Does Guilt Motivate Prosocial Behavior at the Expense of Others? Preregistered Replications and Exploratory Statistical Modeling

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Abstract

Guilt is recognized as a social and moral emotion that drives prosocial behavior, typically through actions to repair relationships with victims, often at a personal cost. Prior research has yielded mixed results regarding compensatory behavior: In some instances, guilt prompted individuals to redirect resources away from unrelated others (observed in the Netherlands) or from themselves (observed in Romania and Japan) to compensate the victim. This study aimed to address these inconsistencies through two preregistered replication experiments, examining the role of relational mobility as a potential moderating factor across different cultural contexts. Contrary to initial findings, our results from Experiment 1 in Japan (n = 254), Experiment 2 in Japan and the Netherlands (n = 263 and 300, respectively), and an exploratory statistical modeling revealed a consistent pattern where guilt led to compensation directed at the victim, sacrificing own resources, irrespective of the country or levels of perceived relational mobility.

Keywords: Guilt, Prosocial Behavior, Compensatory Behavior, Relational Mobility, Statistical Modeling

Introduction

Maintaining positive relationships with social partners confers adaptive benefits; however, inadvertent errors occasionally exacerbate these relationships. Consider the scenario (Cryder et al., 2012) where you stay up late watching a movie and oversleep, missing a crucial meeting. This incident forces your team members to manage your responsibilities hastily in your absence. Individuals are compelled to seek reconciliation, often through apologies, because deteriorating a relationship is maladaptive. Notably, apologies that incur a personal cost (e.g., canceling personal plans to make an immediate apology or compensating for the loss) significantly enhance the likelihood of forgiveness from victims (Ohtsubo & Yagi, 2015; Watanabe & Ohtsubo, 2012).

Guilt, a complex social and moral emotion triggered by the realization of causing harm to another (Baumeister et al., 1994), motivates a range of prosocial behaviors aimed at amending the inflicted damage through personal sacrifices. Reflecting on the hypothetical scenario above (Cryder et al., 2012), individuals experiencing guilt tended to increase financial expenditures on behalf of the aggrieved parties. Furthermore, when individuals acknowledged their faults, they were ready to endure harsher penalties to salvage their relationships (Yu et al., 2014). The inclination towards cooperative behavior, motivated by guilt, was evident in contexts such as the prisoner's dilemma and the ultimatum game, findings that were corroborated by subsequent studies (De Hooge et al., 2007; Ketelaar & Au, 2003). Notably, De Hooge et al. (2007) discerned that shame, another moral emotion, did not elicit the same prosocial responses as guilt. In sum, guilt uniquely sustains interpersonal relationships by promoting compensatory actions toward the victims.

Conversely, De Hooge et al. (2011) investigated the "dark side" of guilt and demonstrated how it can precipitate adverse effects on third parties. Their innovative approach utilized a modified version of the dyadic dictator game, incorporating three players to mirror the complexities of real-world social networks encompassing friends, colleagues, and neighbors. This adaptation is critical for understanding how guilt influences behaviors towards a single individual and across an individual's broader social network.

Compensation for wrongdoing usually incurs costs, such as financial or temporal resources, raising questions about the source of these compensatory resources. In dyadic interactions, it is customary for the transgressor to bear these costs personally (e.g., De Hooge et al., 2007; Ketelaar & Au, 2003). However, in three-person scenarios, the transgressor is presented with a dilemma: to compensate at their expense or redirect resources from an uninvolved third party. De Hooge et al. (2011) revealed in a Dutch sample that individuals feeling guilty opted to compensate the victim by reallocating resources from a non-victimized third party rather than from themselves. This series of experiments highlighted guilt's "dark side," in which compensatory resources were taken at the expense of others. De Hooge et al. (2011) rationalized that guilt drives transgressors to focus their attention and resources on the victim. This focused attention, stemming from limited cognitive capacity, inadvertently diminishes regard for the well-being of other social partners, leading to a biased allocation of resources favoring the victim over others.

If there are adverse consequences of guilt, acknowledging them becomes crucial from a practical and theoretical standpoint. Practically, as De Hooge (2012a) highlighted, guilt in transgressors could inadvertently harm other relationships by diminishing their contributions to individuals unrelated to the initial offense, such as colleagues. Theoretically, this phenomenon prompts a reevaluation of guilt within moral emotions, especially if its inclination to repair a

specific relationship potentially damages another (De Hooge et al., 2011). Moreover, the theoretical significance extends to analyzing behavior in triadic contexts. If guilt prompts more egocentric actions in three-person scenarios, it suggests that dyadic models, traditionally employed in previous studies, might overlook complex dynamics introduced by additional participants. Therefore, understanding guilt's implications for multiple relationships and underlying mechanisms is essential.

Regardless of these practical and theoretical implication, attempts to replicate De Hooge et al.'s (2011) Experiment 1 in various countries, including Romania (Rebega et al., 2014) and Japan (Furukawa et al., 2016), have not yield results supporting the so-called dark side of guilt. In these replication studies, half the participants were first made to feel guilty by reading a scenario in which a borrowed bicycle was stolen, eliciting guilt towards the bicycle's owner (the victim). All the participants then read a situation requiring them to allocate a fixed budget (e.g., 50 euros) between buying birthday presents for the victim and another friend unrelated to the incident or themselves. Contrary to the findings of De Hooge et al. (2011), showing guilt led to preferential financial allocation to the victim at the expense of the other friend, studies in Romania and Japan showed that participants chose to reduce their allocation to compensate the victim, without reducing the allocation for the other friend.

How can we explain these cross-cultural differences? Furukawa et al. (2016), in their Experiment 2, explored the concept of relational mobility (Yuki et al., 2007; Yuki & Schug, 2012) as a potential moderating factor. Relational mobility, grounded in a socioecological framework, examines the interplay between socioecological environments and behavior (Oishi & Graham, 2010; Yuki & Schug, 2012). It measures individuals' societal or contextual freedom to form new relationships independently in a given society or social context (Thomson et al., 2018; Yuki et al., 2007; Yuki & Schug, 2012). Relational mobility has been linked to various psychological and behavioral tendencies. For instance, lower relational mobility is associated with reduced generalized trust (Yuki et al., 2007), increased sensitivity to rejection (Sato et al., 2014), decreased willingness to take risks in interpersonal situations (Li et al., 2016), and a greater reluctance to make sacrifices in moral dilemmas (Awad et al., 2020). Since lower relational mobility limits the selection of new social partners, individuals prioritize maintaining stable, long-term relationships with existing partners to avoid negative reputations and potential ostracization (Kito et al., 2017; Yuki & Schug, 2020).

Relational mobility significantly varies across countries (Salvador et al., 2020; Thomson et al., 2018), with the Netherlands exhibiting higher relational mobility than the global average, whereas Romania and Japan display lower levels. This variation led Furukawa et al. (2016) to hypothesize that the observed discrepancies in guilt's dark side among countries might align with the relative levels of relational mobility. Specifically, individuals in higher relational mobility environments, such as in the Netherlands, might behave similarly to the participants in De Hooge et al. (2011), whereas those in lower relational mobility contexts, like Romania and Japan, might act following the findings of Rebega et al. (2014) and Furukawa et al. (2016). De Hooge et al. (2011) assumed that guilt shifts the transgressor's focus solely to the victim, temporarily reducing their concern for other partners. Conversely, Furukawa et al. (2016) proposed that in societies with lower relational mobility, such as Japan, this dynamic is unlikely due to the limited opportunities for forming new social connections, necessitating the maintenance of good relationships with all partners, even under the social influence of guilt.

Based on this hypothesis, Furukawa et al. (2016) conducted a replication study in Japan to explore whether individual differences in relational mobility within a country correlate with

how guilt influences compensatory behavior towards the victim at the expense of the other partner or oneself. However, the role of relational mobility remained inconclusive due to two primary limitations: the reliance on exploratory analysis without subsequent verification with new data and, more importantly, the assumption that within-country variances imply inter-country differences. Given Japan's classification as a low relational mobility society (Salvador et al., 2020; Thomson et al., 2018), "relatively higher" levels of relational mobility within Japan might not be significant compared to the global average. Therefore, to ascertain whether relational mobility affects the source of compensation in a triadic context—either from the other partner, as suggested by De Hooge et al. (2011), or the transgressor, as observed by Furukawa et al. (2016) and Rebega et al. (2014)—a comparison between Japan and a country with higher relational mobility is warranted.

To address these limitations, the current study includes preregistered replications in Japan (Experiments 1 and 2) and the Netherlands (Experiment 2). Experiment 1 aimed to assess the reproducibility of Furukawa et al.'s (2016) findings in Japan, whereas Experiment 2 extended the investigation to both high (i.e., the Netherlands) and low (i.e., Japan) relational mobility countries, examining the compensatory behaviors of transgressors towards the victim.

Experiment 1

The first author conducted Experiment 1 alone. He conducted Experiment 1 to assess the replicability of Experiment 2 of Furukawa et al. (2016) which replicated the earlier research. Given its nature as a direct replication, he adhered to the hypotheses posited by Furukawa et al. (2016), predicting that guilt-induced participants in Japan prefer to incur costs to themselves rather than to another partner. Furthermore, he examined the interaction between guilt induction and relational mobility on compensatory behavior.

Experiment 1 implemented more rigorous data exclusion criteria than its predecessor to ensure the collection of high-quality data. Both this experiment and Experiment 2 of Furukawa et al. (2016) were conducted online; however, the latter did not eliminate data from participants who may have exerted minimal effort—a phenomenon known as survey satisficing. Survey satisficing can lead to data quality issues, as shown by Miura and Kobayashi (2019), where data from participants who skipped reading instructions did not align with theoretical expectations, unlike data from attentive respondents. Experiment 1 employed two strategies to identify and exclude satisficed responses to mitigate this issue. The Directed Questions Scale (DQS; Maniaci & Rogge, 2014), which asks respondents to select a specific response (e.g., "Please select 2 for this question"), served as one method. Additionally, memory tests were included to screen out participants who may not have thoroughly read scenario descriptions.

The ethics committee affiliated with the first author's institution approved Experiment 1 (Approval Number: 2020-2). The study was preregistered at https://osf.io/zsmq9. We report all manipulations, measures, and exclusions in this study.

Method

Supplementary materials

All relevant data, along with supplementary materials such as scenarios, analysis scripts and outputs, are publicly accessible at https://osf.io/f2xsz/?view_only=bc647ea939b54160baea22974678858f.

Experimental Design

Experiment 1 utilized a between-participants design with one factor: condition (control vs. guilt). Participants were randomly assigned to either the control condition, where no guilt was induced, or the guilt condition, where they were presented with a scenario designed to elicit feelings of guilt.

Participants

Japanese individuals (n = 400) recruited through Cross Marketing Group, Inc. participated in Experiment 1. Experiment 1 was a replication of Furukawa et al. (2016). Therefore, the sample size rationale mirrored that of Furukawa et al. and aimed for at least the same number of participants (total n = 344; n = 246 in the primary analysis) to ensure replication validity. Anticipating the potential exclusion of data from satisficers, the sample size was maximized within the project's budget constraints because it was difficult to accurately predict the exact number of satisficers. The participants' mean ages were 35.37 (SD = 8.53, range = 20-49) in the control condition and 35.29 (SD = 8.29, range = 20-50) in the guilt condition, with an equivalent gender distribution across both groups. Satisficers, identified through non-adherence to the Directed Questions Scale (DQS) instructions, were excluded pre-emptively by the survey company.

Procedure and Materials

The materials were initially developed by De Hooge et al. (2011). It was later adapted by Furukawa et al. (2016) for cultural and linguistic appropriateness in Japanese. The first author employed the same material in this experiment without altering the content, only modifying verbal expressions for clarity.

Participants accessed the survey via personal devices, such as their PCs or smartphones, and were restricted from revisiting previous pages throughout the questionnaire. After consenting to participate in the study and providing demographic information, including their age and gender, the participants read a scenario where they borrowed a bicycle from a friend ("Friend A") for shopping. The questionnaire’s instructions emphasized careful reading and memorization for subsequent memory testing, with critical information highlighted in bold and underlined.

Scenario outcomes varied by condition: in the control condition, the bicycle was returned without incident, whereas in the guilt condition, it was stolen due to the participant's negligence (failure to lock it). Notably, unlike the original study by De Hooge et al. (2011), which included a victim condition, this study and Furukawa et al. (2016) experiment excluded the victim condition based on Rebega et al. (2014) findings that control and victim conditions elicited similar responses.

After reading the scenarios relevant to them, the participants assessed their emotional responses for the ten items relating to guilt, shame, humiliation, and joy using a seven-point scale

ranging between 1 (*not at all*) to 7 (*very strongly*). Joy was included as a filler. These items, randomized in order (see Appendix A), aimed to validate the effectiveness of emotional manipulation. The first author adopted this approach from Furukawa et al. (2016) to enhance the construct validity by assessing primary emotions with multiple items. The approach differs from De Hooge et al. (2011), who measured eight emotions using a single item for assessing each emotion.

Following the initial scenario, all participants encountered a situation in which they were tasked with purchasing birthday gifts for two friends: the friend who lent them the bicycle ("Friend A," henceforth referred to as the "victim") and another friend unrelated to the incident ("Friend B," after this termed "the other partner"). This study anonymized the friends' names to ensure neutrality and avoid influencing participants by the effect of names, unlike in De Hooge et al. (2011), in which the friends were named Jim and Michael. Participants were informed that the victim and the other partner were not acquainted.

The allocation task required participants to distribute 10,000 yen (approximately 70-80 euros at the time of the study) among the victim, the other partner, and themselves. This budget was chosen to accommodate the more comprehensive age range of participants (20-49 years) compared to the original study's university student demographic. Furukawa et al. (2016) conducted two experiments that demonstrated guilt's effect on monetary distribution was consistent across different target ages and budgets. In their studies, guilt-induced participants consistently allocated more funds to the victim and less to themselves without reducing the other partner's share, using a 5,000 yen budget (with university students in Study 1) and a 10,000 yen budget (with participants having a mean age of 40.70 years in Study 2).

Participants then completed the Relational Mobility Scale (Thomson et al., 2018; Yuki et al., 2007), comprising 12 items, such as "They [the people around you] have many chances to get to know other people," rated on a six-point scale from 1 (*not at all*) to 6 (*very strongly*). A single-item directed questions scale (DQS) was embedded within this scale to assess attentiveness by instructing participants to select a specific response ("Please select 2 for this question").

For exploratory purposes, four additional questions were included: three related to the participants' subjective socioeconomic status and one regarding the average amount they typically spend on gifts for friends in their daily lives. Lastly, participants completed three memory tests to ensure engagement and comprehension of the scenarios. These tests queried details about the shopping trip: (1) the mode of transportation to the shop, (2) their success in purchasing desired items, and (3) events after leaving the shop. For further details, refer to Appendix B.

Results

R version 4.1.1 was used for all analyses (R Core Team, 2021). Cronbach's alpha (α) was calculated using the psych package (version 2.1.9; Revelle, 2021) to evaluate internal consistency of scales. Hedges' *g* was employed to estimate effect sizes using the effsize package (version 0.8.1; Torchiano, 2020).

Excluding Participants Who Failed Memory Tests

The first author classified participants who failed to complete the three memory tests accurately, suggesting they might not have carefully read and memorized the scenario instructions, as satisficers. Of the 400 participants who passed the DQS instruction, 254 qualified

for analysis. In the control condition (n = 123), participants had an average age of 35.01 (SD = 8.56), with 52.85% female. In the guilt condition (n = 131), the average age was 35.69 (SD = 8.25), with 51.91% female. Eventually, the first author analyzed a similar number of participants as in the study by Furukawa et al. (2016).

Manipulation Check

In line with prior studies (De Hooge et al., 2011; Furukawa et al., 2016; Rebega et al., 2014), the first author compared self-reported emotions to verify the successful manipulation of guilt. Figure 1 shows that guilt levels were significantly higher in the guilt condition (Cronbach's α = .85; M = 6.14, SD = 1.04) compared to the control condition (M = 3.14, SD = 1.52), t(214.57) = 18.22, p < .001, Hedges' g = 2.31, 95% CI [1.99, 2.62]. In the guilt condition, participants reported significantly stronger guilt than shame (Cronbach's α = .88; M = 4.48, SD = 1.67), t(130) = 11.60, p < .001, Hedges' g = 1.16, 95% CI [0.90, 1.41], or humiliation (Cronbach's α = .85; M = 3.79, SD = 1.61), t(130) = 15.15, p < .001, Hedges' g = 1.71, 95% CI [1.36, 2.06]. These outcomes confirm that the manipulation of guilt was effective. Note that directly comparing different psychological constructs, such as guilt, with other emotions is generally inadvisable. Nevertheless, this method follows the procedure used in the original study by De Hooge et al. (2011) and maintains consistency with their experimental design.

Figure 1

Money Allocation Task

Figure 2 illustrates the monetary amounts participants allocated to each target: the victim, the other partner, and themselves. We conducted multiple regression analyses to assess the impact of guilt and relational mobility on the allocation amounts. The dependent variable was the money allocated to each target, while the independent variables included condition (coded as 0 for the control condition and 1 for the guilt condition), relational mobility (Cronbach's α = .75; M = 3.58, SD = 0.63), and their interaction. All independent variables were centered before analysis.

Table 1 presents the regression analysis results. Participants in the guilt condition allocated significantly more money to the victim (M = 5384.71, SD = 1925.42) than those in the control condition (M = 3612.20, SD = 1531.77). Allocations to the other partner were almost similar between the conditions of guilt (M = 2842.77, SD = 1278.23) and control (M = 2726.83, SD = 1096.27). Participants reserved less money for themselves in the guilt condition (M = 1772.52, SD = 1873.79) than in the control condition (M = 3660.98, SD = 2357.85). Relational mobility had neither a main effect nor an interaction effect for each target (for the visualized interaction effect, see supplementary material).

Figure 2

Table 1

Discussion

The aim of Experiment 1 was to assess the replicability of findings from Experiment 2 in Furukawa et al. (2016), itself a replication of De Hooge et al.'s (2011) Experiment 1. The results indicate the absence of a dark side to guilt within the Japanese context. Specifically, guilt prompted individuals to compensate the victim by diminishing their resources instead of reallocating them from an uninvolved other partner. This finding aligns with previous observations in Japan (Furukawa et al., 2016) and Romania (Rebega et al., 2014) yet diverges from the initial findings in the Netherlands (De Hooge et al., 2011). Moreover, unlike the exploratory analysis by Furukawa et al. (2016), this experiment found minimal evidence to suggest that relational mobility influences guilt-driven compensatory behaviors. Adopting more stringent criteria for data exclusion in this study casts doubt on the significance of relational mobility in moderating guilt-motivated compensation behaviors.

Nonetheless, this experiment encountered a limitation concerning the variability of relational mobility within Japan, which might be narrower than the variability observed between countries. Given that Japan is characterized by low relational mobility (Salvador et al., 2020; Thomson et al., 2018), the levels of relational mobility considered "relatively higher" within Japan may still fall short compared to the global average. Consequently, to ascertain whether relational mobility plays a decisive role in determining the source of compensatory resources in a triadic scenario—whether resources are diverted from an unrelated other partner, as suggested by De Hooge et al. (2011), or from the transgressor, as observed by Furukawa et al. (2016) and Rebega et al. (2014)—it becomes essential to conduct comparative analyses of Japan with societies exhibiting higher levels of relational mobility.

Experiment 2

In Experiment 2, we aimed to explore the moderating role of relational mobility on guilt-induced compensatory behaviors, specifically whether compensation occurs at the expense of an unrelated other partner or the transgressor themselves. This investigation was prompted by contrasting socioecological factors between low and high-relational mobility societies, with the Netherlands identified as a society of high relational mobility and Japan as one of low relational mobility (Salvador et al., 2020; Thomson et al., 2018). The rationale behind this experiment was to test the replicability of the divergent findings observed in previous studies: the dark side perspective noted in the Dutch context (De Hooge et al., 2011) and the self-sacrifice perspective observed in Japan (Furukawa et al., 2016; Experiment 1 of the present study). Thus, the initial step involved confirming these behaviors' reproducibility across the two contrasting cultural contexts.

To ensure a comprehensive evaluation, the first author invited the second and the last authors to participate in this project. Because the study was a replication, we hypothesized that it would reaffirm the outcomes of the previous experiments, specifically Experiment 1 of De Hooge et al. (2011) and Experiment 1 of the current study. In the Netherlands, we anticipated that guilt would prompt participants to preferentially compensate the victim at the expense of the other partner, replicating De Hooge et al.'s (2011) findings. Conversely, in Japan, we expected guilt to lead to self-sacrifice for the victim's benefit, mirroring the results of Experiment 1 of the

current study. Our investigation into relational mobility as a potential factor explaining the differences between countries was planned to follow the successful replication of these distinct compensatory behaviors in each societal context.

The ethics committees affiliated with the first author's institution approved Experiment 2 (approval number 2021-11). We preregistered the study at https://osf.io/hmurd. We report all manipulations, measures, and exclusions in this study.

Method

Supplementary materials

All relevant data, along with supplementary materials such as scenarios, analysis scripts and outputs, are publicly accessible at https://osf.io/f2xsz/?view_only=bc647ea939b54160baea22974678858f.

Experimental Design

Experiment 2 employed a 2x2 between-participants design, with guilt induction (control vs. guilt condition) and participant nationality (the Netherlands vs. Japan) as the two factors. Participants from each country were randomly allocated to one of guilt induction conditions.

Participants

A total of 800 individuals, evenly divided between the Netherlands and Japan (n = 400 each), participated in Experiment 2 via an online survey administered by Cross Marketing Group, Inc. The rationale for this sample size mirrored that of Experiment 1 to maintain consistency in statistical power. We ensured that none of the participants had been involved in Experiment 1. In the Netherlands, the mean age was 34.61 (SD = 8.56, range = 20-49) in the control condition and 34.76 (SD = 8.79, range = 20-50) in the guilt condition. In Japan, participants in the control condition had a mean age of 35.14 (SD = 8.37, range = 20-49), while those in the guilt condition had a mean age of 34.92 (SD = 8.25, range = 20-50). Gender distribution was nearly equal across all conditions in both countries. Notably, the survey company excluded satisficers—participants who failed to follow the DQS instructions—prior to data delivery.

Procedure and Materials

The procedure for Experiment 2 largely mirrored that of Experiment 1, with a few critical adjustments. Firstly, for participants in the Netherlands, the budget allocated for the money allocation task was set at 80 euros, equivalent to approximately 10,000 yen given to Japanese participants. This amount increased from the 50 euros in Experiment 1 by De Hooge et al. (2011). Despite this adjustment, we maintained the stance from Experiment 1 that the specific budget amount does not fundamentally alter the task outcomes.

Secondly, we administered memory tests immediately following the money allocation task to address a significant dropout observed in Experiment 1, where 146 participants failed to complete the memory tests. This dropout rate exceeded our expectations and was attributed to

placing the memory tests at the end of the questionnaire in Experiment 1, possibly extending the retention interval between information encoding and retrieval beyond the optimal length.

Lastly, we modified the exploratory questions included in the survey. We measured subjective socioeconomic status using the MacArthur Scale (Adler et al., 2000). Furthermore, instead of asking participants the average amount spent on gifts for friends, we introduced a moral disengagement scale (Moore et al., 2012). Including these measures was exploratory, and as such, their results are not discussed in the subsequent sections.

Results

We conducted all analyses using R version 4.1.1 (R Core Team, 2021). We assessed internal consistency using Cronbach's alpha (α), calculated with the psych package version 2.1.9 (Revelle, 2021). We determined the effect size using Hedges' *g*, which was calculated with the effsize package version 0.8.1 (Torchiano, 2020).

Excluding Memory Satisficers

Similar to Experiment 1, participants who inaccurately completed the three memory tests were classified as satisficers. In the Netherlands, of the 400 participants who passed the DQS instruction, 300 qualified to be included in the analysis. In the control condition (n = 143), the mean age was 35.27 (SD = 8.78), with 60.84% female participants. In the guilt condition (n = 157), the mean age was 35.34 (SD = 8.90), with 56.05% female participants.

Of the 400 participants passing the DQS instruction in Japan, 263 were considered valid to be included in the analysis. In the control condition (n = 135), the participants' mean age was 35.78 (SD = 8.47). Excluding two participants who did not report their gender, 67.67% were female. In the guilt condition (n = 128), the participants' mean age was 35.79 (SD = 8.24), with 67.19% female participants, again excluding two who omitted their gender information.

Manipulation Check

To verify the effective manipulation of guilt, we compared self-reported emotions. Figure 3 illustrates that in the Netherlands, guilt scores (Cronbach's α = .95) were significantly higher in the guilt condition (M = 6.44, SD = 1.08) than in the control condition (M = 2.28, SD = 1.42), $t(264) = 28.39$, $p < .001$, Hedges' g = 3.32, 95% CI [2.97, 3.67]. In this condition, participants reported significantly stronger guilt than shame (Cronbach's α = .96, M = 5.96, SD = 1.29), $t(156) = 6.45$, $p < .001$, Hedges' g = 0.39, 95% CI [0.26, 0.51], or humiliation (Cronbach's α = .85, M = 4.37, SD = 1.46), $t(156) = 17.25$, $p < .001$, Hedges' g = 1.59, 95% CI [1.32, 1.86], confirming the success of the manipulation.

Figure 3 indicates that in Japan, guilt scores (Cronbach's α = .86) were significantly elevated in the guilt condition (M = 6.20, SD = 1.05) compared to the control condition (M = 3.06, SD = 1.51), $t(240.1) = 19.67$, $p < .001$, Hedges' g = 2.40, 95% CI [2.08, 2.72]. Participants in the guilt condition also reported significantly higher guilt than shame (Cronbach's α = .90, M = 4.42, SD = 1.81), $t(127) = 11.35$, $p < .001$, Hedges' g = 1.16, 95% CI [0.90, 1.42], or humiliation (Cronbach's α = .88, M = 3.87, SD = 1.81), $t(127) = 13.72$, $p < .001$, Hedges' g = 1.54, 95% CI [1.22, 1.87], validating the manipulation. As reiterated from Experiment 1, directly comparing different psychological constructs is generally inadvisable. Nevertheless, this

approach was adopted to align with the methodology of the original work by De Hooge et al. (2011).

Figure 3

Money Allocation Task

Figures 4 and Table 2 illustrate the distribution of funds participants allocated to each target (victim, the other partner, and themselves) across the two countries. We conducted multiple regression analyses to identify inter-country differences in guilt-motivated compensation. We normalized the allocated amounts from 0 to 1 to accommodate the currency differences between the Netherlands and Japan. The dependent variable was the normalized amount allocated to each target, with condition (coded as 0 for the control condition and 1 for the guilt condition), country (coded as 0 for Japan and 1 for the Netherlands), and their interaction serving as the independent variables. We centered all independent variables prior to analysis.

Table 3 presents the regression analysis results. Participants in the guilt condition allocated more money for the victim than those in the control condition. However, when it came to their share, participants in the guilt condition reserved less for themselves than those in the control condition. The allocations for the other partner were unaffected by either condition or country, and we observed no significant interaction between condition and country.

Our preregistration stipulated that examining relational mobility's impact on resource allocation patterns would only proceed if we found notable inter-country differences. Since this condition was not met, we conducted an exploratory basis to assess the influence of relational mobility on the amounts allocated to each target (detailed in the supplementary material). The regression coefficients for relational mobility were nearly zero, indicating a negligible effect on the allocation decisions.

Figure 4

Table 2 and 3

Discussion

A key objective of Experiment 2 was to investigate the consistency of guilt-induced compensatory behaviors across different cultural contexts, explicitly comparing findings from the Netherlands (De Hooge et al., 2011) and Japan (Furukawa et al., 2016; Experiment 1 of the current study). Our findings reveal that irrespective of country, individuals motivated by guilt preferred compensating the victim at their own expense. This result supports the observation that the so-called dark side of guilt, where individuals redirect resources from unrelated other partners to the victim, does not manifest in Japan. Moreover, our findings challenge the results from De Hooge et al. (2011) in the Dutch context, showing no significant inter-country differences in guilt-motivated compensatory behavior, thereby diminishing the imperative to investigate the influence of relational mobility.

Exploratory Analysis

Statistical Modeling of Resource Allocation Behavior

Prior research offers two conflicting perspectives: the dark side model and the self-sacrifice model. The dark side model, outlined by De Hooge et al. (2011), suggests compensation is taken from other partners, whereas the self-sacrifice model, evidenced by the current study, posits that compensation comes from own resources. Our results predominantly support the latter. However, there are notable limitations to consider.

Firstly, our study aimed for methodological consistency with previous research (De Hooge et al., 2011; Furukawa et al., 2016) by pre-registering similar materials, procedures, and analytical approaches, including using multiple regression analysis akin to ANOVA. Nonetheless, the constraints of null hypothesis significance testing mean we cannot definitively confirm the absence of resource diversion from the self (dark side view) or other partners (self-sacrifice view) in resource allocation. Secondly, when performing ANOVA and regression analysis on the money allocation data, previous studies (De Hooge et al., 2011; Furukawa et al., 2016; Rebega et al., 2014) and our study did not account for the compositional nature of the data (Smithson & Broomell, 2022) and assumed that the allocation resources followed a normal distribution independently. However, these assumptions might be flawed. Since participants allocated a fixed amount (e.g., 80 euros) among three entities, allocating two determines the remaining amount for the third (i.e., violation of independence assumption). Besides, as Figures 2 and 4 indicate, resources allocated to oneself in the guilt condition heavily skewed (i.e., violation of normally distributed assumption).

To address these issues, we conducted exploratory statistical modeling through the third author's contribution. We designed models to describe potential strategies for resource allocation and estimated Bayes factor to identify which model was favored by data the most. The R and Stan codes for this analysis are available in the supplementary material.

Let a vector, $\boldsymbol{y_i} = (y_{i1}, y_{i2}, y_{i3})$ denote the ratio of allocated resources by participant i for the victim, the other partner, and the self, respectively, $(y_{ik} \in (0,1)\ and\ \sum_{k=1}^{3} y_{ik} = 1)$. For example, if a Dutch participant allocated 40 euros for the victim, y_{i1} was calculated as $y_{i1} = \frac{40}{80} = 0.5$. We modeled that in the control condition (condition 0), $\boldsymbol{y_i}$ would follow a Dirichlet distribution with parameters $\phi\boldsymbol{\mu}$ as

$$\boldsymbol{y_{0i}} \sim \text{Dirichlet}(\phi_0 \boldsymbol{\mu_0})$$
$$\boldsymbol{\mu_0^{(\cdot)}} = \left(\mu_{01}^{(\cdot)}, \mu_{02}^{(\cdot)}, \mu_{03}^{(\cdot)}\right)$$
$$\phi_0 \sim \text{Normal}^{+}(0, \sigma^2),$$

where $\boldsymbol{\mu}$ denotes a vector of inter-participant mean $(\mu_k \in (0,1)\ and\ \sum_{k=1}^{3} \mu_k = 1)$. $\phi > 0$ is a precision parameter in which larger ϕ indicates the smaller inter-participant variance of $\boldsymbol{y_i}$. ϕ was modeled to follow a half normal prior distribution with a mean parameter of 0 and variance parameter σ^2. To check the robustness of the model comparison, we set three variances ($\sigma^2 \in \{6.25, 25, 100\}$). $\boldsymbol{\mu}$ follows a uniform Dirichlet prior.

If the dark side view were true (Model 1), the model of the guilt condition (referred to as Condition 1) could be described as follows:

$$\boldsymbol{y_{1i}} \sim \text{Dirichlet}\left(\phi_1 \boldsymbol{\mu_1^{(1)}}\right)$$
$$\boldsymbol{\mu_1^{(1)}} = \left(\mu_{11}^{(1)}, \mu_{12}^{(1)}, \mu_{13}^{(1)}\right) = \left(\mu_{01}^{(1)} + \delta^{(1)}, \mu_{02}^{(1)} - \delta^{(1)}, \mu_{03}^{(1)}\right)$$

$$\delta^{(1)} \sim \text{Uniform}(0, \mu_{02}^{(1)})$$
$$\phi_1 \sim \text{Normal}^{+}(0, \sigma^2),$$

where δ is the ratio of diverted resources from someone to the victim. Model 1 describes that diverted resource for the victim (μ_{11}) was taken only from the other partner (μ_{12}) and never from the self (μ_{13}).

In contrast, if the self-sacrifice view were true (Model 2), δ is diverted as follows:

$$\boldsymbol{\mu_1^{(2)}} = \left(\mu_{11}^{(2)}, \mu_{12}^{(2)}, \mu_{13}^{(2)}\right) = \left(\mu_{01}^{(2)} + \delta^{(2)}, \mu_{02}^{(2)}, \mu_{03}^{(2)} - \delta^{(2)}\right)$$
$$\delta^{(2)} \sim \text{Uniform}\left(0, \mu_{03}^{(2)}\right).$$

The hybrid model (Model 3) assumes that increased allocation for the victim was taken from *both* the other partner and the self, as expressed by the following equation:

$$\boldsymbol{\mu_1^{(3)}} = \left(\mu_{11}^{(3)}, \mu_{12}^{(3)}, \mu_{13}^{(3)}\right) = \left(\mu_{01}^{(3)} + \delta_1^{(3)} + \delta_2^{(3)}, \mu_{02}^{(3)} - \delta_1^{(3)}, \mu_{03}^{(3)} - \delta_2^{(3)}\right),$$
$$\delta_1^{(3)} \sim \text{Uniform}\left(0, \mu_{02}^{(3)}\right),\ \delta_2^{(3)} \sim \text{Uniform}\left(0, \mu_{03}^{(3)}\right).$$

In addition to the three models described above, we also developed a null model (Model 4) and a saturated model (Model 5). Specific benchmarks are necessary because model comparison is a relative rather than an absolute evaluation method. Lee et al. (2019) proposed comparing interested models with *bookend models*: one end being a null model and the other a saturated model.

The null model (Model 4) assumes that guilt does not change resource allocation behavior as expressed by the following equation:

$$\boldsymbol{\mu_1^{(4)}} = \boldsymbol{\mu_0^{(4)}} = \left(\mu_{01}^{(4)}, \mu_{02}^{(4)}, \mu_{03}^{(4)}\right),$$

which is quite restrictive and thus under-fit the data (Lee et al., 2019). On the other hand, the saturated model (Model 5) simply declares that each condition has each of the following expected values:

$$\boldsymbol{\mu_0^{(5)}} = \left(\mu_{01}^{(5)}, \mu_{02}^{(5)}, \mu_{03}^{(5)}\right)$$
$$\boldsymbol{\mu_1^{(5)}} = \left(\mu_{11}^{(5)}, \mu_{12}^{(5)}, \mu_{13}^{(5)}\right),$$

which overfit the data (Lee et al., 2019). According to Lee et al., the models superior to bookend models (i.e., Model 4 and 5 here) can balance parsimony and goodness-of-fit.

As Figures 2 and 4 show, specific participants did not allocate any resource for the self, even though each element of the vector, $\boldsymbol{y_i} = (y_{i1}, y_{i2}, y_{i3})$ must be positive. One solution is to replace zero with a small value $\varepsilon > 0$ (Smithson & Broomell, 2022). Therefore, we replaced zero with $\varepsilon = 1$ (yen or euros). For example, if participant i allocated 80 euros as, $(50, 30, 0)$, we replaced this vector with, $(50, 30, 1)$. We calculated each element as, $\boldsymbol{y_i} = \frac{1}{(50+30+1)}(50, 30, 1) \cong (0.617, 0.370, 0.012)$.

We used R version 4.1.1 (R Core Team, 2021) and cmdstanr package version 0.7.0 (Gabry et al., 2023) for Bayesian estimation by Markov chain Monte Carlo methods (MCMC). We ran four chains to obtain 12,000 MCMC samples, respectively, and 2,000 samples from each chain were discarded in the warm-up period. We judged that the MCMC chains have converged, and a random number has been obtained from the posterior distribution because all the parameters satisfied, $\hat{R} \leq 1.10$. The log marginal likelihood of each model is shown in Table 4. A larger log marginal likelihood indicates a better fit between data and the model. Results

indicate that all data supported Model 2, indicating that transgressors used only their resources to compensate the victim.

When denoting, $\log\big(p(y|M_m)\big)$ as the log marginal likelihood of each model ($m = 1, 2, \ldots, 5$), $BF_{21} = \exp\big(\log\big(p(y|M_2)\big) - \log\big(p(y|M_1)\big)\big)$ indicates the Bayes factor (Model 2 over 1). According to the heuristic classification scheme for the Bayes factor (e.g., Stefan et al., 2019), there was robust evidence ($114.66 \leq BF_{21} \leq 1.82 \times 10^{12}$) for Model 2 (i.e., the self-sacrifice model) over Model 1 (i.e., the dark side model). Notably, the self-sacrifice model outperformed the null model (Bayes factors between 369.44 and 4.02×10^{12}) and was more strongly favored by the data than the saturated model (Bayes factors between 6.74 and 29.08). These results suggest that the self-sacrifice model balanced parsimony and goodness-of-fit (Lee et al., 2019).

As highlighted previously, one significant benefit of our model-based approach is comparing models that propose compensation directly from a single source (Models 1 and 2) with one suggesting a mixed strategy (Model 3). The data relatively favored Model 2 over Model 3, but the evidence for the self-sacrifice model was almost on par with that for the hybrid model ($1.05 \leq BF_{23} \leq 9.61$). Due to the fact that the self-sacrifice model best explains the data among the five models, we lean towards the self-sacrifice perspective that guilt motivates compensation primarily through one's resources and uphold the view of guilt as a fundamentally moral emotion. However, currently we do not dismiss the possibility that transgressors might sometimes allocate resources from other partners.

Table 4

Manipulation Check of Memory Satisficers

Adhering to our preregistered data exclusion criteria, we removed memory satisficers (i.e., participants who failed to recall scenario details accurately, after passing the DQS instruction). An exploratory analysis yielded significant findings, detailed in the supplementary material, but summarized as follows:

In Experiment 1, 146 of 400 Japanese participants were identified as memory satisficers, with their manipulation checks indicating a possible failure in inducing guilt in the guilt condition. Despite enhanced compensation for the victim in the guilt condition, allocations for the other partner and themselves did not differ significantly between conditions. The internal consistency (Cronbach's α) of the relational mobility scale was low.

In Experiment 2, 100 Dutch and 137 Japanese participants were classified as memory satisficers, with manipulation checks failing in both countries. In the Netherlands, guilt did not increase compensation for the victim. In Japan, while compensation for the victim was higher in the guilt condition, amounts allocated to the other partner and themselves did not vary significantly between conditions. The internal consistency of the relational mobility scale was low. Notably, the distribution of relational mobility scores in the Netherlands shifted leftward, with the mean level of relational mobility was near the midpoint of a six-point scale (M = 3.87, SD = 0.62), challenging prior findings (Salvador et al., 2020; Thomson et al., 2018).

In conclusion, although the single DQS item helped filter out a subset of satisficers, our two-step verification process, which included memory tests on scenario details, was essential for obtaining uncontaminated data.

General Discussion

The positive influence of guilt on prosocial behavior, particularly in efforts to mend relationships with victims, is well-documented and uncontroversial (Cryder et al., 2012; De Hooge et al., 2007; Ketelaar & Au, 2003; Yu et al., 2014). Guilt drives individuals to restore their strained relationships, playing a crucial adaptive role in societal life. However, the source of resources for such compensatory actions remains debatable. De Hooge et al. (2011) argued that in the Netherlands, a narrowed focus on the victim might lead to diminished attention to maintaining positive relations with other social partners, demonstrating guilt's potential to motivate compensating the victim at another partner's expense. However, subsequent attempts to replicate these findings in Romania (Rebega et al., 2014) and Japan (Furukawa et al., 2016) did not observe this dark side of guilt.

Consistently across four replication attempts in Japan (including two from Furukawa et al. [2016] and two from this study), we found that guilt invariably encouraged prosocial behavior towards the victim, with participants allocating more funds to the victim. Notably, these studies collectively refuted the notion of guilt's dark side within the Japanese context, showing that individuals compensated the victim using their resources rather than reallocating from others. Cultural psychology often highlights how inter-country variations can offer fresh perspectives on the human mind. However, the anticipated replication of guilt's dark side in the Netherlands, as initially reported by De Hooge et al. (2011), was not confirmed in Experiment 2 of our study. Initially, we hypothesized that these differences might be explained through relational mobility. However, our findings suggest that the tendency for self-sacrificing compensation may be more universally observed across different cultures, including the Netherlands, Romania, and Japan.

Further illustrating this point, another study in the Netherlands contradicted the dark side hypothesis. In Experiment 5 by De Hooge (2012b), participants who believed their poor performance had caused their partner's loss displayed guilt-induced prosocial behavior. Participants chose to allocate more of their time to the victim rather than reduce the time allocated for an unrelated third party, indicating a preference for self-sacrifice over disadvantaging others. Although this finding was a by-product of a different research question (i.e., whether guilt motivates compensation for the victim if the victim's harm has already been compensated by someone else), it challenges the dark side perspective of guilt, even within the Dutch context. These counterexamples from multiple countries suggest that the supposed dark side of guilt is not as prevalent as once thought. While the exact boundary conditions remain unclear, the evidence thus far indicates that, at least under experimental procedure similar to De Hooge et al.'s (2011) Experiment 1, the self-sacrificing type of compensation is likely to occur.

Several procedural modifications distinguished the current study from De Hooge et al. (2011), yet we maintain that these changes did not compromise replicability. Firstly, our decision to conduct experiments online instead of offline might raise concerns about survey satisficing (Krosnick, 1991; Miura & Kobayashi, 2019). However, both online and offline surveys are susceptible to this issue. We aimed to mitigate potential data degradation by carefully excluding satisficed data. Moreover, the absence of the dark side of guilt in both offline surveys (Furukawa et al., 2016; Rebega et al., 2014) and experiments (De Hooge, 2012b) supports the notion that the mode of survey administration likely did not influence our findings.

Secondly, we made minor adjustments to the scenario expressions to enhance clarity without altering their content. For instance, while De Hooge et al. (2011) named the victim and the other partner as Jim and Michael, we opted for anonymization ("Friend A" and "Friend B").

Given that De Hooge et al. (2011) also employed anonymization in another scenario (Pilot Study 1), it is unlikely that using names versus anonymization impacted the results.

Thirdly, our scenarios in Japan explicitly stated that the two friends (the victim and the other partner) were unacquainted, ensuring no possibility of them comparing the gifts received. This detail was intended to enhance experimental control, allowing for a uniform situation across participants. Interestingly, specifying the friends' relationship as “unknown to each other” potentially favored the dark side hypothesis by facilitating the "safe" exploitation of the other partner. Therefore, clarifying their relationship does not provide an alternative explanation for the different results.

The contributions of this study are threefold. Firstly, it introduces a reliable experimental approach for assessing guilt-driven compensation to victims, utilizing one's resources within more complex social networks (i.e., in a three-person dictator game). This finding is significant given the well-established pattern of transgressors compensating victims at their own expense in dyadic settings victims (e.g., De Hooge et al., 2007; Ketelaar & Au, 2003). Our experimental procedure proves effective in consistently measuring guilt-motivated compensation in a multi-agent context, offering a helpful tool for future researchers interested in exploring the dictator game dynamics among multiple parties.

Building on the first point, our study adds valuable insights to socioecological research, which explores the dynamic interplay between socioecological environments and human behavior (Oishi & Graham, 2010; Yuki & Schug, 2012). While it is well-established that relational mobility is linked to various psychological and behavioral tendencies, including personality traits and decision-making processes, our review reveals a gap in the literature regarding its impact on multi-agent settings within the dictator game framework. Notably, Park et al. (2017) engaged European Americans and Koreans in a dictator game, albeit in its dyadic form, not addressing the multi-agent context. Similarly, Li et al. (2019) focused on a dyadic dictator game to investigate how residential mobility—a factor akin to but distinct from relational mobility—affects socioecological behavior. Their findings suggest that emphasizing residential stability fosters increased prosocial behavior towards in-group members instead of out-group members within the game. This distinction between residential and relational mobility shows the complexity of socioecological influences on human behavior. Thus, systematically gathering supportive and contradictory evidence concerning various socioecological factors is crucial for comprehensively understanding their differential effects on our actions.

Thirdly, we conducted statistical modeling of the behavior of multi-agent dictator games, enhancing the analytical tools available for economic games commonly used in social science research. This methodological advancement allows for a more nuanced analysis of resource allocation behavior beyond the limitations of mere comparisons of mean allocations by scrutinizing the specific sources and targets of diverted resources. Future improvements in models describing the full feature of resource allocation behavior in the dictator game could unveil new insights within well-established research areas.

While our work focused on replicating Experiment 1 from De Hooge et al. (2011), the replication studies in this field suggest a need for broader examination. For instance, Abbate et al. (2022) successfully replicated Experiment 2 of De Hooge et al. (2011) using a different experimental setup and observed guilt-induced compensatory behavior at the expense of other partners. To exploring boundary conditions, further examination is necessary.

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Disclosure of Interest

The authors declare no conflicts of interest related to this publication.

Data Availability Statement

All associated data, supplementary materials, analysis scripts, and output files are publicly accessible at https://osf.io/f2xsz/?view_only=bc647ea939b54160baea22974678858f.

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Appendix A

Emotion-related items in the manipulation check. Participants responded to each item on a seven-point scale ranging from 1 (*not at all*) to 7 (*very strongly*). The order of the ten items was randomized.

1. I feel guilty. (guilt)
2. I feel that I made a mistake. (guilt)
3. I suffer from a guilty conscience. (guilt)
4. I am ashamed. (shame)
5. I feel ashamed. (shame)
6. I am embarrassed. (shame)
7. I hurt my self-esteem. (humiliation)
8. I am humiliated. (humiliation)
9. I am dishonoured. (humiliation)
10. I am happy. (joy)

Appendix B

Three memory tests were conducted to exclude participants who remembered the scenario imperfectly. Participants chose one option that corresponded to the scenario for each test.

Memory Test 1:

How did you go to the shop?

- In my car
- In friend A's car
- In friend B's car
- By bus
- By taxi
- By train
- On my bicycle
- On friend A's bicycle
  ※True answer in both conditions
- On friend B's bicycle
- On foot

Memory Test 2:

Could you buy what you wanted?

- Yes, I could.
  ※True answer in both conditions.
- No, I could not.

Memory Test 3:

What happened after you left the shop?

- Nothing special happened.
  ※True answer in the control condition.
- I left my wallet at the shop.
- The bicycle was stolen.
  ※True answer in the guilt condition.
- I found a celebrity at the shop.
- The train was delayed.

Table 1. Summary of multiple regression analyses in Experiment 1

		b	*SE*	95% *CI*	*t* value	*p*-value
Victim	(Intercept)	4526.642	109.923	[4310.15, 4743.14]	41.180	< .001
	Condition	1771.287	219.956	[1338.08, 2204.49]	8.053	< .001
	RM	94.179	175.859	[-252.17, 440.53]	0.536	.593
	Condition × RM	-87.171	353.090	[-782.58, 608.24]	-0.247	.805
The other partner	(Intercept)	2787.451	74.893	[2639.95, 2934.95]	37.219	< .001
	Condition	117.056	149.861	[-178.09, 412.21]	0.781	.435
	RM	-96.163	119.816	[-332.14, 139.81]	-0.803	.423
	Condition × RM	-260.749	240.567	[-734.55, 213.05]	-1.084	.279
Self	(Intercept)	2685.907	133.504	[2422.97, 2948.84]	20.119	< .001
	Condition	-1888.343	267.141	[-2414.48, -1362.21]	-7.069	< .001
	RM	1.984	213.584	-418.67, 422.64	0.009	.993
	Condition × RM	347.921	428.835	[-496.67, 1192.51]	0.811	.418

Note: *b* = non-standardized regression coefficient; *SE* = Standard error; 95% *CI* = 95% Confidence interval; RM = Relational mobility.

Table 2. Descriptive statistics of money allocated in Experiment 2

			Currency unit		Normalized score	
			Mean	*SD*	*Mean*	*SD*
The Netherlands (Euros)	Victim	Control	26.014	9.922	0.325	0.124
		Guilt	39.427	16.573	0.493	0.207
	Third-party	Control	22.657	8.154	0.283	0.102
		Guilt	21.592	9.355	0.270	0.117
	Self	Control	31.329	16.950	0.392	0.212
		Guilt	18.981	17.657	0.237	0.221
Japan (Yen)	Victim	Control	3811.111	1445.356	0.381	0.145
		Guilt	5229.164	2254.579	0.523	0.225
	Third-party	Control	2744.444	1009.335	0.274	0.101
		Guilt	2631.508	1390.293	0.263	0.139
	Self	Control	3444.444	2209.568	0.344	0.221
		Guilt	2139.328	2318.268	0.214	0.232

Note: *SD* = Standard deviation.

Table 3. Summary of multiple regression analyses in Experiment 2

		b	*SE*	95% *CI*	*t* value	*p*-value
Victim	(Intercept)	0.430	0.008	[0.415, 0.445]	56.618	< .001
	Condition	0.156	0.015	[0.126, 0.185]	10.240	< .001
	Country	-0.043	0.015	[-0.073, -0.013]	-2.814	.005
	Condition × Country	0.026	0.030	[-0.034, 0.086]	0.849	.396
The other partner	(Intercept)	0.273	0.005	[0.263, 0.282]	56.126	< .001
	Condition	-0.012	0.010	[-0.032, 0.007]	-1.272	.204
	Country	0.008	0.010	[-0.011, 0.027]	0.795	.427
	Condition × Country	-0.002	0.019	[-0.040, 0.036]	-0.104	.918
Self	(Intercept)	0.297	0.009	[0.279, 0.315]	31.851	< .001
	Condition	-0.143	0.019	[-0.180, -0.107]	-7.677	< .001
	Country	0.035	0.019	[-0.002, 0.072]	1.877	.061
	Condition × Country	-0.024	0.037	[-0.097, 0.050]	-0.637	.524

Note: *b* = non-standardized regression coefficient, *SE* = Standard error; 95% *CI* = 95% Confidence interval.

Table 4. Summary of log marginal likelihood of each model in exploratory statistical modeling

Experiment	Country	Prior (σ^2)	Model 1	Model 2	Model 3	Model 4	Model 5
1	Japan	6.25	382.090	410.084	408.530	381.320	406.962
1	Japan	25	381.648	409.824	408.283	380.852	406.707
1	Japan	100	380.488	408.720	407.179	379.697	405.605
2	Japan	6.25	409.593	414.355	414.294	408.433	412.436
2	Japan	25	408.988	413.745	413.696	407.829	411.833
2	Japan	100	407.809	412.551	412.504	406.639	410.643
2	The Netherlands	6.25	263.003	287.337	285.074	260.634	283.973
2	The Netherlands	25	264.372	289.165	286.910	261.948	285.799
2	The Netherlands	100	263.695	288.603	286.357	261.250	285.233

Note: Model 1 = The dark side model (De Hooge et al., 2011). Model 2 = The self-sacrifice model (the current study). Model 3 = The hybrid model. Model 4 = The null model. Model 5 = The saturated model.

Figure 1

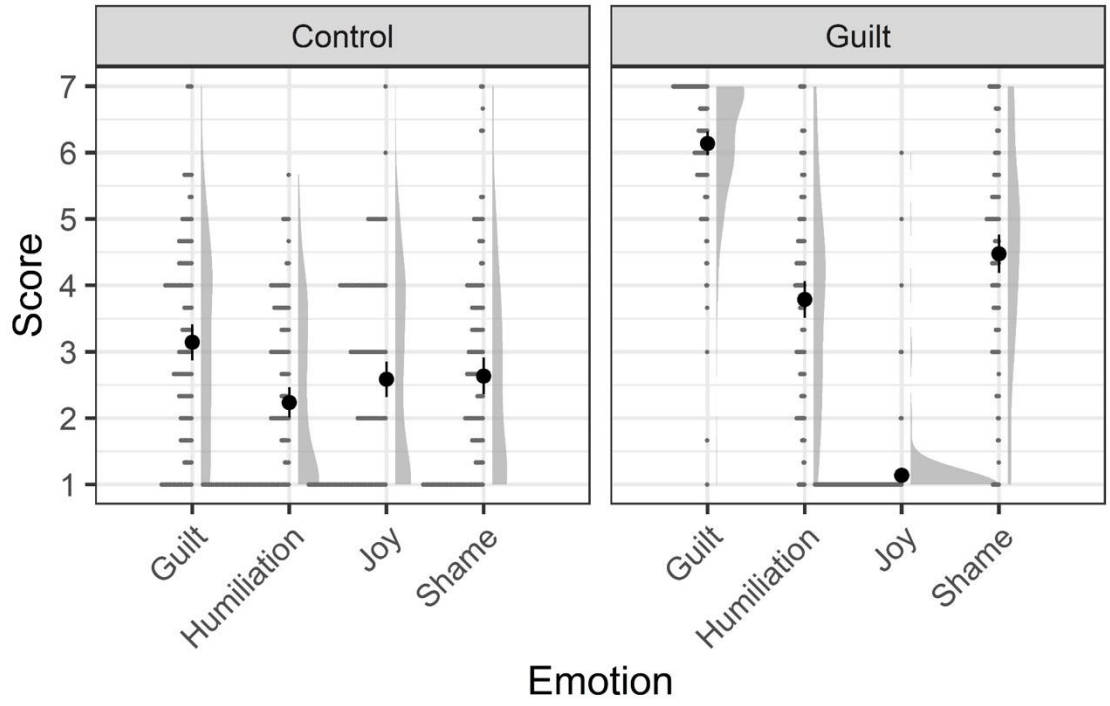

Control
Guilt
Score
7
6
5
4
3
2
1
Guilt
Humiliation
Joy
Shame
Guilt
Humiliation
Joy
Shame
Emotion

Figure 2

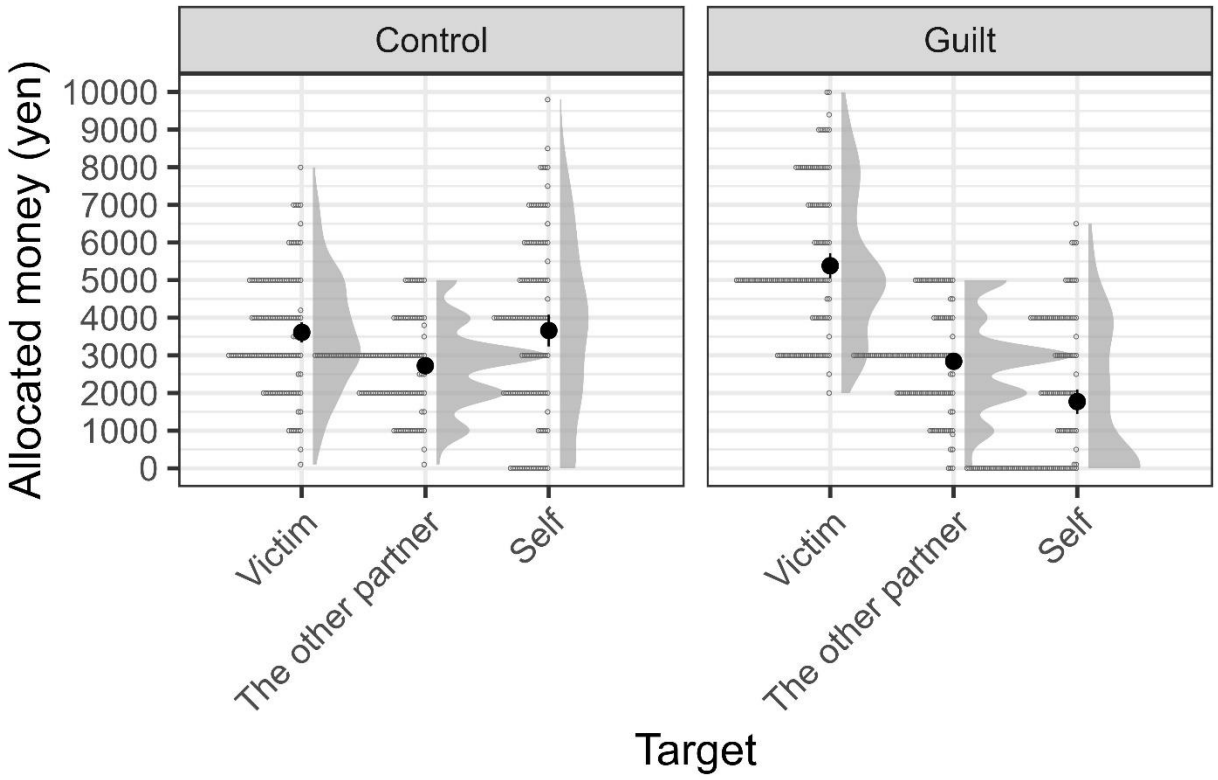
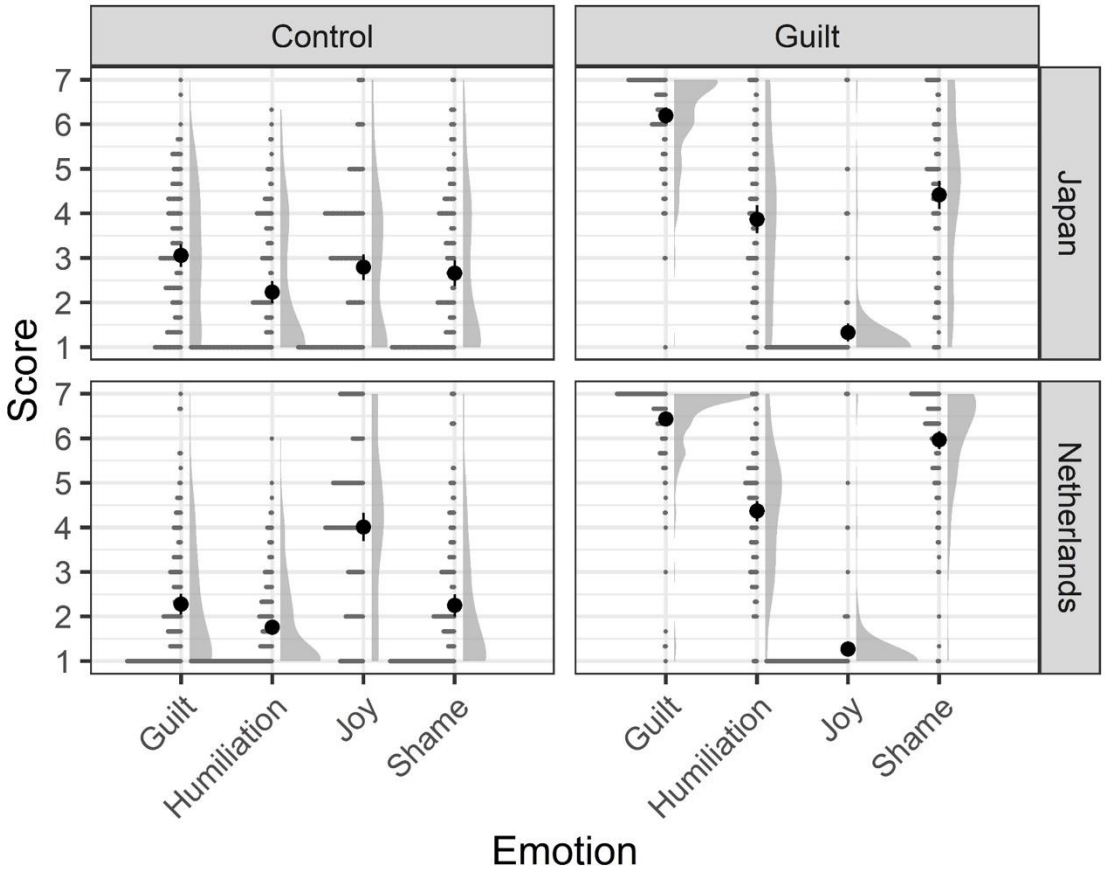
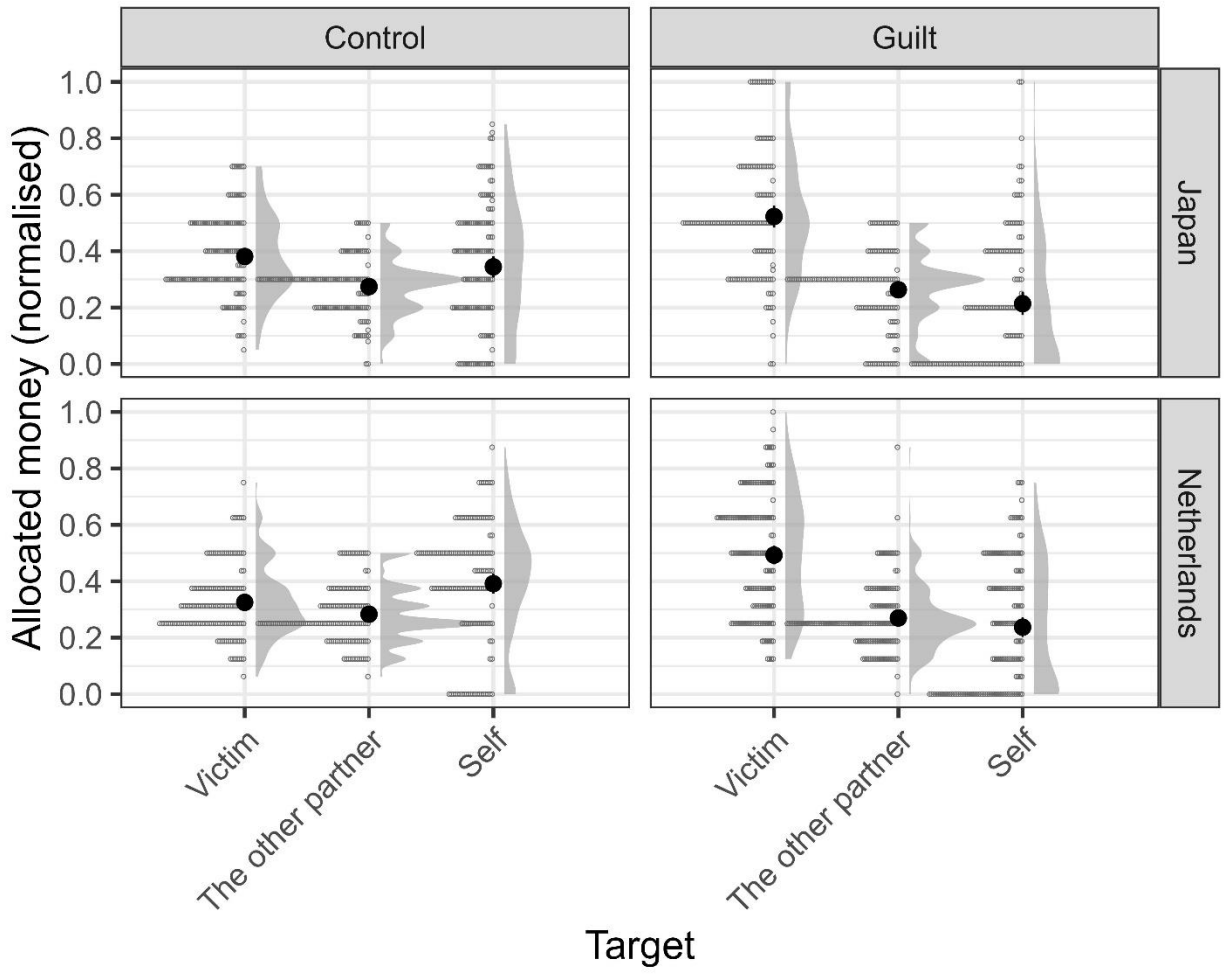

Control
Guilt
Allocated money (yen)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Victim
The other partner
Self
Victim
The other partner
Self
Target

Figure 3


Control
Guilt
Japan
Netherlands
Score
7
6
5
4
3
2
1
Guilt
Humiliation
Joy
Shame
Emotion

912 # Figure 4



913
914

Figure Captions

Figure 1. Distribution of emotion scores in Experiment 1. Individual participant scores are shown as small dots. The large black dots denote the means, and the vertical lines indicate the 95% confidence intervals. The emotion of joy, used as a filler in the questionnaire, is also presented for comparison.

Figure 2. Distribution of monetary allocations in Experiment 1. Small dots represent each participant's allocation. Mean allocations are marked by larger black dots, with vertical lines denoting the 95% confidence intervals.

Figure 3. Distribution of emotion scores in Experiment 2. Small dots represent individual participant scores, while larger black dots indicate the means. The vertical lines represent the 95% confidence intervals. Joy, included as a filler emotion, is included for comparative purposes.

Figure 4. Distribution of monetary allocations in Experiment 2, normalized from 0 to 1. Participant allocations are shown as small dots, with means indicated by larger black dots. Vertical lines represent the 95% confidence intervals.