DEONTOLOGICAL GUILT AND DISGUST SENSITIVITY MODULATE MORAL BEHAVIOUR

Irene Parisi, Alessandra Mancini, Francesco Mancini, Salvatore Maria Aglioti, Maria Serena Panasiti

Abstract

Objective: Deontological Guilt (DG), and Altruistic Guilt (AG) emerge from the appraisal of violating an internalized rule or an altruistic principle, respectively. DG is strictly connected with Disgust Sensitivity and plays a key role in the development and maintenance of Obsessive-Compulsive Disorder (OCD). Previous studies investigated how DG affects responses to hypothetical moral dilemmas, however how DG and Disgust Sensitivity interact modulating moral behavior is still unknown.

Methods: STUDY 1. 46 healthy participants performed an ecological paradigm in which people can spontaneously decide to lie to obtain a reward (egoistic lie) or give it away (altruistic lie) after three emotional inductions: DG, AG or neutral. Furthermore, OCD traits, Morality, Guilt Propensity and Disgust Sensitivity were assessed by means of questionnaires. STUDY 2. 27 participants from the original sample were retested during the COVID-19 lockdown in Italy to ascertain whether the pandemic modified traits related to morality, disgust, guilt or OCD symptoms and whether these changes modulated moral behavior (measured by a task in which cheating was associated to higher pay-offs).

Results: STUDY 1. Compared to the neutral, after the DG induction participants produced less altruistic and more egoistic lies. This effect was stronger in participants with high Disgust Sensitivity. STUDY 2. During the COVID-19 lockdown participants became more sensitive to the Authority pillar of the Moral Foundations and more sensitive to Disgust: this increment in deontological morality affected (im) moral behavior depending on changes in Disgust Sensitivity.

Conclusions: Our data suggest that people with high Disgust Sensitivity are more affected by deontological inductions which translate to higher immorality, supposedly by lowering their moral self-image. These results might have important clinical implications as they suggest that addressing Disgust Sensitivity in therapy, might also decrease the effect of guilt on patients' behavior.

Key words: deontological guilt, disgust sensitivity, moral behaviour, obsessive-compulsive disorder

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Guilt is an emotion with multiple determinants that can be experienced in a variety of different situations and concerns one's responsibility for an harmful attitude or behavior (Miceli & Castelfranchi, 2018). The dualistic thesis (Mancini, 2008), proposes the existence of two different types of guilt: the Deontological Guilt (DG) related to the transgression of an internalized moral rule and the Altruistic Guilt (AG) elicited by the failure of an altruistic goal (F. Mancini & Gangemi, 2018, 2021). Although DG and AG usually co-occur in everyday life, they can be elicited separately. In fact, they serve different purposes and are characterized by specific thoughts and action tendencies. AG derives from not having behaved altruistically toward another person who is suffering or has been unjustly penalized. Importantly, no moral transgression is necessary to evoke AG. On the other hand, DG might occur without the presence of a victim and the violation of the internalized norm is necessary and sufficient (A. Mancini & Mancini, 2015; F. Mancini & Gangemi, 2018).

Mounting evidence supports the distinction between the two types of guilt. Basile & Mancini (2011) showed that it is possible to selectively induce DG and AG presenting participants a combination of facial expressions and statements related with the relative inner dialogue typically associated with the DG and AG feeling. Moreover, a neuroimaging study showed that AG induction shares the activation with brain areas underlying the theory of mind (i.e. medial prefrontal areas) (Shallice, 2001) whereas DG induction activates brain areas typical of feeling of disgust, self-reproach, and self-loathing (i.e., insula) (Rozin et al., 1999). It has been suggested that guilt in general and DG in particular may play a key-role in the genesis and in the maintenance of Obsessive Compulsive Disorder (OCD) (Gangemi & Mancini, 2017; Stewart & Shapiro, 2011). In keeping, several studies show that an induction of DG enhances obsessive-like behaviors (i.e. checking and washing) more than induction of AG (D'Olimpio & Mancini, 2014; Giacomantonio et al., 2019; Ottaviani et al., 2019). Also, OCD patients showed dysfunctional brain processing indexed by a reduced activation of anterior cingulate cortex and insula related to DG but not AG (Basile et al., 2014). Interestingly, these two types of guilt differentially influence decision making. Indeed, unlike AG, DG induction seems to boost in participants the "Do not play God/Do not tamper with Nature" principle, according to which no man -only God/Nature/Destiny – can decide who should live or die. The endorsement of this principle after DG induction has been reflected in: 1) a decrement in the tendency of deciding on behalf of others as shown by higher acceptance rate of moderately unfair offers during a third-party version of an ultimatum game (A. Mancini & F. Mancini, 2015); 2) an enhancement of deontological choices (i.e. omission options of not turning the trolley to kill one person for saving more)in moral dilemmas (Gangemi & Mancini, 2013; F. Mancini & Gangemi, 2015). In line with this, OCD patients presented with these moral dilemmas are more likely to opt for omission choices, similarly to non-clinical people when DG is induced (F. Mancini & Gangemi, 2015). However, investigating moral decision making through moral dilemmas requires participants to perform hypothetical forecasting on their choices which may be less emotionally charged than a decision in real life (Teper et al., 2011). Therefore, in study 1, we tested whether the induction of DG or AG could differentially affect participants' moral behavior in an ecological paradigm, the Temptation to lie Card Game (TLCG – Panasiti et al., 2011, 2014, 2016; Azevedo et al. 2018), where participants could decide how to assign a given payoff by lying or telling the truth. Lies can imply obtaining an undue monetary reward to the detriment of the game partner (egoistic lie) or to sacrifice a deserved reward to the advantage of the game partner (altruistic lie). There is little evidence regarding the influence of guilt on dishonesty showing that: i) guilt evoked by positive inequity (i.e. when winning a lottery at the cost of others) makes people deceptively help others (Gino & Pierce, 2009); ii) compared to anger, the induction of guilt reduces unethical behavior (Motro et al., 2016; Panasiti & Ponsi, 2017). However, the differential effects of DG and AG over moral decision making in ecological contexts remains unexplored. With respect to our experimental task, we predicted that the DG induction would make the "Do not play God/Do not tamper with Nature" principle more salient in our participants and this would be reflected in a reduction of both egoistic and altruistic lies. Moreover, we expected that the AG induction may enhance participants' altruistic goals and

lead to a higher number of altruistic choices, both lies and truths. In addition, we checked whether our effects could be different according to participants' morality (as measured by the Moral foundation questionnaire).

Finally, given the key role played by DG in the genesis and maintenance of the OCD symptoms (for a review see (F. Mancini & Gangemi, 2021), we tested whether our effects were moderated by OCD traits and by Disgust or Guilt sensitivity (typical emotions for OCD patients) (Gangemi & Mancini, 2017; F. Mancini & Gangemi, 2015; Ottaviani et al., 2019)

In study 2, part of the original sample was re-tested during the Covid-19 Italian lockdown. During the period between the 11ᵗʰ of March 2020 to the 4ᵗʰ of May 2020, the Italian Government adopted extraordinary measures to contain the spreading of the virus SARS-Cov 2. Our aim was to test whether the increased focus toward virtuous behaviors as well as the attention to rules and restrictions may have influenced the importance attributed to deontological aspects of morality. Indeed, as suggested by Troisi (2020) the psychological mechanisms implicated in the response to the pandemic (i.e. disgust and fear) may have had an impact on aspects that pertain to social psychology (i.e. xenophobia, conformism, and authoritarianism). To this aim, we tested for pre- post pandemic changes in individual differences concerning morality, OCD symptoms, Disgust and Guilt sensitivity. Moreover, we tested whether these changes could influence participants' moral behaviour. To do so, since participants were already debriefed about the real scope of the TLGC, we used a different task, the Spot the Difference task (Scattolin et al., 2021), where participants are tempted to misreport the number of differences found between two images in order to get a monetary reward.

STUDY 1

Materials and Methods

Participants. Based on the effect sizes obtained in a previous research where the same experimental paradigm and similar manipulations were used (eta squared= 0.1) (Panasiti et al., 2011), we performed a power analysis (power = 0.80; α = 0.05) for a within subjects ANOVA 2x3 with the software More Power 6.0.4. (Campbell & Thompson, 2012) that estimated a sample of N = 46 to be adequate.

Careful recruitment procedures guaranteed that participants were naïve to research involving online interactions with other participants. A total of 53 healthy participants, between 18 and 45 years old, voluntarily took part to the experiment. Seven participants were excluded from the analysis because they did not conclude the second session (3 females) or they did not believe they were actually playing with a real opponent (2 males and 2 females; for details see 'manipulation check' section below). Thus, the final sample included 46 participants (23 females, age between 19,5 and 44,3 years, mean=29.35). An exclusionary criterion was the presence of prior diagnosis of any psychiatric disorder. All subjects signed a written informed consent form prior to enrollment and again after the debriefing. During the recruitment phase, as part of the cover story, participants were told that they would receive a variable amount of money depending on their decisions during the task, when actually they were all paid the maximum amount (15 €) for their participation. The experimental protocol was approved by the independent Ethics Committee of Guglielmo Marconi University (Telematic-Via Plinio

44 – Rome, Italy) and was carried out in accordance with the principles of the 1964 Declaration of Helsinki. The data collection has been carried out between June and October 2019.

Experimental task. Subjects performed *The Temptation to Lie Card Game (TLCG* – Panasiti et al., 2011) which is a paradigm developed to elicit a moral conflict raised by the opportunity to spontaneously deceive another person in order to obtain a monetary reward. It implies that two players interact in a two cards game where an ace of heart is associated with gain and an ace of spades is associated with loss. One player is the participant, while the other is the opponent. The opponent starts by picking one of two covered cards that can be either a winning or a losing card, without knowing which card they picked. Crucially, the uncovered card is visible only to the participant who has to communicate to the opponent the outcome of their choice. The participant has the chance to either tell the truth or lying and reverse the original outcome of the game. This paradigm is a zero-sum game in which only one of the two players can obtain the monetary reward associated to each trial. Specifically, the TLCG presents two possible situations to the participant: when the opponent picks the winning card, the outcome is unfavorable for the participant, and thus lying produces a self-gain that leads to a personal reward (egoistic lie); conversely, when the opponent picks the losing card, the participant faces a favorable situation, and lying produces a gain for the opponent (altruistic lie). As cover story, participants were told that we randomly assigned people to one of the two possible groups namely the card picker and the outcome communicator. Participants were selected as outcome communicators. They were also told that each choice was associated with a variable unknown amount of money. This procedure allowed us to rule out the possibility that the participants performed any trial-by-trial computation of gain/loss. The TLCG was repeated three times, each after hearing a different induction-story (for details see section 'Emotional inductions' below). Each time participants were matched with a different opponent randomly assigned by the computer, identified just as a number in order to avoid any effect related with the opponent's personal characteristics. Participants were told that their compensation as well as the opponents' one depended on the amount of money won during the TLCG .

Emotional inductions. Each participant performed the TLCG three times. Before completing the task, they were required to listen to one of the three audio-stories that have been previously recorded and used to successfully induce AG, DG and a neutral emotional state (D'Olimpio & Mancini, 2014; Ottaviani et al., 2019). The second-person was used in all the audio scripts (e.g. "You are") and adapted to the participant's gender. They were asked to immerse themselves in the situation described. Different stories were used for men and women to induce DG in accordance to a preliminary validation of the audio stimuli (D'Olimpio & Mancini, 2014). The scripts consisted in a vivid description of one of the following scenes: (a) betraying one's own beloved boyfriend and lying to him about it (DG, female version); (b) taking one's own father's car against his will, damaging it and lying to him about it (DG, male version); (c) witnessing an old woman being stolen of her pension without doing anything to prevent it (AG, male and female versions); (d) travelling on a train going to university observing people around (neutral induction, male and female versions).

Visual analog scales (VAS). Participants were required to rate their emotional status by selecting with the mouse one point along an horizontal bar (VAS: 0 = not present, 100 = very intense). They were asked to rate the intensity of 11 emotions: DG, AG, shame, sadness, anger, fear, disgust, pity, happiness, pride, efficacy. In accordance with the procedure used in previous studies (D'Olimpio & Mancini, 2014; Ottaviani et al., 2019) each emotion was identified through its name and a brief description including feelings, a typical verbal expression and an action disposition. For example, the VAS description for DG was: feelings of guilt related to a moral transgression, regret and need to confess, atone or apologize – "Oh no, what I have done? How could I have done this?"; whereas the VAS description for AG was: feelings of guilt and sorrow towards another person who is suffering, desire to sacrifice oneself to help or, to alleviate suffering of the victim, even at one's own expenses – "I should have helped him/her, I had the chance to do it". Participants rated their current emotional status before hearing the audio scripts (pre story) and after the induction as a manipulation check (post story).

Manipulation check. At the end of the TLCG, to determine whether participants believed the cover story, the following questions were asked : "During the game have you pictured the other player as a person who was a similar age as you?", "During the game have you pictured the other player as a person who was the same gender as you?", "Do you think the other player played according to some strategy?", "Do you think the other player is angry at you because of your behavior during the game?", "Have you played according to some strategy?", "Please rate how guilty you felt after the card game", "Did you feel involved in the game even if you were not sitting in the same room as the other player?" and "To what extent did you feel involved in the game?". Responses were provided by selecting with the mouse the answer: "Yes", "No", "I don't know". or selecting on a 5-point scale (with 1 being "not at all" and 5 "very much") the number more appropriate to describe their answer. The subjects who declared they did not feel involved or were skeptical about the fact that the Opponent was a real player were excluded from the analysis. In particular 4 persons, excluded from the analyses, declared at the end of each condition they were not involved in the game and the average rate on the Likert-scale for the question "To what extent did you feel involved in the game?" was < 2.

Questionnaires. The questionnaires were built and run through the online survey editor SurveyMonkey™ (Momentive Inc., San Mateo, California, USA, www. momentive.ai). Participants filled out the following standardized questionnaires:

-*Moral Foundation Questionnaire* (MFQ; Graham et al., 2011; italian version: Bobbio et al., 2011). It is a 30-item self-report measure which describes how much a person relies on five moral categories expressing judgments over morally relevant facts. It entails five factors, reflecting the five domains of the Moral Foundation Theory: Harm/Care, Fairness/ Reciprocity, Ingroup/loyalty, Authority/Respect, Purity/Sanctity.

-*Obsessive-Compulsive Inventory revised* (OCI-R, Huppert et al., 2007 – Italian version: Marchetti et al., 2010) as a measure of the basic dimensions commonly represented in OCD. The OCI-R is an 18-item self-report measure where participants are required to rate how much some every-day life events bothered or stressed them during the past month, using a five-point Likert Scale. It is composed by

6 factors (washing, checking, ordering, obsessing, hoarding, and neutralizing) and a total score.

-*Disgust Scale Revised* (DS-R, Olatunji, Williams, et al., 2007). It is a 25-item self-report questionnaire used to measure individual differences in sensitivity to disgust and to examine the relationships among different kinds of disgust. Participants rate their degree of disgust or repugnance if they were to be exposed to each item, using a 5-point Likert-type scale with response options ranging from "no disgust or repugnance at all (or "totally disagree") to "extreme disgust or repugnance" (or "totally agree"). It entails a total score and three subscales: Core Disgust which represents a sense of offensiveness and the threat of contamination; Animal Reminder Disgust which reflects the aversion to stimuli that serve as reminders of the animal origins of humans; Contamination-Based Disgust which refers to disgust reactions based on the perceived threat of transmission of contagion.

- Interpersonal Guilt Rating Scale (L'IGRS-15, Gazzillo et al., 2018). It is a 15-item self-report questionnaire which assesses the tendency to feel sense of guilt in relations to others. It identifies three factors: Omnipotence Guilt – an exaggerated sense of responsibility and concern for the happiness and wellbeing of other people; Survivor Guilt – refers to the experience that the attainment of good things in life is unjust to those who have not gained them, or was at the expense of those who have not obtained them; Self-hate – describes the feeling of being inherently wrong, bad, inadequate, and not deserving of acceptance, protection, love, and happiness.

Procedure. The entire study entails two sessions performed in two different days (each separated by a maximal interval of seven days – lasting approximately 30 mins each) to avoid any carry over effect of the two emotional inductions. During the first session participants completed two blocks: the first included the Neutral Induction and the second a Guilt Induction either Deontological or Altruistic, according on a counterbalanced order. During the second session participants performed the task after the induction not used in the first session. Each block was administered with the E-Prime software (Version 2.0; Psychology Software Tools, 2017) and it entailed three VAS, one Induction Story and the TLCG with 32 trials presented in a randomized order: half of the trials presented the favorable outcome (the opponents picked an ace of spade) and the other half the unfavorable outcome (the opponent picked the ace of heart).

Participants seated in front of an LCD monitor (1280 × 1024 resolution) placed 60 cm from their eyes. After being instructed on the task, they were told that they had been selected to be part of the group with the role of outcome communicators, then they performed a brief practice session consisting of six trials. Participants were told to use their dominant hand to respond and to wear the headphones before starting. During the experiment, the experimenter sat at distance of two meters from the participant and could not see the monitor, to make sure that the participant did not feel observed during the game. Participants started each block rating their baseline emotional status. Subsequently, they were asked to close their eyes and immerse themselves in the story. After the induction, subjects rated again their emotional status and completed the card game.

For the TLCG, each trial started with the presentation of a central fixation cross lasting 500 msec, followed by the presentation of the stimuli: two cards consisting in an ace of heart and an ace of spades, on a black background (see **figure 1**). The left/right position of the heart/spades ace was counterbalanced. After a 500 msec, one of the two cards became bigger, indicating the Opponent's choice. Then, participants were asked to press on a keypad either the "S" or the "D" key to select respectively the left or the right card. Selecting a card was equal to "show" the card to the opponent communicating in this way which one of the cards the participant intended to assign to the Opponent.

After each decision, a feedback message appeared on the screen communicating to the participant the outcome of the trial. Depending on the participant's decision (lie or tell the truth) in reaction to the opponent's pick (Favorable or Unfavorable for the participant) there were four possible messages: "You lost, You told the truth,", "You won, You told the truth,!", "You lost, you lied", "You won, you lied!". Four additional trials in each block were delivered randomly as attentional checks and consisted in the presentation of two identical cards: participants were instructed to avoid pressing any key and wait for the next trail. After the TLCG, participants rated again their emotional status and completed several questions as manipulation check to determine whether they had believed the cover story. Finally, participants completed personality questionnaires and were debriefed about the experiment. At the end of the data collection all participants signed up again the consent form giving their consent to the use and treatment of the collected data also for future studies.

Data handling and design. For each trial of the TLCG we analyzed participants' behavioral responses related to the tendency to lie (i.e., lie vs. truth). A 2 × 3 within-subject design was used to test the interactions and main effects of Outcome (Favorable Vs Unfavorable) x Inductions (Neutral Vs Deontological Guilt Vs Altruistic Guilt) on number of lies. The VAS scores of 11 emotions were recorded in two specific moments during the task i) pre story, baseline, ii) post-story, emotional check.

Data analysis. Differences at $p \leq .05$ were regarded as significant. Data processing was performed with SPSS 25 (IBM) and Statistica 7 Software with the exception of mixed-effects models that were performed with the statistical software R (R version 3.3.2, Team, R. C. R: A Language and Environment for Statistical Computing, 2018). We used the function glmer() from the lme4 package to run multilevel log-linear regression analyses (GLMM, "generalized mixed-effects models" – (Garson, 2013; Pinheiro & Bates, 2000) for dichotomous dependent variables. Post hoc tests were performed using the lsmeans() function from the lsmeans package and emtrends () function from the emmeans package. Different models were compared using the anova() function from the stats package in R. Model effect sizes were computed using the r.squaredGLMM() function from the MuMIn package.

Results

Emotion Induction manipulation check. In order to check the effectiveness of the emotional inductions, we ran a 3 (Induction: Neutral vs Deontological vs Altruistic, within-subject factor) X 2 (Time: Pre-Induction, Post-Induction, within subject factor) X 11 (Emotions: deontological guilt vs altruistic guilt vs shame vs sadness vs anger vs compassion vs fear vs disgust vs pity vs happiness vs pride vs efficacy, within-

Figure 1. *a)* *Schematic representation of a block. Each block started with the rating of the baseline emotional status on VAS. Then, participants listened to a prerecorded story to induce neutral emotion or deontological/altruistic sense of guilt. Before and after the card game, subjects rated their current emotional status. At the end of each block participant answered several questions as manipulation check. **b)** Exemplary trial timeline of the adapted version of the TLCG. A fixation cross (500 ms) appeared before the two cards. After 500 ms, one of the two card became clearly bigger, indicating the opponent's choice. The two cards stayed on the screen until the participants decided whether to lie or tell the truth to the opponents. Response was provided by pressing either the "S" (card on the left) or "D" (card on the right) depending on the card they intended to assign to the opponent (regardless of the card previously picked by the opponent). Then was no time limit to make this choice. Thus, a feedback appeared on the screen communicating the outcome of the trial. The figure was created by the authors*
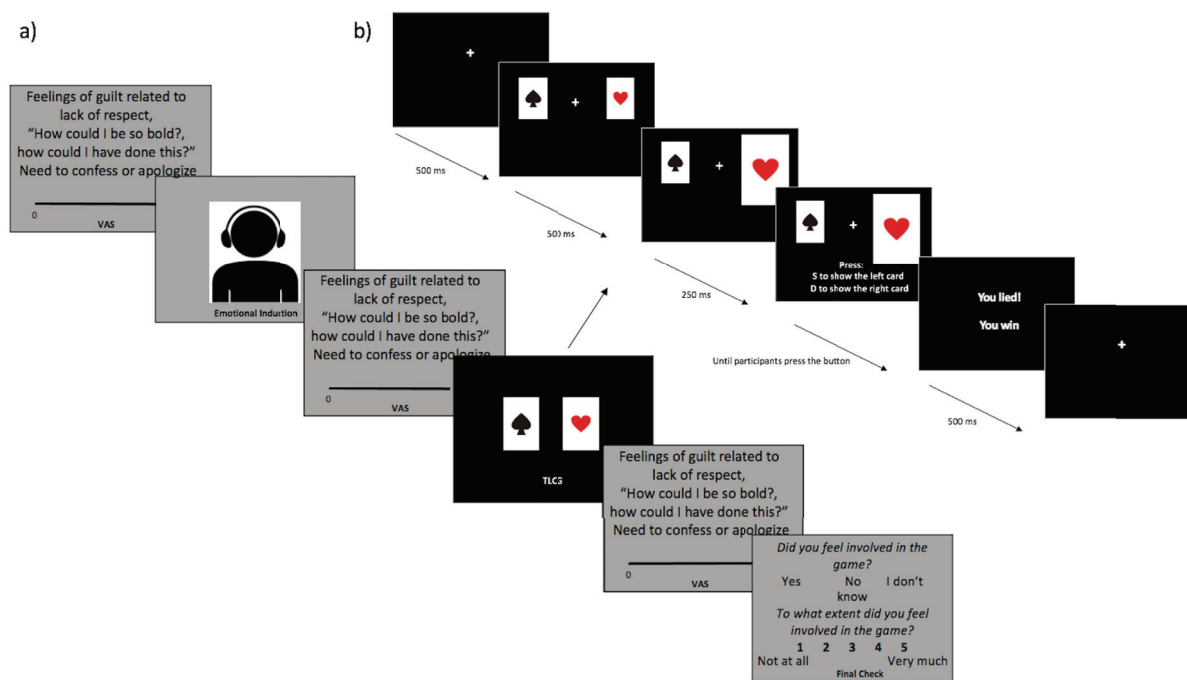
subject factor) Repeated Measure Analysis of Variance (ANOVA) on VAS scores. A significant Induction X Time X Emotion interaction emerged, F (20,1020) = 23.21, p < .001; η ² =.31. Newman-Keuls Post-hoc analyses showed that after the Neutral Induction no significant difference between pre and post induction was reported for any emotion. Compared to the baseline, after the DG induction the ratings of DG, shame, disgust and fear were significantly enhanced (p < .001). Instead, after the AG induction the VAS scores (p < .001) related to AG, sadness, pity, anger and disgust were significantly increased. For both Guilt Inductions all positive emotions (happiness, efficacy and pride) were significantly reduced (p < .001) compared to the baseline (**figure 2**).

Effects of Guilt induction on moral behavior. Due to the categorial nature of our variables, we ran a multilevel mixed log-linear regression analysis to investigate the effect of each Induction over the decision to deceive another person either for self or other gain. All the continuous variables were mean centered. Type III Wald *Anova* function from the R package *car* was used to determine the statistical significance of the fixed effects (p < .05). For significant effects, FDR-corrected post-hoc comparisons were performed with the R package *lsmeans* () function included in the R package lsmeans.

For the model we used the tendency to lie as dependent dichotomous variable (i.e., lie/truth). The fixed effects were the Outcome (Favorable and Unfavorable), Condition (Neutral, Deontological and Altruistic) and their respective interaction. In order to control for the non-independence of our data set considering that multiple responses per subject were collected, participants were considered as random factors and fixed effects and their interaction were also modelled as random slopes over participants (Barr et al., 2013).

The resulting model was:

Lies ~ (Outcome * Condition|Subject) + Outcome * Condition

The model ($R^2_{marginal}$ = 0.243, $R^2_{conditional}$ = 0.494) showed a significant *Outcome* X *Condition* interaction (χ^2 = 10.071, Df = 2, p = 0.006) that revealed the impact of the DG induction over the decision to lie for egoistic vs. altruistic purposes. In particular, the difference between altruistic and egoistic lies was larger after the DG induction with respect to the neutral condition, indicating that participants tended to be more selfish, producing less altruistic and more egoistic lies (estimate =1.113, SE = 0.381, z value= 2.920, p = 0.003) (see **figure 3**).

Personality traits. As exploratory analysis we correlated participants' personality traits with their deceptive behavior during the TLCG. For each participant we extracted the individual-specific slope for the significant effect found in the main analysis (i.e., the so-called 'BLUPs', best linear unbiased predictors (Bates & Pinheiro, 1998) by using the *coef* function in R, which gives the fixed effect of that interaction plus the by-subject random effect. We performed a bi-variate correlation using SPSS between BLUP for the significant effect and participants' scores on subscales of: 1) Moral Foundation Questionnaire (MFQ); 2) Obsessive-

Figure 2. *Emotional induction manipulation check. Mean scores of self-reported intensity of each emotion pre (white bars) and post (grey bars) inductions, for the Deontological (on top) and the Altruistic (on the bottom) conditions*
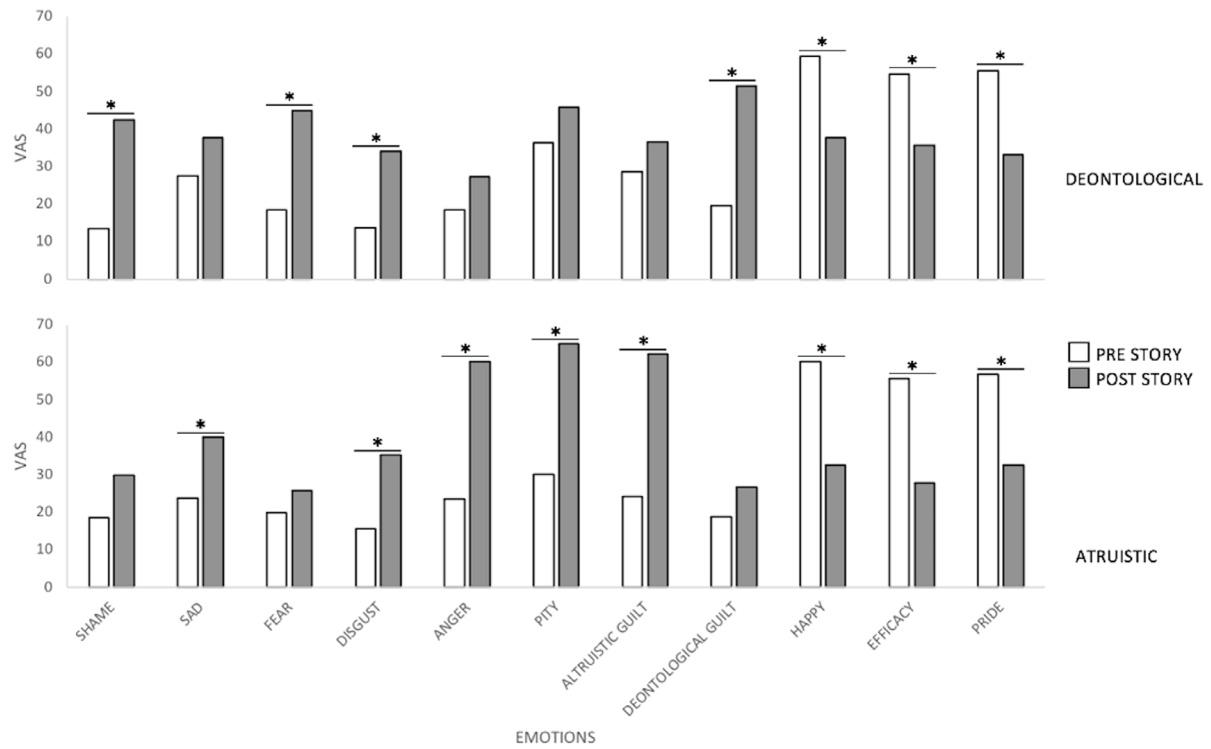
Figure 3. *Number of lies. Altruistic (Favourable Outcome) and Egoistic (Unfavourable Outcome) lies (mean ± standard error) produced after the three inductions (Neutral, Deontological, Altruistic). The difference between altruistic and egoistic lies was larger after the Deontological induction with respect to the neutral condition (p=0.0035), indicating that participants tended to be more selfish*
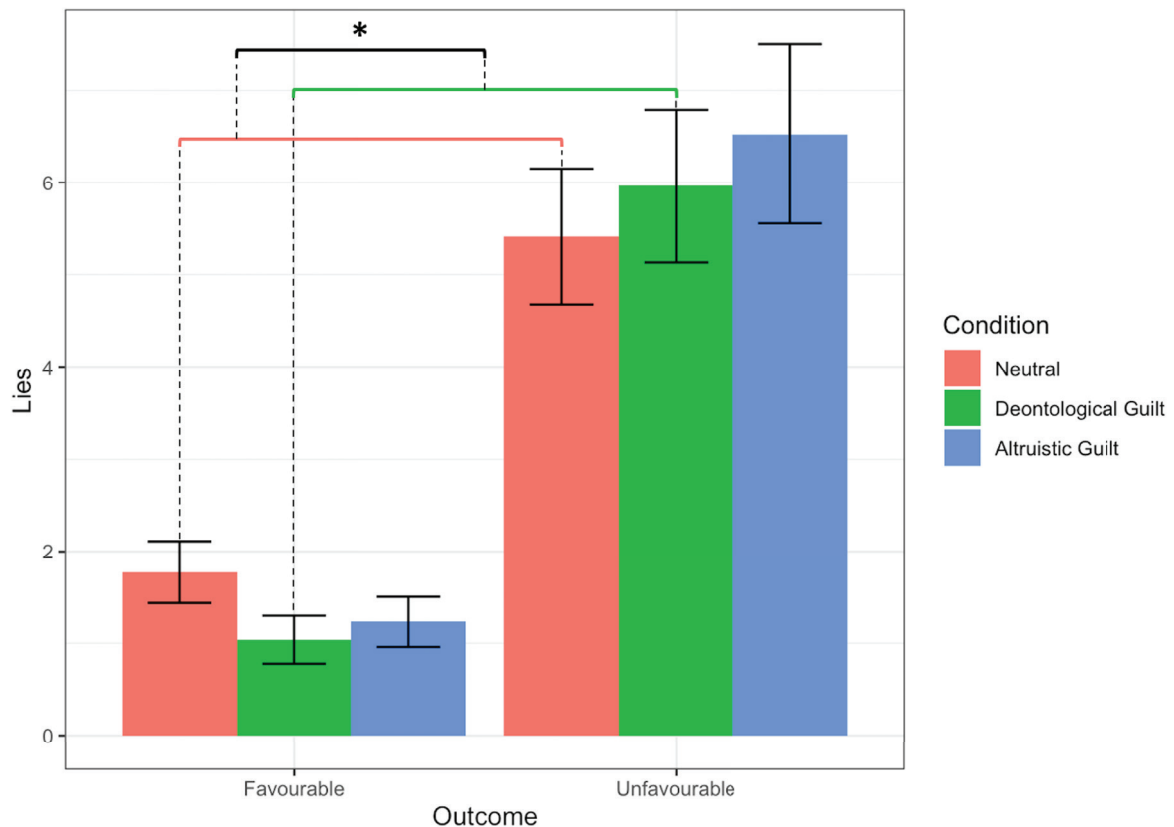
Compulsive Inventory Revised (OCI-R); 3) Disgust Scale Revised (DS-R); 4) Guilt Sensitivity Scale (GSS).

The correlations between 'Disgust Sensitivity Tot' and the BLUP for the effect of the Deontological vs Neutral induction on the production of altruistic and egoistic lies appeared marginally significant. Results revealed that the more participants were sensitive to disgust (i.e., higher scores in DS-R, subscale Tot), the more selfish they were after the DG induction (r(45) = .284, p = 0.058, two-tailed)(see **figure 4**).

Disgust Sensitivity. We further analyzed the role of Disgust Sensitivity by adding this trait as predictor in our previous model, testing whether it would fit better with our results. For our model we used the tendency to lie as dependent dichotomous variable (i.e., lie/truth). The fixed effects were the Outcome, Condition and Disgust Sensitivity (subscale TOT DS). We considered the random intercept over participants and the random slope of Condition and Outcome over participants as random factors.

The resulting model was:

Lie ~ (Outcome * Condition|Subject) + Outcome * Condition*Disgust Sensitivity

The model including Disgust Sensitivity (AIC= 2833.6) provided a significant better fit of the data (Chisq= 14.745, p = 0.02) respect of the previous one (AIC= 2836.3).

The model ($R^2_{marginal}$ = 0.254, $R^2_{conditional}$ = 0.479) showed a significant *Outcome* X *Condition* X *Disgust Sensitivity* interaction (χ^2 = 6.627, p < .05) that revealed how the impact of the Deontological Induction over the decision to lie for egoistic vs. altruistic purposes was modulated by tendency to feel disgust.

Post-Hoc pairwise comparison were estimated with the emtrends function from the *emmeans* package and indicated that the slope relative to the altruistic lies was significantly different from zero for the Neutral (estimate= 0.039, SE = 0.019, z.ratio = 2.066, p = 0.038) and the Altruistic condition (estimate = 0.043, SE= 0.02, z.ratio = 2.181, p = 0.029), indicating that the more participants were high in Disgust Sensitivity the more they lied altruistically during the TLCG. In contrast, in the Deontological condition, the slope relative to the egoistic lies was significantly different from zero (estimate = 0.075, SE= 0.031, z.ratio = 2.382, p = 0.017), indicating that the more participants were high in Disgust Sensitivity the more they lied egoistically during the TLCG.

Discussion study 1

Figure 4. *Correlation between personality trait and participants' individual-specific slope for the significant interaction (Best Linear Unbiased Predictors – BLUP s). This figure shows the association between the measure of Disgust Sensitivity (DS-R – TOT) and the Condition X Outcome interaction BLUPs on deceptive behavior. Higher scores in Disgust Sensitivity are associated with a tendency to produce less other-gain lies and more self-gain lies after the Deontological Condition*
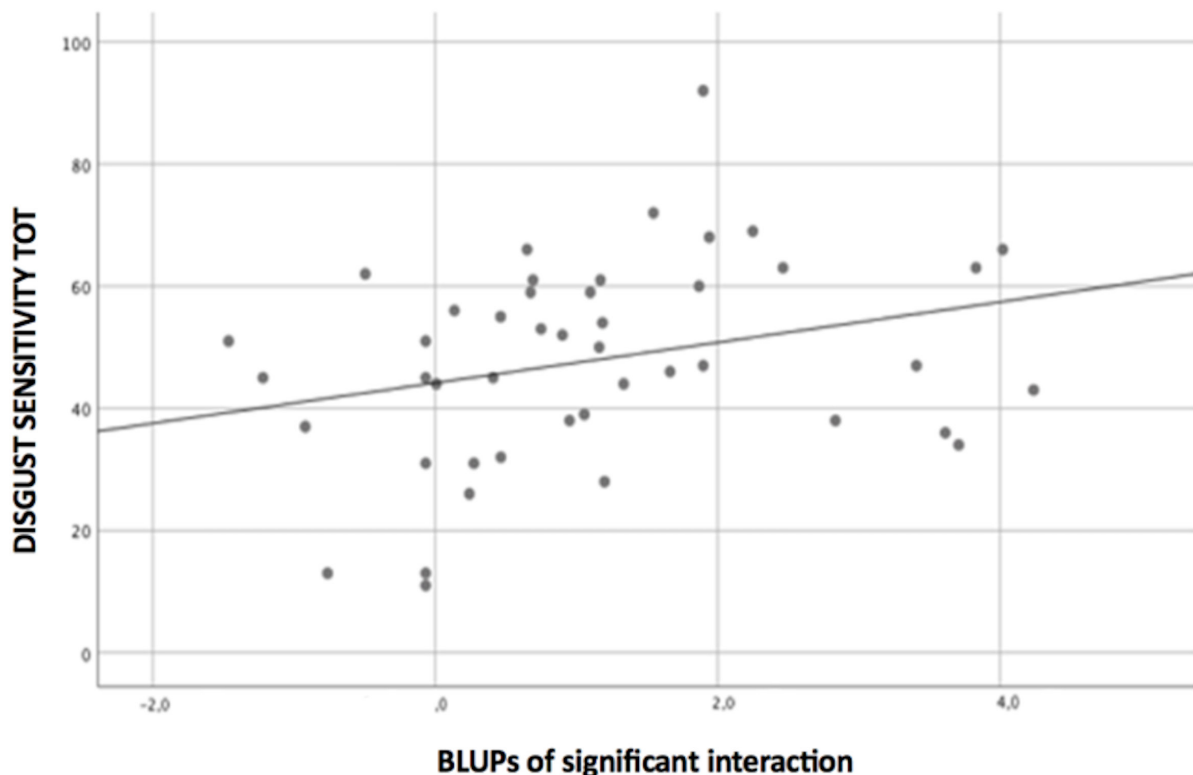
Figure 5. *Deceptive behavior related to the tendency to feel disgust. The figure shows the effect of the Disgust Sensitivity over the number of lies for each different Condition and Outcome . The slope relative to the altruistic lies (showed in red) is significantly different from zero (p<.05) for the Neutral and the Altruistic condition, indicating that the more participants were high in Disgust Sensitivity the more they lied altruistically. In contrast, the slope relative to the egoistic lies (showed in blue) is significantly different from zero (p<.05) for the Deontological condition, indicating that the more participants were high in Disgust Sensitivity the more they lied egoistically*
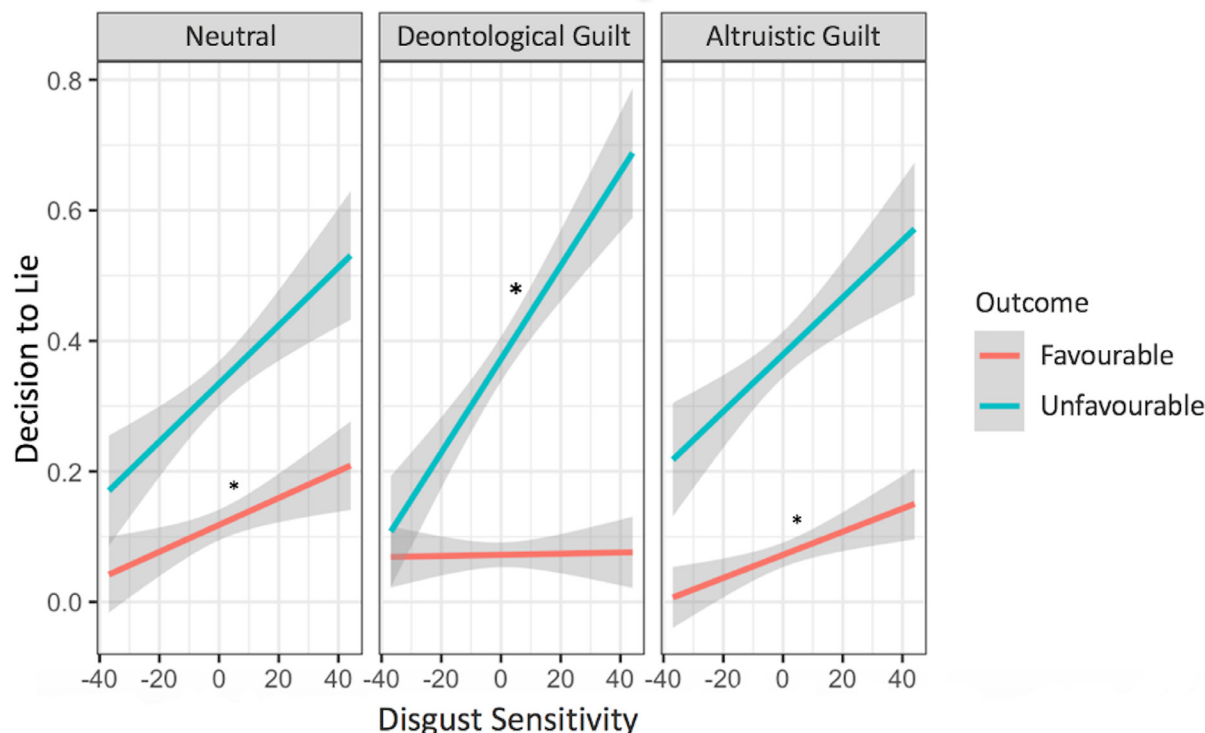
In this study we aimed at testing whether the induction of DG, AG or a neutral state could differentially modulate moral behavior in an ecological paradigm where participants had the chance to lie egoistically or altruistically. In line with previous studies (D'Olimpio & Mancini, 2014; Ottaviani et al., 2019), the emotional induction effectively evoked corollary emotions that are typically associated with DG and AG: namely, shame and fear for DG (i.e. feeling relates to self-reproach and the acknowledgement that one's own violation could be discovered); sadness, pity and anger for AG (feelings related to the acknowledgement that one's own action had caused someone else's sufferance). On the other hand, after both guilt inductions we found enhanced disgust suggesting that being in the shoes of someone who committed specific moral violations triggered an emotion associated to the willing of separating themselves from that situation (Woody & Tolin, 2002). Importantly though, it is possible that disgust elicited after the AG induction was directed toward the mugger in the story, rather than toward the self as for the DG induction. Regarding moral behavior, we found a larger difference between altruistic (less) and egoistic (more) lies after the DG induction compared to the Neutral induction. In other words, participants tended to be more selfish after imagining themselves performing deontological moral violations. This result is not in line with our hypothesis: we expected the DG induction to boost the "Not play God/Do not tamper with Nature" principle in our participants and in turn decrease any kind of lies; in contrast we found that DG induction enhanced selfishness. This result may also be in contrast with the study in which inducing deontological morality (by asking participants to read the Ten Commandments or a code of Honor), decreased unethical choices (Mazar et al., 2008). However, rather than merely enhancing attention toward deontology, in the present study we induced a guilt feeling by asking participants to imagine themselves committing a moral violation. We hypothesize that participants imagining themselves performing such immoral acts might have had a detrimental effect on their moral image, resulting in a loss of their personal value which in turn enhances selfish/immoral behaviour. Alternatively, it is possible that the emotional burden associated to DG induction may have promoted selfishness in order to buffer the associated distress.

Finally, we found that increment in egoism after that the deontological induction was stronger in people with high Disgust Sensitivity. Interestingly, people high in Disgust Sensitivity tended to increase the altruistic lies in neutral or altruistic guilt induction conditions. This pattern of results suggests that the deontological induction is particularly effective in enhancing egoism in high disgust sensitivity people, probably because their moral image is particularly weak and permeable to this specific emotion.

STUDY 2

Materials and Methods

Participants. All subjects that took part to Study 1 have been invited to take part to another online study during the Covid-19 pandemic. Due to the lockdown, the entire procedure was carried out online through the free website PsyToolkit (Stoet, 2017). 27 participants from the original sample completed this second experiment (14 females, age between 20 and 44 years, mean=29.41). Participants were paid 2,80 € for their participation and an additional amount of money depending on their decision during the online game, ranging from 0,20 € to 11,7 €. The experimental protocol was approved by the Ethics Committee of Fondazione Santa Lucia (Via Ardeatina, 306, 00142 Roma) and the data collection was carried out between the 24th of April and the 3rd of May 2020 (i.e. during the first COVID-19 lockdown in Italy that ended on the 4th of May 2020).

Main experimental task. Participants' (im)moral behaviour was assessed using a Spot the Difference Task (STDT, Scattolin et al., 2021 – Preprint) in which they were presented with pairs of images in the middle of the screen and asked to find as many differences as they could in 45s (see **figure 6**). A countdown was displayed on the top center of the screen while numbers from 0 to 10 were shown on the bottom: participants were instructed to click on the number corresponding to the differences they had found, once the countdown was ended. They were informed that images in each pair differed for 10 details and that, when given the same amount of time, most people only found 5 differences. All participants completed the task twice, with different pairs of images and under two different conditions, reward and no reward: in the no reward condition, they would gain 0.10 € for completing the task; in the reward condition, in addition to the 0.10 € for partaking, participants also received 0.30 € for each difference above five they reported finding, as well as 10 € if, at the end of data collection, they were among those who found the highest number of differences. Crucially, images in each pair differed only for five details, so any response above this number was considered a lie.

Questionnaires. The experiment was part of a broad project aimed at investigating the effect of the lockdown over Body Ownership, Sense of Agency, Moral Identity and Moral Behavior during the Covid-19 pandemic. The present study focuses on the MFQ, the DS-R, the OCI-R and the IGRS, questionnaires that participants filled out for the second time.

Procedure. The experiment started with an initial part where the information sheet, the consent form and the data treatment information were delivered. Participants were free to withdraw their participation or to continue after giving their consent by selecting the relative check box. All subjects completed a first block of socio-demographic and sanitary questions (for these questions participants had the chance to select the box "Prefer not to answer"). Then, subjects completed the STDT which consisted in two randomized blocks (reward and no reward) counterbalanced across participants. Also the pairs of images used for the reward and the no reward condition were counterbalanced. After the task, participants completed the same questionnaires of Study 1 delivered in a randomized order. Finally, participants were debriefed about the experiment and at the end of the data collection they signed up again the consent form that authorized the use and storage of their data. The entire study lasted 30-40 mins in total.

Data analysis. Differences at $p \le .05$ were regarded as significant. Data processing was performed with

Figure 6. *Example of Spot The Difference Task (STDT) trial (Scattolin et al., 2021 – Preprint)*
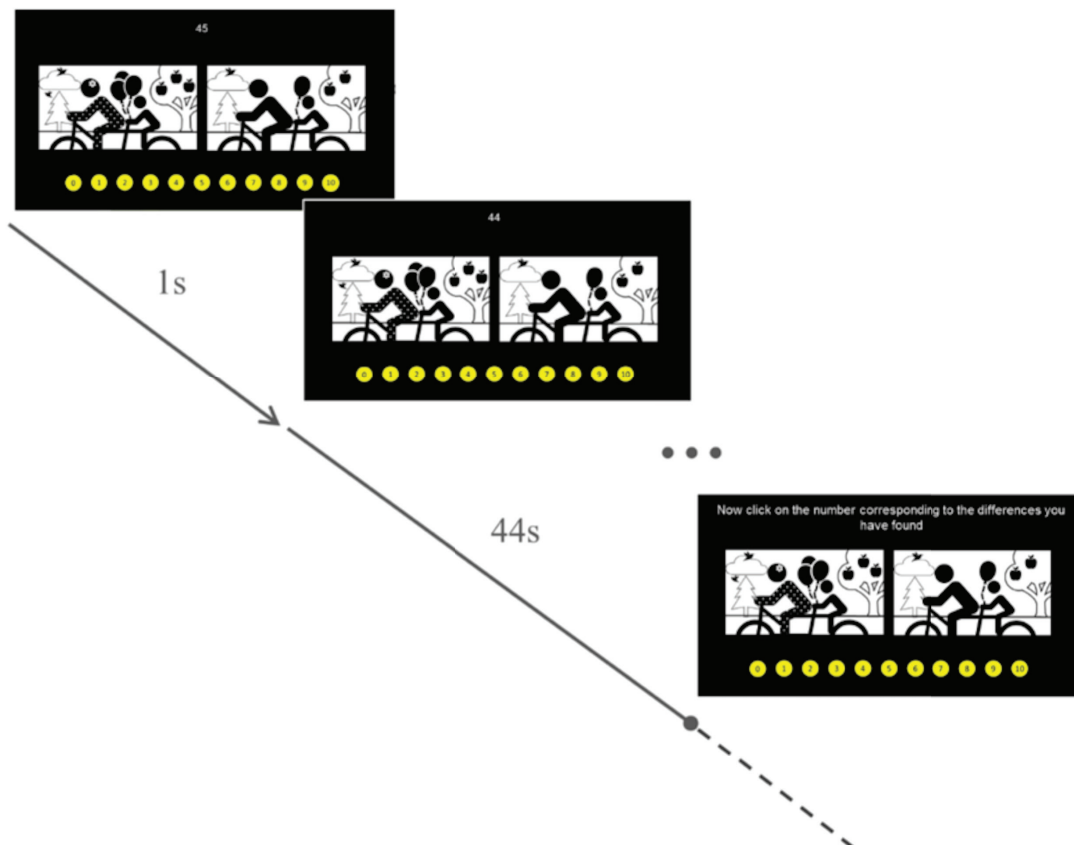
SPSS 25 (IBM). We performed a series of paired t-test in order to compare changes in personality measures. To assess differences relatives to the number of Lies in the Reward and the No-Reward condition we conducted a one-tailed t-test against 0. Lies were calculated by subtracting the actual number of differences (five) from the response of participants: results smaller than or equal to zero were coded as zero. Finally, we conducted a Moderated Multiple Regression to investigate whether the relationship between changes in morality and participants' immoral behavior (lie) was influenced by Disgust Sensitivity.

Results

Changes in individual differences during the COVID 19- Italian lockdown. To check whether the restrictions determined by the Covid-19 pandemic caused a shift on individual differences, we performed a series of two tailed Paired Samples t-test comparing questionnaires' means used to evaluate participants' moral values (MFQ), Disgust Sensitivity (DS-R), OCD symptomatology (OCI-R) and guilt propensity (IGR) filled in the pre-covid (PRE) and during-lockdown (POST) phase. Results revealed that the mean scores reported during-lockdown were significantly higher compared to scores reported pre-covid for: MFQ-Authority (t = 2,478(26), p = 0.02), Disgust Sensitivity TOT (t = 3. 525(26), p = 0.002), Disgust Sensitivity Core (t = 2,357 (26), p = 0.026), Disgust Sensitivity Contamination (t = 3,793 (26), p = 0.001), Disgust Sensitivity Animal Reminder (t = 2,36 (26), p = 0.026) and OCI-Washing (t = 4,216 (26), p < .001). Mean score reported for OCI-Hoarding during the lockdown were significantly lower (t = -2,49 (26), p = 0.019) (**table 1**).

STDT. To test our hypothesis wherein the number of lies in the reward condition would be different from the number of lies in the no reward condition we performed a one tailed t-test against 0 (where 0 corresponded to a number of reported differences of 5 or below 5). Results showed that for the No-Reward condition the number of lies produced by participants (M = 0.07, SD = 0.266) was not different from 0 (t = 1.442, df = 26, p-value = 0.081). Conversely, the number of lies produced for the reward condition (M = 0.370, SD = 1.043) was significantly different from 0 (t = 1.844, df = 26, p-value = 0.038). As expected, participants tended to produce more lies in the self-gain situation.

Moderation of Disgust Sensitivity. To analyze whether the increase in morality (as inferred from the enhancement in the Authority Pillar of the MFQ)

Table 1. *Table shows means, standard deviations, t and p values of Pre-covid (PRE) Vs During-lockdown (POST) comparisons*

Questionnaire	Mean	N	Std. Deviation	Std. Error Mean	t	p
PRE Disgust Sensitivity TOT	47.04	27	18.71	3.60	3.525	.002
POST Disgust Sensitivity TOT	53.52	27	18.73	3.60		
PRE Disgust Sensitivity CORE	1.99	27	.73	.14	2.357	.026
POST Disgust Sensitivity CORE	2.18	27	.73	.14		
PRE Disgust Sensitivity CONTAMINATION	1.24	27	.88	.17	3.793	.001
POST Disgust Sensitivity CONTAMINATION	1.65	27	.76	.14		
PRE Disgust Sensitivity ANIMAL REMINDER	1.85	27	.94	.18	2.360	0.26
POST Disgust Sensitivity ANIMAL REMINDER	2.11	27	.93	.18		
PRE AUTHORITY MFQ	12.63	27	5.42	1.04	2.478	.020
POST AUTHORITY MFQ	14.78	27	5.61	5.61		
PRE WASHING OCI	.89	27	2.43	.27	4.216	.000
POST WASHING OCI	2.89	27	2.43	2.43		
PRE HOARDIG OCI	2.81	27	2.94	.56	-2.490	.019
POST HOARDIG OCI	1.85	27	1.93	.37		

due to the pandemic had an effect on moral behavior in our task and whether this effect was moderated by Disgust Sensitivity we conducted a Moderated Multiple Regression using Hayes' Process Macro v3.5. with SPSS (Hayes, 2017). In particular, our hypothesis was that the relationship between increased values of Authority and number of Lies produced in order to obtain a monetary reward was moderated by the enhancement in Disgust Sensitivity. For this purpose we computed the pre/during-lockdown difference in participants' scores in the Authority MFQ subscale (Increase in Authority) and DS-R subscale TOT (Increase in Sensitivity). Following this approach, we predicted Lies (Y) from Increase in Authority (X) with Increase in Disgust Sensitivity (W) serving as a moderator of that relationship.

The two continuous predictors were mean-centered. The *Increase in Authority* x *Increase in Disgust Sensitivity* interaction was statistically significant (b = .014, se = .005, p = .017), indicating that the effect of the increment in Authority on the Number of lies was moderated by participants' levels of Disgust Sensitivity.

The Johnson-Neyman technique was used to identify the regions in the range of the moderator variable when the effect of Increase in Authority on lies was statistically significant. It showed that for low levels of Increase in Disgust Sensitivity (mean-centered scores between -19. 418 and -6.755) a higher Increase in Authority was related to a decrease in dishonesty (b = -.309, SE = .123, t = -2.505, p = 0.019). However, for high level of Increase in Disgust Sensitivity (mean-centered scores between 13.749 and 21.518), high levels of Increase in Authority corresponded to an increment in dishonesty (b = .278, SE = .120, t = 2.317, p = 0.029).

Discussion study 2

The significant enhancement in the Authority pillar of the MFQ indicates that the pandemic condition affected participants' morality. Attention toward strict rules might have influenced the importance attributed to authorities and norms, making more prominent the need to comply with them. As expected, Disgust Sensitivity resulted significantly increased during the lockdown and this could be reasonably related to a defensive mechanism aimed at preventing contamination during the pandemic. Interestingly, we found that this increment in morality (Authority) was related to higher honesty in people who reported a little change in Disgust Sensitivity and to higher dishonesty in people who reported bigger changes in Disgust Sensitivity during the pandemic. Results found in Study 2 corroborate previous findings providing further evidence that an increment in deontological morality can differentially affect moral behavior depending on participants' Disgust Sensitivity.

General Discussion

The aim of this research was to investigate the effects of Deontological and Altruistic guilt on (im) moral behavior and to check whether these effects could be moderated by differences in participants' morality or OCD related traits or emotions. For this purpose, in study 1, we manipulated participant's emotional state in three different conditions (Neutral, DG, AG) through an induction procedure which required them to immerse themselves in a pre-recorded story (D'Olimpio & Mancini, 2014; Ottaviani et al., 2019). After the induction we asked participants to play the TLCG, an experimental paradigm where they can decide

whether to lie or not to another person, egoistically or altruistically. In study 2, we re-tested a subsample of the participants from study 1 during the Covid-19 Italian lockdown and checked: i) whether the situation modified traits and individual differences related to morality, disgust, guilt, or OCD related symptoms; ii) whether these changes influenced moral behavior as measured by a task where cheating was associated to a monetary reward (STDT).

In line with findings which show that deontological guilt enhances the 'Do Not Play God/Do not tamper with Nature' principle (Gangemi & Mancini, 2013; F. Mancini & Gangemi, 2015), and altruistic guilt enhances cheating to help others (Gino & Pierce, 2009), in study 1, we expected the deontological induction to decrease both kinds of lies (egoistic and altruistic) and the altruistic induction to enhance both kind of altruistic behavior (lies an truths). We found that the DG induction was associated with and increment of selfish behaviors (less altruistic and more egoistic lies). It is worth noting that previous studies investigated the effects of DG and AG inductions on theoretical moral dilemmas where no reward was associated with participant's choice. On the opposite, our ecological paradigm allowed us to explore the effects of those type of guilt when participant's behaviour was directly associated with a monetary outcome. It is possible that participants' experience of imagining themselves violating an internalized moral rule during the DG induction might have determined a redefinition of their moral self-concept, promoting a behavior in line with a reduction of morality (more selfish). The impairment of the moral self-concept was even stronger when taking into account participant's Disgust Sensitivity: the more participants were sensitive to disgust, the more selfishly they behaved (by increasing egoistic and decreasing altruistic lies) after the DG induction compared to the Neutral. According to a recent integrative model – the Social Cognitive Chain of Being (SCCB – Brandt & Reyna, 2011) – humans tend to organize their own moral world along a vertical axis, that ranges from immorality (down) up to virtue and sanctity. This vertical moral hierarchy is used to judge others as well as the self. The position along the chain of being can be changed depending on motivations and appraisals across time. Moral emotions, such as guilt and shame, shape our perception of targets' position along the Chain of Being, guiding social judgments and decision making. According to this theoretical framework we argue that "embodying" a character violating an introjected moral rule during the DG induction, may have promoted a downgrading of the self-perceived moral image leading to a behavior compatible with this reduction. In keeping, Virtual Reality studies show for example a modulation of attitudes, behaviors and cognitive processing related to the embodiment of an avatar with specific abilities: in particular embodying superhero-like avatars (such as Superman) promotes prosocial behavior (Rosenberg et al., 2013; Yoon & Vargas, 2014) while embodying super-villain avatars (such as Voldemort) increased antisocial actions (Yoon & Vargas, 2014). In line with our interpretation, Knouchaki and colleagues (2018) across eight studies tested the bidirectional causative role of immoral behavior on self-dehumanization. They found that unethical behavior leads to subsequent self-dehumanization, and that self-dehumanization can in turn lead to downstream dishonesty (Kouchaki et al., 2018). Indeed, since morality is a fundamental part of what makes us humans, the mere observation of oneself engaging in an immoral behavior may be enough to make people feel less human (Haslam, 2006; Haslam

et al., 2012; Kouchaki et al., 2018). In addition, it has been shown that a first transgression may facilitate the engagement of subsequent immoral conducts trough a "slippery-slope" effect (Welsh et al., 2015). We posit that, participant's unethical behavior during the TLCG in the DG condition may have been boosted by the first moral violation experienced through the DG induction.

Importantly, the enhancement of selfishness after DG was stronger in participants high in Disgust Sensitivity, suggesting that for these participants the experience of imagining themselves committing a violation of a deontological rule had a stronger impact on their moral image and consequently on their immoral behavior. This is in line with studies showing that higher disgust propensity enhanced self-disgust which in turn was associated with persistent negative body image (von Spreckelsen et al., 2018) and with a higher motivation for restrained eating behaviors when the body mass index was high (Spinelli et al., 2021). Moreover, higher self-disgust was associated to increased psychopathy and Machiavellianism, two personality traits associated with immoral behavior and with less punishment of severe transgressions (Olatunji et al., 2012).

Moreover, Disgust Sensitivity has been associated to greater presence of contamination symptoms commonly observed in OCD (Deacon & Olatunji, 2007) like washing and checking (F. Mancini et al., 2001). The sensation of dirtiness elicits a stronger tendency to judge oneself more negatively from a moral point of view (Tobia, 2015), confirming that people high in this trait might have a more malleable moral image.

It is worth noting that AG induction did not modulate deceptive behavior in our task. We speculate that, contrary to DG, AG is a kind of guilt that does not determine a modification of the self-perceived moral value. Although theorists report that the emotion of Guilt involves feelings of tension, remorse, and regret, but does not affect one's core identity (Eisenberg, 2000), here we hypothesize a modulation of the moral self-concept after the DG but not AG induction.

In study 2, by comparing pre-/ during- COVID-19 lockdown participants' measures of morality and OCD symptoms and emotions, we found higher scores for Disgust Sensitivity, Core Disgust, Contamination and OCI-Washing. These results are in line with recent findings showing an impact of the Covid-19 pandemic on Disgust Sensitivity and hygiene behaviors (Stevenson et al., 2021). In an evolutionary perspective, disgust is an emotion functional to body defense against toxicity and diseases (Rozin et al., 2008) and an increment in Disgust Sensitivity in a pandemic context may have several functional benefits (i.e. hand and food-related hygiene). Moreover, we also found an increment of sensitivity to the Authority that indexes the extent to which people consider relevant virtues of leadership and followership, including deference to legitimate authority and respect for traditions. In Italy a list of the Decrees has been issued by the Italian Prime Minister with the measures adopted to contain the spread of the Covid-19. In this context it is reasonable that the enhancement in the Authority pillar might be related to the importance attributed to the authorities dealing with the emergency and promoting a strict observance of rules and restrictions. In line with that, it has been suggested that conformism and authoritarianism might represent two social effects of the psychological adaptations to avoid infection: people might exhibit conformist attitudes under conditions in which they perceive that they are more vulnerable to infection (Troisi, 2020). Moreover, It has been shown that the presence of an authority prototype like a judge

or a policeman determines the preference for the deontological choices in moral dilemmas (Gangemi & Mancini, 2013). Interestingly, we found that the enhancement in deontological morality (Authority) could differentially affect moral behavior depending on participants' increment in Disgust Sensitivity. In particular an increment in Authority was related to higher honest behavior in people who report a little change in Disgust Sensitivity. This suggests that for little increment in Disgust Sensitivity, the enhancement of moral standards (Authority) promotes honesty, probably by determining a more rigorous judgment of one's own behavior. Differently, for bigger increment in Disgust Sensitivity, an increment in sensitivity to Authority, translated to higher dishonesty. It may be possible that due to the pandemic emergency, people highly sensitive to disgust may have perceived their body as fearful becoming hypervigilant about any changes that might be a sign of the COVID-19 infection (Schimmenti et al., 2020). Feeling anxious for diseases has been associated with an enhanced body vigilance (Olatunji, Deacon, et al., 2007) and attention toward visceral cues has been reported to be related to impulsive and dishonest behavior (Ditto et al., 2006; Williams et al., 2016). Moreover, the differential effect of low vs. high Disgust Sensitivity on moral behavior has been reported by at least two studies which highlighted that when primed with disgusted faces: i) during hypothetical moral dilemmas, those with high Disgust Sensitivity found the utilitarian actions more acceptable, while the ones with low-sensitivity found them less acceptable (Ong et al., 2014); ii) those with high sensitivity to disgust behaved more dishonestly while the ones with low sensitivity were more honest (Lim et al., 2015). The authors interpreted the above-mentioned results suggesting that high Disgust Sensitivity (compared to low) may determine a decrement of concern for social blame translate to a more immoral and utilitarian behavior.

Future investigations should test whether differential effect of low vs high disgust on morality which is triggered by deontological or disgust stimuli is explained by an increased distance between moral self-image and moral standards (as we suggest) or by a drop in reputational concerns.

Limitations. The present study is not exempt from limitations and replication is needed. Although our paradigm did not abolish the participants' tendency to act in a socially appropriate and sensible manner, it was effective in pushing participants towards deception (Panasiti et al., 2011). Indeed, receiving instructions by the experimenter on the possibility to freely decide to reverse the outcome of the game by lying might have promoted an effect of self-licensing facilitating deceptive behavior. Moreover, although the emotional guilt inductions have been previously successfully used to elicit Deontological and Altruistic guilt separately, the stories used are not culture/gender free. To guarantee the replicability and the generalizations of results future studies might opt for a different emotional induction methodology to elicit DG and AG (Basile et al., 2011, 2014; Basile & Mancini, 2011).

Conclusion. The results of these two studies point at an important role played by Disgust Sensitivity as a moderator of the effect of enhanced deontological guilt or morality on moral behavior. This is particularly crucial as maladaptive disgust is not only present in a wide range of psychopathologies (Knowles et al., 2019) but is also resistant to exposure-based therapies (Mason & Richardson, 2012; Olatunji, Forsyth, et al., 2007). Future studies should assess whether reducing disgust might dampen the impact of deontological guilt

on moral behaviour. At this purpose a recent research showed that an inhibition of insular activity through a cathodal tDCS procedure could be implemented as a treatment to reduce OCD symptoms (Salvo et al., 2021). Also real-time fMRI biofeedback protocols focused on regulating insular activity (Buyukturkoglu et al., 2015), as well as use of drugs (such as domperidone in Nord et al., 2021) could be used for symptom alleviation in OCD disorder by acting on disgust. Moreover, targeting patients' early experiences of guilt-inducing reproaches through Imagery Rescripting (ImR), an experiential technique, often integrated in the context of Schema Therapy and aimed at modifying the meaning attached to early aversive experiences (Hagenaars & Arntz, 2012), is effective in reducing OCD symptomatology (Tenore et al., 2020). Previous studies, found that that imagery manipulation and cognitive reappraisal were superior to control conditions in changing current levels of disgust in the contamination subtype of OCD (C-OCD) (Fink et al., 2018), confirming the promising power of imaginative techniques in addressing disgust in OCD. These evidences confirm a prominent role of disgust on the relation between Deontological guilt, responsibility and OCD symptomatology, suggesting that the combination between a neural based intervention on Disgust Sensitivity and a psychotherapeutic treatment focused on deontological guilt might favor a better outcome of the clinical treatment.

Acknowledgements

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