratory. If she does not solve the sliders in the slider task, she will not get any payoff.

If Person A decides not to buy the product,

- Person B will get the 75 points she was endowed with.

Once Person A has made her choice, a round ends and Person B is informed of the choice of Person A in the current round. After that, Person A is matched to a different Person B and the next round starts.

At the end of the experiment, we will start with the payment of those participants who do not have to solve any sliders. Every participant who has received her payment can leave the laboratory. Participants, who have to solve sliders, will work on the task and be paid afterwards.

Illustrative Example 1

Suppose the price of the product is 10 points in a given round. Person A decides to buy the product, which gives her a payoff of 165 points (= 75 points endowment + 100 points value of the product - 10 points price of the product). Since Person A bought the product, Person B will have to solve 240 sliders in the slider task at the end of the experiment to receive her payoff.

Person A decides to use 10 points of her payoff to reduce the number of sliders by 80 sliders (= 8 sliders per point x 10 points). Instead of 240 sliders, Person B therefore has to solve 160 sliders (= 240 sliders - 80 sliders) at the end of the experiment in order to get a payoff of 75 points. Person A's final payoff in this round is thus 155 points (= 165 points from stage 1 - 10 points from stage 2).

Illustrative Example 2

Suppose now the price of the product is 50 points in a given round. Person A decides to buy the good, which gives her a payoff of 125 points (= 75 points endowment + 100 points value of the product - 50 points price of the product). Therefore, Person B will have to solve 240 sliders at the end of the experiment to receive her payoff.

Suppose now that in stage 2, Person A decides to use 30 points of her payoff to reduce the number of sliders by 240 sliders (= 8 sliders per point x 30 points). Instead of 240 sliders, Person B therefore has to solve no sliders (= 240 sliders - 240 sliders) at the end of the experiment to get a payoff of 75 points. Person A's final payoff in this round will be 95 points (= 125 points from stage 1 - 30 points from stage 2).

Illustrative Example 3

Suppose now the price of the product is 23 points in a given round. Person A decides to buy the good, which gives her a payoff of 152 points (= 75 points endowment + 100 points value of the product - 23 points price of the product). Therefore, Person B will have to solve 240 sliders at the end of the experiment to receive her payoff.

Suppose now that in stage 2, Person A decides not to use any points of her payoff to reduce the number of sliders for Person B. Therefore, Person B has to solve the full 240 sliders at the end of the experiment to get a payoff of 75 points. Person A's final payoff in this round will be 152 points (= 152 points from stage 1 - 0 points from stage 2).

Do you still have any questions? If so, please raise your hand. We will then come to your seat to answer your question in private. If all the instructions are clear, please wait until we give you the password, which allows you to proceed with a few comprehension questions on the screen.