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Gender differences in guilt aversion in Korea and the United Kingdom

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Abstract (200/200)

Guilt aversion, which describes the tendency to reduce the discrepancy between a partner's expectation and his/her actual outcome, is a key driving force for cooperation in both the East and the West. A recent study based on functional magnetic resonance imaging and online behavioral experiments reported that men show stronger guilt aversion than women and also suggested that men's predominance in guilt aversion arises from stronger sensitivity to social norms. However, since the participants of that study were all Japanese, it remains unaddressed how common the gender difference in guilt aversion is. Here, we conducted online behavioral studies on people from Korea and the U.K. (Korea; $n = 294$, U.K.; $n = 347$) using the same trust game. We confirmed that men exhibit stronger guilt aversion than women in both countries. Furthermore, consistent with the Japanese study, our Lasso regression analysis for U.K. participants revealed that Big Five Conscientiousness (rule-based decision) correlated with guilt aversion in men. In contrast, guilt aversion in Korean men correlated with Big Five Neuroticism. Thus, our results

suggest that gender differences in guilt aversion is universal but the underlying cognitive processes may be influenced by cultural differences.

Introduction

Previous research has indicated gender differences in socioeconomic behaviors such as occupational choice [1,2,3,4], judicial rulings [5,6], medical practice patterns [7], and educational decisions [8]. It is often hypothesized that these differences are caused by different social preferences between genders.

Indeed, a large body of evidence has reported gender differences in social preferences (for example, trust, reciprocity, altruistic, inequality averse and competitive preference; for a review, see [9]). Guilt aversion is an important factor of cooperation that lives up to the expectations of others, since people suffer from guilt if they disappoint others [10,11,12,13] (see Materials and Methods for a more detailed definition). Both laboratory and field experiments have supported this theory for populations in both the East and the West (e.g., East [14,15,16], West [11,17,18,19,20,21,22,23,24]).

Although guilt-aversion depends on one's own beliefs about the underlying intention of others, a comparison of behavioral outcomes between the self and other is also important for social decision making [25]. Inequity aversion [26] is the most perceived form of outcome-based decision making, which is defined as the propensity to avoid an imbalance between outcomes for the self and the other. Additionally, empirical evidence has revealed gender differences in inequity aversion [9].

However, only a limited number of reports have examined gender differences in guilt aversion. It is possible that gender differences in guilt aversion reflect the different cognitive strategies used by men and women. Specifically, guilt aversion requires the ability to assess another individual's expectations, and it is directly related to his/her disappointment (i.e., empathy or theory of mind [27]). Moreover, guilt aversion represents psychological pressure, and it is directly related to the sensitivity of negative emotions (i.e., the sensitivity of negative emotions [10]). At the same time, guilt aversion is a normative behavior elicited by experience (i.e., rule-based decision making [28]). Hence, if there are gender differences in guilt aversion, these three potential cognitive strategies—empathetic consideration, the sensitivity of negative emotion, and rule-based decision making—may contribute to such differences.

Our recent study [15] based on functional magnetic resonance imaging and online behavioral (Japanese participants; $n = 4,723$; 2,737 women) experiments reported that men show stronger guilt aversion than women. The study also revealed that the Big Five conscientiousness (rule-based decision making) correlates only with guilt aversion in men, while Big Five agreeableness (empathetic consideration) correlates with guilt aversion in both genders. This observation suggests that the consideration of social norms plays a key role in men's predominance in guilt aversion. However, the study was based on an exclusively Japanese population. To our knowledge, no study has examined cross-country tests for gender differences in guilt aversion and its cognitive underpinning.

Here, to address this issue, we investigated gender differences in guilt aversion and the cognitive underpinnings by conducting online experiments on people living in Korea and the United Kingdom (U.K.) using the same task as the Japanese study, which was designed to study guilt aversion as well as inequity aversion. The two countries have relatively the same economic status (according to the World Economic Outlook Database [29], the 2020 per-capita GDP in the U.K. was US\$44,153, while that of Korea was US\$44,750).

We also collected demographic information and Big Five scores. The Big Five personality traits [30], widely known as a measure of individual personality, are based on five dimensions: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Agreeableness is characterized by the understanding of others' emotions, intentions, and mental states; neuroticism is characterized by negative emotion and includes various traits such as anxiety, anger, depression, and shame; and conscientiousness is characterized by rule-based regulation and self-discipline. Women consistently score higher than men on agreeableness and neuroticism across countries, whereas gender differences in conscientiousness are not consistent across cultures, and no significant gender difference has typically been found [31]. These findings suggest that if gender differences do exist in guilt-aversion behavior, there may also be cultural differences in the underlying cognitive strategies.

Results

We conducted an online behavioral study (Korea; $n = 294$ [175 women], U.K.; $n = 347$ [190 women]; for detailed statistics, see Supplementary Table S1) of a trust game that was designed to dissociate the computational processes for guilt aversion and inequity aversion. The participants were involved in two consecutive experiments (Fig. 1; see also

Materials and Methods). In the first experiment, all the participants performed the role of Player A and completed one trial. Specifically, Player A had to choose between *W* or *Z* and reveal his/her belief about the probability (0% to 100%) that Player B will choose *R* (i.e., *Cooperate*). The participants knew that these choices would be used when Player B was asked to make a choice in the second experiment.

In the second experiment, all the participants performed the role of Player B and completed 45 trials. In each trial, with knowledge of Player A's belief probability, Player B had to decide whether to *L* (*Defect*) or *R* (*Cooperate*). Each participant completed 45 trials with a different partner (for Player A, the order of exposure was randomized across subjects). To dissociate the computational processes for guilt aversion and inequity aversion, their values were taken to be orthogonal (the correlation coefficient of the two variables was -0.045; Pearson's correlation test, $P = 0.772$). This task design allowed us to investigate guilt aversion while removing the influence of inequity aversion.

Model selection. We conducted a statistical analysis of guilt aversion based on Player B's choices (see Materials and Methods). For inequity, Fehr and Schmidt's model [26], which splits inequity into advantages and disadvantages, is commonly used. However, as we reported previously [15], the Bayesian information criterion (BIC) between these two models showed that for 3,714 out of the 4,723 participants (78.6%) the absolute difference for the inequity model was selected. Therefore, we also compared the BIC between Fehr and Schmidt's model [26] and the absolute difference model in the present study.

We found not only that the absolute difference model had a slightly smaller mean BIC than Fehr and Schmidt's model [26] for both the Korea and U.K. participants (Korea, 48.723 vs. 49.680; U.K., 50.520 vs. 51.989), but also that for 224 out of the 294 participants (76.2%) in Korea and for 276 out of the 347 participants (79.5%) in the U.K., the smallest BIC model was the absolute difference model. Based on these findings, we determined that the absolute difference model for inequity was plausible for the current task.

Next, we performed a logistic regression comprised of Reward, Guilt, and Inequity (i.e., absolute difference), and found that the β values of Reward, Guilt and Inequity were positive and significant ($P < 0.001$, see Table 1) for both the Korea and U.K. participants, clarifying that these three components all have a critical effect on behavior in this task.

Gender differences in guilt aversion.

To identify the relationship between guilt aversion (the β value of Guilt, called $\beta(\text{Guilt})$ hereafter) and gender under the control of social-demographic environments and basic personality traits, we first performed a Lasso regression (target variable: $\beta(\text{Guilt})$) based on the explanatory variables, including gender (men = 1), Big Five Inventory-10, age, education, and income for all participants.

Fig. 2a and Supplementary Table S2(1) show the Lasso regression results. Gender had relatively high weights for the Korea and the U.K. participants. We also obtained the same result using a general linear model regression (Korea, $P = 0.0282$; U.K., $P = 0.0045$). These results are consistent with the Japanese study [15] and suggest that guilt aversion is stronger in men than women in both the East and the West.

Underlying cognitive mechanisms for gender differences in guilt aversion.

Next, to identify the cognitive mechanisms for the gender difference, we conducted a second Lasso regression, including interaction terms between the gender (dummy) variable and the Big Five Inventory-10 and socioeconomic status scores. Fig. 2b and Supplementary Table S2(2) present these Lasso regression results. We found that the Gender $\times$ Conscientiousness had a high positive weight for the U.K. population. We also obtained the same result using a general linear model regression (U.K., $P = 0.0484$). This finding shows that for the U.K., the stronger guilt aversion in men is attributable to greater use of rule-based (social norm-based) strategies, again consistent with the Japanese study [15]. On the contrary, only Gender $\times$ Neuroticism had a positive weight for the Korea population. The correlation coefficient between Neuroticism and Conscientiousness for Korea was quite small (correlation coefficient; -0.15; see also Supplementary Fig. S1, which presents a correlation matrix for the Big Five variables). These findings indicate that, although gender differences in guilt-based prosocial behavior are similarly observed among these countries, the cognitive underpinnings may be heterogeneous depending on the social systems, culture, etc.

Discussion

In this study, we conducted an online behavioral study (Korea, $n = 294$ [175 women]; U.K., $n = 347$ [190 women]) of a trust game that was designed to investigate guilt aversion. We found that men exhibited stronger guilt aversion than women in both Korea and the U.K. Additionally, our Lasso regression, including interaction terms between the gender variable and the Big Five variables, revealed that conscientiousness and

neuroticism are key to men's predominance in guilt-aversion in the U.K. and Korea, respectively.

These results suggest that men's predominance of guilt aversion may be universal in different cultures but the underlying mechanisms for the gender difference may differ. Guilt aversion includes an aspect of normative behavior elicited by experience (i.e., rule-based decision making [28]). Our current results and our previous study [15] show that men utilize rule-based strategies more in the U.K. and Japan. Simultaneously, guilt aversion represents social pressure and may be related to sensitivity to negative emotions [10]. The correlation between men's predominance in guilt aversion and neuroticism in the Korean population may echo this aspect, suggesting that men in Korea perceive guilt aversion as a strong social pressure.

Related to cultural differences, previous research [31,32,33,34] found that more gender-equal societies and economically developed countries are associated with larger gender differences in personality traits (Big Five) and social preferences (altruism, trust, reciprocity, risk-taking, and patience). One possible interpretation for this is that people living in more progressive and equal countries have more opportunities to express cultural and biological differences. This view is consistent with the fact that we see men's predominance of guilt aversion in developed countries (Korea, the U.K., and Japan).

Of course, there are alternative explanations for the different contributions of conscientiousness and neuroticism to men's guilt aversion in Korea and the U.K. We used the Korean version of The Big Five Inventory-10 [35] translated from the original English version [36], which was used in our U.K. experiment. Since this Korean version was designed mainly for the elderly (65 years and older) and the reliability of the scale was tested using elderly subjects (mean age: 73.4 years), the vocabulary familiar to this demographic may be selected in the translation. Therefore, we cannot rule out the possibility that this scale could not measure the Big Five personality traits of younger generations precisely. Second, this short version of Big Five examines five factors with only 10 questions (two questions per factor), which may have made it more difficult to measure the five factors precisely than full versions. Further research is needed to validate the cognitive mechanisms underlying cross-cultural and gender differences in guilt aversion. Nevertheless, our findings about men's predominance of guilt aversion in Korea, the U.K. as well as Japan [15] provide an important clue that helps understand the universality and heterogeneity of gender differences in prosocial behavior.

Materials and Methods

Participants.

We analyzed the data of 294 participants in Korea (175 women) and 347 participants in the U.K. (190 women) (for more descriptive statistics, see Supplementary Table S1) who followed the task instructions correctly. The participants were recruited from the registrants of an Internet research service company (NTT Com Research, Inc.). The study protocol was approved by the ethical committee of the National Institute of Information and Communications Technology, and all participants gave informed consent.

Task.

In this task, adapted from a previous experimental study [11], two participants were paired as Players A and B (see Fig. 1a). First, Player A was asked to choose between playing W or Z and reveal his/her belief about τ_A (0%–100%), i.e., the probability that Player B will choose R (i.e., *Cooperate*). In other words, τ_A represents Player A's level of trust in Player B. If Player A choose Z , then Players A and B receive payments z_A and z_B , respectively. If Player A chooses W , then (knowing Player A's belief probability) Player B is asked to choose between playing L (i.e., *Defect*) or R . If Player B chooses L , then Player A receives y_A and Player B receives y_B , whereas if Player B chooses R , then the two players receive x_A and x_B , respectively. For convenience, L and R in Fig. 1a are denoted as *Defect* and *Cooperate*, respectively. Note that although the expressions L and R represent the terms *Defect* and *Cooperate*, respectively, these terms were not used in our experiment.

Fig. 1a presents two important conditions regarding the payments: if (1) $y_A < z_A < x_A$, then player A signals trust (cooperation) to player B when player A chooses W ; if (2) $z_B < x_B < y_B$, then player B feels guilt upon disappointing player A relative to Player A's belief in what Player A will receive. These two conditions are necessary for guilt aversion theory. Additionally, if Player B is rational and selfish, then Player B chooses *Defect* (L). Player A, anticipating this action, will choose Z and produce the allocation of the money payoffs z_A and z_B . This online trust game was also used in our previous study [15].

Procedure.

In the trust game, the participants were involved in two consecutive behavioral measurements (Fig. 1b; see also the instructions in the Supplemental Information). Before the first experiment, online participants read the rules of the trust game and the procedure. In the first experiment, each participant played the trust game as Player A (i.e., choose *W* or *Z* and reveal belief probability τ_A) and experienced one trial. The participants knew that these choices would be used when Player B was asked to make a choice in the second experiment. Participants were instructed that player B was another participant who would take part in the second experiment. However, player A was not informed of player B's identity. The second experiment comprised 45 trials, with each participant involved in performing Player B's role (i.e., choose *Defect* or *Cooperate*) conditional on the matched Player A choosing *W* and without knowing Player A's actual choice. The participants were also told that Player A will differ for each trial and that the pairings will be anonymous. The sequence of the trials was randomized across participants, and no feedback was provided to the participants during the experiment. Additionally, each participant completed the personality trait tests (the Big Five Inventory-10 for Korea [35] and for the U.K. [36]). Big Five Inventory-10 is a 10-item short version of the Big Five Inventory-44 [37] and provides a measure of the Big Five for contexts in which a participant's time is severely limited.

For their participation, participants were paid in cashable points, proportional to the number of payoffs earned during the experiment (equivalent to US\$3–5). The participants were also informed that the final payoff would be the sum of the decisions made as Players A and B. For the second experiment, the participants were told that the earnings for Player B would be the sum of the actual outcome of the 45 trials (instead of randomly selecting only one trial).

Guilt aversion and inequity aversion.

We illustrate the guilt aversion model using the guilt sensitivity introduced by previous theoretical and experimental studies [11,12]. Note that guilt sensitivity elicited in the trust game by guilt aversion theory is fundamentally related to the Test of Self-Conscious Affect-3 (TOSCA-3) and the Guilt and Shame Proneness Scale (GASP), which is a common measure of guilt sensitivity in psychology but is unrelated to shame [38,39].

A guilt-averse player suffers from guilt to the extent he/she believes he/she hurts others relative to what they believe they will get. Therefore, individuals are motivated by their own beliefs. The guilt aversion model includes social pressure on Player B if the

profile $(W, Defect)$ is played (see Fig. 1a). Let τ_A denote Player A's belief about the probability (0% to 100%) that Player B will choose *Cooperate*. Player B is assumed to believe that if Player A chooses W , then Player A believes that he/she will get a return of $\tau_A \cdot x_A + (1 - \tau_A) \cdot y_A$, as the setting of Player A's payoff is $y_A < z_A < x_A$. The difference, $\{\tau_A \cdot x_A + (1 - \tau_A) \cdot y_A\} - y_A = \tau_A(x_A - y_A)$, which is non-negative in our settings, can measure how much Player B believes he/she hurts Player A relative to what Player A believes he/she will get if Player B chooses *Defect*. In other words, the difference $\tau_A(x_A - y_A)$ is the amount of guilt that Player B experiences. Let us assume that parameter γ_B measures Player B's sensitivity to guilt. A player is guilt-averse and will *Cooperate* if $y_B - \gamma_B \cdot \tau_A(x_A - y_A) < x_B$.

By contrast, an individual is known to have the preference for fairness and resistance to incidental inequalities [26]. Therefore, the inequity aversion model assumes that their utility decreases when the allocation of monetary payoffs differs. Thus, if an inequity-averse player suffers from inequity, he/she make decisions so as to minimize inequity in outcomes. Notably, the advantageous inequity (receiving a larger reward than others) in Fehr and Schmidt's inequity aversion model is also referred to as "guilt." However, this outcome-based "guilt" and the intension-based "guilt" that we treat in guilt aversion are completely different.

As mentioned in the Results section, using the BIC, we found that the absolute difference for inequity was superior than the standard inequity aversion model [26]. Based on this finding, we judged the absolute difference model for inequity to be a plausible one for the current task. We also integrated guilt aversion and inequity aversion (absolute inequity) into the utility function (u_B) for Player B as follows:

$$u_B = \begin{cases} x_B - \alpha_B |x_A - x_B| & \text{if the profile } (W, Cooperate) \\ y_B - \gamma_B \cdot \tau_A \cdot (x_A - y_A) - \alpha_B |y_A - y_B| & \text{if the profile } (W, Defect), \end{cases}$$

where α_B is a constant measuring Player B's sensitivity to inequity. A narrowly self-interested agent is given the special case $\gamma_B = \alpha_B = 0$. In our game, the players choose between binary actions that yield two different monetary payoff allocations: $X = (x_A, x_B)$ and $Y = (y_A, y_B)$. The utilities of these allocations are given by the aforementioned formula, yielding $u_B(X)$ and $u_B(Y)$.

Logistic regression of the behavioral data.

Based on the logistic model of stochastic choice, we estimated three separate components

(i.e., monetary self-interest, guilt, and inequity) for each participant. The probability that Player B chooses *Cooperate* can be expressed as $P_{B,Cooperate} = 1/1 + e^{-\{u_B(X)-u_B(Y)\}}$. We then used logistic regression as follows:

$$\text{logit}(P_{B,Cooperate}) = \beta_0 + \beta_1 \text{Reward}_t + \beta_2 \text{Guilt}_t + \beta_3 \text{Inequity}_t,$$

where Reward_t is the reward size, calculated as $x_B - y_B$ at time t , Guilt_t is the guilt size calculated as $-\{0 - \tau_A \cdot (x_A - y_A)\}$, and Inequity_t is the inequity size calculated as $-(|x_A - x_B| - |y_A - y_B|)$. For convenience, β_1 , β_2 , and β_3 are denoted as $\beta(\text{Reward})$, $\beta(\text{Guilt})$, and $\beta(\text{Inequity})$, respectively. To orthogonalize the three explanatory variables, the actual τ_A used in the experiments was also set by the experimenter. The correlation coefficients among the three explanatory variables were less than 0.30 and nonsignificant ($P > 0.05$), and the values of guilt and inequity were designed to be orthogonal (correlation coefficient of these two variables was -0.138 and nonsignificant ($P = 0.367$)) to dissociate the computational processes for guilt aversion and inequity aversion. This task design allowed us to investigate guilt aversion without the influence of inequity aversion. This logistic analysis was also used in our previous study [15].

The logistic regression was done in R (R Development Core Team, 2008). We used the `brglm` package to conduct our maximum likelihood estimation with the bias-reduction method [40].

Lasso regression of the behavioral data.

Having confirmed that these three factors play crucial roles in the current task using logistic regression, we conducted a Lasso regression [41] to identify the relationship between $\beta(\text{Guilt})$ and gender under controlled social-demographic environments (age, education, and income) and basic personality traits (Big Five Inventory). Moreover, to investigate the cognitive processes potentially underlying gender differences in guilt aversion, we conducted a second Lasso regression that included the interactions of gender with personality trait scores.

Specifically, to identify the relationship between guilt aversion ($\beta(\text{Guilt})$) and gender, we first performed a Lasso model analysis (target variable: $\beta(\text{Guilt})$) based on the explanatory variables, including gender (men = 1) and the Big Five Inventory-10 and socioeconomic status scores (age, education, and income) for all participants (see also Fig. 2a and Supplementary Table S2(1)). Next, to identify the cognitive mechanisms

specific to gender, we performed a second Lasso model regression (target variable: $\beta(\text{Guilt})$), including interaction terms between the gender variable and the Big Five Inventory-10 and socioeconomic status scores (see also Fig. 2b and Supplementary Table S2(2)).

Lasso regression [41] is a variable-selection-and-constraint method that is best used for a large number of predictors, especially when they are highly correlated. The LASSO algorithm constrains or penalizes the absolute size of the regression coefficients so that no coefficients are too large when compared with others. The Lasso procedure not only achieves beneficial shrinkage, but it also ensures that a variable remains in the model with a non-zero coefficient if its incremental predictive value is sufficient for justifying the sacrifice of a degree of freedom. Based on the benefits of Lasso regression, we adapted this method for our behavioral data. Lasso was done in R (cv.glmnet and glmnet included in the glmnet package [42]).

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Author contributions

TN and MH designed the study; TN, TT, and MH performed the research and analyzed the data; TN wrote the first draft; MH edited the manuscript.

Competing interests

The authors declare no competing interests.

Data availability

The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

Figure legends

Figure 1. Design of the trust game. (a) First, Player A chooses W or Z and reveals the belief probability (τ_A) that Player B will choose R (*Cooperate*). If Player A chooses Z , then Players A and B receive z_A and z_B , respectively. If Player A chooses W (i.e., he/she trusts player B), then with the knowledge of Player A's belief probability, Player B decides whether to L (*Defect*) or R (*Cooperate*). If Player B chooses L , Players A and B receive y_A and y_B , respectively; if Player B chooses R , Players A and B receive x_A and x_B , respectively. (b) An illustration of the complete experimental paradigm. In the first experiment, which contained one trial, each participant (as Player A) chooses W or Z and reveals his/her belief probability that Player B will choose R . In the second experiment, which contained 45 trials, each participant (as Player B) chooses L or R . Participants were told that the other participant (player A) differed for each trial.

Figure 2. The results of the Lasso regression of gender differences for guilt (except the intercept terms for display purposes). Guilt-aversion behavior ($\beta(Guilt)$) was regressed using Lasso regression, with the following variables as regressors: (a) gender, Big Five, and socioeconomic status (age, education, and income); and (b) gender, Big Five, socioeconomic status, and the interaction between gender and Big Five and socioeconomic status.

Tables

Table 1. Logistic regression models predicting decision to *Cooperate* or *Defect*

Explanatory variable	Dependent variable: $\text{logit}(P_{B,Cooperate})$	
	Korea	U.K.
Reward	0.027144 *** (0.0011336)	0.022336 *** (0.0009943)
Guilt	0.013334 *** (0.001055)	0.013744 *** (0.0009652)
Inequity	0.006226 *** (0.0005297)	0.008717 *** (0.0004956)
Constant	0.0968 (0.0675389)	0.132108 * (0.0611583)
McFadden's R^2	0.06202934	0.05632867
Observations	294	347

Note: Significance: *** $P < 0.001$; * $P < 0.05$.

Supplementary Information for

Gender differences in guilt aversion in Korea and the United Kingdom

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Supplemental Results and Discussion

Behavioral results of the gender differences for inequity.

For the inequity-aversion behavioral analysis, we replaced the target variable $\beta(\text{Inequity})$ and performed the same Lasso regression as the one for guilt aversion (see Supplementary Fig. S2 and Table S3). Supplementary Fig. S2a and Table S3(1) present the Lasso regression results to identify the relationship between inequity aversion ($\beta(\text{Inequity})$) and gender under a controlled socioeconomic status. We found that gender had no weight in either the Korean or U.K. populations. However, this result is not consistent with previous empirical studies (for a review, see [1]). For the U.K., openness and education had large positive weights. Supplementary Fig. S2b and Table S3(2) present the Lasso regression results to identify the cognitive mechanisms specific

to gender. We found that the interaction term of gender with personality traits had no weight in the Korea or U.K. populations.

Why were no gender differences for inequity aversion?

Although we found that both countries were inequity averse (see Table 1), we did not observe gender differences in inequity aversion. However, many previous studies have observed differences in inequity aversion, including studies on populations in Korea and the U.K. Those previous studies often used dictator games and social value orientation tasks, which are suitable for focusing on inequity aversion. On the contrary, our trust game was primarily designed to measure guilt aversion. Thus, a potential reason for the inconsistent results is the experimental tasks used. Another potential reason is that the mental concentration of the participants was lower while conducting the task online. Indeed, the withdrawal rate in the present study was higher than in our previous study [2]. In any case, we believe we can remove the effect of inequity aversion from the analysis of guilt aversion using the present task.

Figure S1. Correlation matrix for the Big Five variables: (a) Korea; (b) U.K.

Figure S2. The results of the Lasso regression of gender differences for inequity (except the intercept term for display purposes). Inequity-aversion behavior ($\beta(Inequity)$) was regressed using Lasso regression, with the following variables as regressors: (a) gender, Big Five, and socioeconomic status (age, education, and income); and (b) gender, Big Five, socioeconomic status, and the interaction between gender and Big Five.

Table S1. Descriptive statistics for the online sample

Variables	Korea			U.K.		
	All (<i>n</i> = 294)	Men (<i>n</i> = 119)	Women (<i>n</i> = 175)	All (<i>n</i> = 347)	Men (<i>n</i> = 157)	Women (<i>n</i> = 190)
Neuroticism	5.88 (1.63)	5.39 (1.62)	6.21 (1.55)	6.28 (2.24)	5.69 (2.19)	6.76 (2.16)
Extraversion	5.96 (1.54)	5.83 (1.50)	6.04 (1.56)	5.61 (204)	5.35 (200)	5.83 (206)
Openness	6.76 (1.77)	6.31 (1.83)	7.06 (1.67)	7.15 (1.73)	7.10 (1.66)	7.19 (1.78)
Agreeableness	7.04 (1.31)	7.08 (1.42)	7.01 (1.24)	7.01 (1.81)	6.89 (1.87)	7.11 (1.77)
Conscientiousness	6.99 (1.39)	7.01 (1.46)	6.97 (1.35)	7.75 (1.62)	7.69 (1.68)	7.80 (1.57)
Age	35.29 (8.03)	34.82 (7.95)	35.60 (8.10)	37.09 (8.55)	37.72 (8.29)	36.56 (8.75)
Education	5.65 (0.82)	5.60 (0.87)	5.69 (0.78)	5.10 (1.46)	5.03 (1.54)	5.16 (1.40)
Income	2.57 (1.20)	2.83 (1.28)	2.39 (1.11)	3.00 (1.4)	3.43 (1.44)	2.64 (1.25)

Notes: All of the scores are mean scores. Standard deviations are in parentheses. The Big Five Inventory is a 10-point scale. Education and Income are a 7-point scale.

Table S2. Lasso regression of the gender differences for guilt

Explanatory variable	Dependent variable: $\beta(Guilt)$			
	(1)		(2)	
	Korea	U.K.	Korea	U.K.
Gender	0.00361	0.00949	0	0
Neuroticism	0	0.00135	0	0.00139
Extraversion	0	-0.000069	0	-0.0000335
Openness	0	0	0	0
Agreeableness	0	-0.000723	0	-0.000757
Conscientiousness	0	0.000145	0	0
Age	0	0	0	0
Education	0	0.00104	0	0.00098
Income	0	0	0	0
Gender $\times$ Neuroticism			0.00114694	0
Gender $\times$ Extraversion			0	0
Gender $\times$ Openness			0	0
Gender $\times$ Agreeableness			0	0
Gender $\times$ Conscientiousness			0	0.00132
Gender $\times$ Age			0	0
Gender $\times$ Education			0	0
Gender $\times$ Income			0	0
(Intercept)	0.03135	0.0155	0.03030806	0.0164

Notes: All of the scores are Lasso regression coefficients.

Table S3. Lasso regression of the gender differences for inequity

Explanatory variable	Dependent variable: $\beta(\text{Inequity})$			
	(1)		(2)	
	Korea	U.K.	Korea	U.K.
Gender	0	0	0	0
Neuroticism	0	0.00035137	0	0.000120673
Extraversion	0	-0.0004084	0	-0.00012027
Openness	0	0.00187695	0	0.00140548
Agreeableness	0	0	0	0
Conscientiousness	0	-0.0002229	0	0
Age	0	-0.0005575	0	-0.00046888
Education	0	0.0012337	0	0.000681066
Income	0	0	0	0
Gender $\times$ Neuroticism			0	0
Gender $\times$ Extraversion			0	0
Gender $\times$ Openness			0	0
Gender $\times$ Agreeableness			0	0
Gender $\times$ Conscientiousness			0	0
Gender $\times$ Age			0	0
Gender $\times$ Education			0	0
Gender $\times$ Income			0	0
(Intercept)	0.01378527	0.02084356	0.01378527	0.0218515144

Notes: All of the scores are Lasso regression coefficients.

Instructions

1. General introduction

In this experiment, you will be paired with another person. In each pair, one person will be Player A and the other will be Player B. You will be participating in a game, which will be explained later. During this experiment, you will be asked to make a number of decisions, and you will change pairs each time you make a decision so that you are paired with the same person only once. The experiment is strictly anonymous; that is, your identity will not be revealed to others, and others' identities will not be revealed to you.

2. Rules of the game

Please review and ensure that you understand the rules of the game by referring to the following figure. Every time you make a decision, a figure similar to the one below will be displayed, but the values in the figure will change.

1. In the first stage, Player A will make two decisions based on the amount of money in the game. For the first decision, Player A must choose W or Z . If Player A chooses Z , Players A and B will receive z_A and z_B pence, respectively. If Player A chooses W , then Player B will make the decision.

For the second decision, Player A must report a belief probability from 0% to 100% in increments of 10% that Player B (partner) will choose R .

2. If Player A chooses W , then given Player A's belief probability, Player B must choose L or R . For example, if Player B chooses L , Player A receives y_A pence and Player B receives y_B pence; if Player B chooses R , then Players A and B will receive x_A and x_B pence, respectively.

Note:
The values here are examples.

3. Procedure of the experiment

Here, we will explain the tasks along the flow of the experiment. You will first make one decision as Player A and then make 45 further decisions as Player B.

1. First, a game will be displayed on your screen, and you (as Player A) will choose W or Z and reveal your belief probability that Player B will choose R based on the amount of money in the game. You will experience one trial as Player A. Your choices will be used when Player B makes their choice in the next stage.

In this experiment, many participants will make decisions as Player A, just as you did; therefore, it is uncertain whether the decision you make as Player A will be used in the next stage. If your choice is used in the next stage, you will receive money according to the choices made by both you and your partner. Therefore, if you choose Z in today's experiment and the earnings are already fixed, you will not be paid if it is not used in the experiment. We will contact you again if we have to pay.

2. Next, another game will be displayed on your screen. In this game, you will make decisions as Player B. Your partner (Player A) is one of the many participants. Player A has already made a decision, but without knowing Player A's choice, you assume that Player A has chosen W and make your own decision. Please choose L or R based on the amount of money and Player A's belief probability that you will choose R . You will play the game as Player B for 45 trials. Each time you make a decision, you will have a new

Player A, and the amount of money and the belief probability will also change. After 45 decisions, the experiment is complete.

Finally, your earnings will be equal to the amount of money you earned from the one decision you made as Player A and the 45 decisions you made as Player B multiplied by 0.07. Since your decisions directly affect you and your partner's earnings, please concentrate on the task during the experiment. This concludes the instructions.

References

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