**The level of construal involved in the elicitation of core vs. moral disgust**

**Online supplement**

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1. **Pretests**

**Pretest A (for the pictures used in Experiment 1)**

Ninety-nine MTurk workers (40% women, *Mage* = 36.86, *SD*= 11.50) were presented with 24 disgusting images. For each image, the participants rated the extent to which each image elicits disgust and repulsion (0 = not at all, 100 = very much) and selected the category to which the picture belongs (core disgust, moral disgust, both, or neither). In the beginning of the pretest, we explained the meaning of core and moral disgust (see <https://osf.io/tvfwy/>, for a detailed description of the materials and results).

We chose images based on several criteria. First, for each category, we chose images that participants judged as belonging more to the corresponding category of disgust than to the other three options. Second, we included only images that their mean disgust rating was above 45. This resulted in four valid moral disgust images and 12 valid core disgust images. Next, we chose four core disgust images that matched in their overall disgust level to the mean disgust level of the four valid moral disgust images.

**Pretest B (for the pictures used in Experiments 3-5)**

Two hundred and five MTurk workers (39% women, *Mage* = 35.15, *SD*= 10.29) were presented with 25 disgusting images, out of 93 possible images. For each image, the participants rated the extent to which each image elicits disgust (0 = not at all, 100 = very much) and provided a brief description of the image. Next, participants rated the extent to which each of the following was responsible for their feeling disgust: (a) the specific details in the image, and (b) the violation of a moral principle/norm on two separate scales (0 = not at all, 100 = very much). Finally, participants rated the extent to which each image elicited other negative emotions: fear, sadness, and anger (0 = not at all, 100 = very much).

We chose images based on three criteria. First, based on the descriptions that participants provided, we chose images that were clear to all participants. Second, we included only images that their mean disgust rating was above 50 and was not significantly lower than the other reported negative emotions. Third, we included in the core disgust category images that participants rated as disgusting due to the specific details, as compared to the violation of a moral principle/norm (*Cohen's d* > 0.30, *BF10* > 3). We included in the moral disgust category images that participants rated as disgusting due to the violation of a moral principle/norm, as compared to the specific details (*Cohen's d* < -0.30, *BF10* > 3). Based on these criteria, we generated a pool of 15 images from each disgust category from which we chose stimuli for Experiments 3, 4, and 5 (see <https://osf.io/3cvfs/>, for a detailed description of this pretest).

1. **The Scenarios Used in Experiment 2 (Translated from Hebrew)**

**Core Disgust**

**Smell.** A young woman gets on a bus and stands in the middle of it. At the next station, an elderly man comes up and stands next to her. The man has a strong smell of sweat and urine. Due to the overcrowded bus, the girl has to stand close to the man throughout the ride.

**Rat.** A businessman goes to sleep at a motel. When he gets into bed and moves to find a comfortable position, he sees a dead rat jump on the mattress following his movements.

**Worms.** An elderly man goes for a walk in the park. He gets tired and sits down on a bench. To the side of the bench is a garbage pail. The man closes his eyes and falls asleep for a few minutes. When he wakes up, he realizes that worms are crawling up his leg.

**Vomit.** A young man is partying with his best friend. They both drink a lot of alcohol. While they dance, the friend stops and begins to vomit on his friend shoes and clothes.

**Moral Disgust**

**Picture.** A man goes to a condolence visit of a friend whose younger sister has died. He finds a picture of the sister in a bathing suit. The man shuts himself in the bathroom and masturbates in front of the picture.

**Monkeys.** Your friend watches a nature program on television. During the program, there is a close-up of two monkeys having sex. The friend feels sexually aroused following the viewing.

**Money.** A man moves into a new house. He knocks on his new neighbor's door and asks for a glass of milk. While the neighbor goes to the kitchen to bring the milk, the man steals 200 NIS in cash from the neighbor's bag.

**Friend.** A young girl tells her best friend that she went out for a first date with a good-looking guy she likes very much and that she wants to see him again. After a few days, the girl discovers that her best friend is now dating this guy.

1. **Additional Results**

**Experiment 2**

**Non-significant effects.**

***Level of construal***. The main effect of disgust type was not significant, *F*(1, 205) = 2.42, *p* = .121, *ηp2* = .01.

***Coding of essays.*** The main effects of disgust type, *F*(1, 205) = 0.21 *p* = .647, *ηp2* = .001 and construal level, *F*(1, 205) = 1.67, *p* = .197, *ηp2* = .008, were not significant.

**Experiment 3**

**Non-significant effects.**

***Coding of essays.*** The main effects of disgust type, *F*(1, 166) = 1.53, *p* = .217, *ηp2* = .009, was not significant.

**Percentage of participants who used abstract or concrete terms.**Table S1 summarizes the percentage of participants who used abstract or concrete terms (were coded higher than 0), for each of the pictures.

*Table S1*

*The percentage of participants who used abstract and concrete terms (were coded higher than 0) for each of the pictures in Experiment 3.*

|  |  |  |
| --- | --- | --- |
| Image | Concrete | Abstract |
| **Core disgust** (n = 83) |  |  |
| Cockroaches | 55% | 51% |
| A dirty toilet | 48% | 59% |
| Vomiting | 75% | 53% |
| Acne | 72% | 62% |
| A bug in a sandwich | 65% | 49% |
| Mycosis | 63% | 62% |
| **Total** | **63%** | **56%** |
| **Moral disgust** (n = 85) |  |  |
| A pedophile | 60% | 72% |
| A dog bound | 31% | 67% |
| Sex with a dog | 47% | 72% |
| Rape | 28% | 74% |
| Prisoner’s abuse | 54% | 56% |
| Ku Klux Klan | 27% | 80% |
| **Total** | **41.17%** | **70.17%** |

**Experiment 5**

**Non-significant effects.**

***Disgust ratings*.** The main effect of level of construal was not significant, *F*(1, 166) = 1.90, *p* = .170, *ηp2* = .01.

**Mediation analysis.** We found that generating categories for moral disgust images led to a greater focus on the violation of a social norm/moral principle than on the specific details of the images. Therefore, we tested if categorization enhanced the experience of moral disgust, because it increased abstract construal of the images.In Step 1 of the mediation model, the regression of moral disgust intensity on construal level, ignoring the mediator, was significant, *β* = .26, *t*(77) = 2.37, *p* = .019. Step 2 showed that the regression of elicitors difference (the mediator) on construal level was also significant, *β* = .22, *t*(77) = 2.03, *p* = .045. Step 3 of the mediation process showed that elicitors difference, controlling for construal level, was not a significant predictor of moral disgust intensity, *β* = .16, *t*(76) = 1.44, *p* = .152. Step 4 of the analyses revealed that, controlling for the mediator, construal level was still a significant predictor of disgust intensity, *β* = .22, *t*(76) = 2.00, *p* = .048.

1. **Replication of Experiment 2**

To overcome the alternative explanations for the results of Experiment 2, we conducted a replication experiment, in which we included a subset of the scenarios that were used in Experiment 2. Specifically, we used two scenarios from each condition: a dead rat in a hotel room, and worms crawling on a man's leg, for the core disgust condition; and sexual arousal from animals having sex, and betrayal between friends, for the moral disgust condition. We chose these scenarios as they did not differ in the level of disgust they elicited, *Mcore* = 6.20, *SDcore*= 2.30, *Mmoral* = 6.15, *SDmoral* = 2.43, *F*(1, 100) = 0.01, *p* = .92, *ηp2* < .001, *BF01* = 4.76, nor in their perceived likelihood, *Mcore* = 5.10, *SDcore*= 2.04, *Mmoral* = 5.27, *SDmoral* = 2.69, *F*(1, 100) = 0.13, *p* = .72, *ηp2* = .001, *BF01* = 4.52.

**Method.**

**Participants.** We planned to collect valid responses from 100 participants (25 responses for each scenario). One hundred and twenty-two undergraduate students from Ben-Gurion University in Israel completed the experiment online for the chance of winning monetary prizes in a lottery. We collected data from more than 100 participants because several participants began but did not complete the study. We excluded 11 participants who did not complete the study. The final sample included 111 participants (56% women, *Mage* = 24.28, *SDage* = 2.93).

**Procedure and materials.** The procedure and materials were identical to those used in Experiment 2, except that we used only four scenarios: two for core disgust (a dead rat in a hotel room, and worms crawling on a man's leg) and two for moral disgust (sexual arousal from animals having sex, and betrayal between friends).

**Results.**

**Disgust ratings.** Table S2 reports the average disgust ratings for each scenario. Core disgust and moral disgust scenarios did not differ in the level of disgust they elicited, *Mcore* = 6.60, *SDcore*= 2.12, *Mmoral* = 6.56, *SDmoral* = 2.16, *F*(1, 109) = 0.01, *p* = .91, *ηp2* < .001, *BF01* = 4.94.

**Level of construal.** Table S2 reports the average concrete and abstract construal ratings for each scenario. We submitted the ratings to a 2 (disgust type: core, moral; between participants) X 2 (level of construal: concrete, abstract; within participants) mixed ANOVA. The main effect of disgust type was marginally significant, *F*(1, 109) = 3.83, *p* = .053, *ηp2* = .03, and the main effect of construal level was not significant, *F*(1, 109) = 0.06, *p* = .803, *ηp2* < .001.

Replicating the results from Experiment 2, there was a significant interaction between disgust type and reported construal, *F*(1, 109) = 53.08, *p* < .001, *ηp2* = .32. Supporting our prediction, participants who read a core disgust scenario reported thinking more concretely (*M* = 5.72, *SD* = 2.32) than abstractly (*M* = 3.44, *SD* = 2.20), *F*(1, 56) = 28.07, *p* < .001, *ηp2* = .33. By contrast, participants who read a moral disgust scenario reported thinking more abstractly(*M* = 6.30, *SD* = 2.57) than concretely (*M* = 4.17, *SD* = 2.39), *F*(1, 53) = 25.15, *p* < .001, *ηp2* = .32.

As in Experiment 2, we examined whether level of construal was related to disgust ratings. For core disgust scenarios, the correlation between concreteness and disgust was stronger, *r*(55) = .48, *p* < .001, than the correlation between abstractness and disgust, *r*(55) =.29, *p* = .024. The difference between the two correlations did not reach significance, *z* = 1.01, *p* = .157. For moral disgust scenarios, the correlation between abstractness and disgust was stronger, *r*(52) =.30, *p* = .026, than the correlation between concreteness and disgust, *r*(52) =.04, *p* = .73. The difference between the two correlations was marginally significant, *z* = 1.52, *p* = .063.

**Coding of essays.**Two independent judges, different from those in Experiment 2, coded the essays using the same scales from Experiment 2. We averaged the coding of the two judges into a single index (Cronbach's α = .70, for the concreteness index, and .83, for the abstractness index).

Table S2 reports the average concreteness and abstractness coding for each scenario. We submitted the coding to a 2 (disgust type: core, moral; between participants) X 2 (level of construal: concrete, abstract; within participants) mixed ANOVA.The ANOVA yielded a main effect of coding type, *F*(1, 109) = 7.69, *p* = .006, *ηp2* = .06, reflecting that, overall, the essays included more concrete (*M* = 1.06, *SD* = 0.79) than abstract characteristics (*M* = 0.77, *SD* = 0.94). The effect of disgust type was not significant, *F*(1, 109) = 0.39, *p* = .533, *ηp2* = .003. Importantly, replicating Experiment 2A’s findings, there was a significant interaction between disgust type and level of construal, *F*(1, 109) = 131.10, *p* < .001, *ηp2* = .54. Judges rated the essays of participants who read core disgust scenarios as more concrete (*M* = 1.56, *SD* = 0.72) than abstract (*M* = 0.21, *SD* = 0.38), *F*(1, 56) = 133.96, *p* < .001, *ηp2* = .70. By contrast, they rated the essays of participants who read moral disgust scenarios as more abstract (*M* = 1.35, *SD* = 1.00) than concrete (*M* = 0.53, *SD* = 0.43), *F*(1, 53) = 29.64, *p* < .001, *ηp2* = .35.

As in Experiment 2, we examined whether the construal coding of participants' essays was related to disgust ratings. For core disgust scenarios, the correlation between concreteness and disgust was stronger, *r*(55) = .29, *p* = .025, than the correlation between abstractness and disgust ratings, *r*(55) = .14, *p* = .294. However, the difference between the two correlations did not reach significance, *z* = 0.73, *p* = .229. For moral disgust scenarios, the correlation between abstractness and disgust was weaker, *r*(52) = .10, *p* = .471, than the correlation between concreteness and disgust, *r*(52) = .24, *p* = .07, and the difference between the two correlations did not reach significance, *z* = 0.70, *p* = .240.

**Likelihood ratings.** Table S2 reports the average likelihood rating for each scenario. Core disgust and moral disgust scenarios did not differ in their perceived likelihood (*Mcore* = 5.23, *SDcore*= 2.15, *Mmoral* = 5.57, *SDmoral* = 2.16), *F*(1, 109) = 0.72, *p* = .339, *ηp2* = .006, *BF01* = 3.60.

**Discussion.**

The results of this experiment replicate the results of Experiment 2 with scenarios that did not differ in the disgust intensity they elicit or in their perceived likelihood. Overall, the results of the two experiments support the prediction that core disgust involves more concrete than abstract construal, whereas moral disgust involves more abstract than concrete construal.

*Table S2*

*Disgust rating, probability rating, reported construal, and coded construal as a function of scenario in the replication of Experiment 2.*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | n | Disgust | Likelihood | Reported concreteness | Reported abstractness | Coded  concreteness | Coded  abstractness |
| **Core disgust** |
| Rat | 32 | 7.09 (2.04) | 5.13 (2.20) | 5.59 (2.53) | 3.84 (2.41) | 1.38 (0.60) | 0.30 (0.42) |
| Worms | 25 | 5.96 (2.09) | 5.36 (2.12) | 5.88 (2.07) | 2.92 (1.82) | 1.80 (0.80) | 0.10 (0.29) |
| **Moral disgust** |  |  |  |  |  |  |  |
| Monkeys | 25 | 6.00 (2.24) | 4.40 (2.04) | 3.64 (1.98) | 5.44 (2.65) | 0.62 (0.42) | 1.00 (0.87) |
| Friend | 29 | 7.03 (2.01) | 6.59 (1.72) | 4.62 (2.64) | 7.03 (2.31) | 0.45 (0.43) | 1.66 (1.02) |

*Notes.* Standard deviations are in brackets.

1. **A Mini Meta-Analysis of Correlations between Construal Level and Disgust Intensity**

In Experiment 2, the replication of Experiment 2, and Experiment 3, we examined whether level of abstractness and level of concreteness were related to core disgust and moral disgust intensity. In Experiments 2 and the replication of Experiment 2, we measured level of abstractness and level of concreteness using both participants' self-report and judges’ coding of essays. In Experiment 3, we used coding of essays only. We conducted meta-analyses for eight fixed effects (Goh, Hall, & Rosenthal, 2016)[[1]](#footnote-1) to identify robust effects across experiments (see Table S3).

First, we conducted a meta-analysis for the *self-report measures* across Experiment 2 and its replication. The correlation between the intensity of core disgust and concreteness level was robust with a medium effect size, *r* = 0.40, 95% CI [0.268, 0.530], *z* = 5.36, *p* < .001, while the correlation with abstractness level was robust with a small effect size, *r* = 0.16, 95% CI [0.005, 0.311], *z* = 2.02, *p* = .043. The difference between the correlations was significant, *z* = 2.29, *p* = .011. The correlation between the intensity of moral disgust and concreteness level was robust with a small effect size, *r* = 0.19, 95% CI [0.038, 0.342], *z* = 1.97, *p* = .048, while the correlation with abstractness level was robust with a medium effect size, *r* = 0.32, 95% CI [0.171, 0.455], *z* = 4.09, *p* < .001. The difference between the correlations was not significant, *z =* 1.21*, p = .*113.

Next, we conducted a meta-analysis for the *coding measures* across Experiment 2, its replication, and Experiment 3. The correlation between the intensity of core disgust and concreteness level was robust with a small-medium effect size, *r* = 0.21, 95% CI [0.083, 0.326], *z* = 3.30, *p* < .001, while the correlation with abstractness level was not robust with a very small effect size, *r* = 0.05, 95% CI [-0.073, 0.181], *z* = 0.83, *p* = .406. The difference between the correlations was significant, *z =* 1.78*, p = .*037. The correlation between the intensity of moral disgust and concreteness level was robust with a small effect size, *r* = 0.12, 95% CI [0.001, 0.252], *z* = 1.97, *p* = .048, while the correlation with abstractness level was robust with a medium effect size, *r* = 0.26, 95% CI [0.142, 0.379], *z* = 4.08, *p* < .001. The difference between the correlations was marginally significant, *z =* 1.58*, p = .*056. Taken together, the results of the meta-analyses support our prediction that the elicitation of core disgust depends more on concrete than abstract construal, while the elicitation of moral disgust depends more on abstract than concrete construal.

*Table S3*

*Correlations of disgust intensity with level of abstractness and concreteness in Experiments 2-3.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Experiment | Disgust type | Self-report Concreteness | Self-report Abstractness | Coded  Concreteness | Coded  Abstractness |
| 2 | Core | *.*37\*\*\* | *.*09 | *.*28\*\* | .06 |
| Moral | .27\*\* | .33\*\* | .15 | *.*33\*\* |
| Replication | Core | .48\*\*\* | .29\* | *.*29\* | *.*14 |
| Moral | .04 | .30\* | .24 | .10 |
| 3 | Core | - | - | .06 | -.01 |
| Moral | - | - | .03 | .28\* |
| Meta-analysis | Core | .40\*\*\* | .16\* | .21\*\*\* | .05 |
| CI | [.268,.530] | [.005,.311] | [.083,.326] | [-.073, .181] |
| Moral | .19\*\* | .32\*\*\* | .12\* | .26\*\*\* |
| CI | [.038, 0.342] | [.171,.455] | [.001,.252] | [.142,.379] |

*Note.* \* *p* < .05, \*\* *p* < .01, \*\*\* *p* < .001.

1. **Linear Mixed Models Analyses in Experiments 3-5**

**Experiment 3**

A multilevel analysis, with participants and images as random effects, disgust type, construal level, and their interaction as fixed effects, and coding as the dependent variable,[[2]](#footnote-2) yielded the predicted interaction between disgust type and level of construal, *B* = -0.62, *SE* = 0.12, *t*(166.96) = -4.880, *p* < .001. Supporting our prediction, descriptions of moral disgust images were rated as more abstract than concrete, *B* = 0.43, *SE* = 0.10, *t*(69.30) = 4.251, *p* < .001. By contrast, descriptions of core disgust images were rated as more concrete than abstract, *B* = -0.18, *SE* = 0.10, *t*(80.84) = -1.76, *p* = .081.[[3]](#footnote-3)

**Experiment 4**

A multilevel analysis, with participants and images as random effects, disgust type, construal level, and their interaction as fixed effects, and disgust ratings as the dependent variable,[[4]](#footnote-4) yielded a main effect of construal level, *B* = -5.08, *SE* = 0.62, *t*(103.96) = 8.178, *p* < .001, indicating that participants reported higher disgust intensity for colorful images than for BW images. Importantly, supporting our prediction, disgust type moderated the effect of construal level on intensity, *B* = -6.11, *SE* = 1.24, *t*(103.96) = 4.918, *p* < .001. Participants reported lower intensity for core disgust images, when these were presented in BW than in color, *B* = -8.14, *SE* = 0.88, *t*(108.08) = 9.167, *p* < .001. Participants also reported lower intensity for moral disgust images, when presented in BW than in color; however, this effect was much smaller, *B* = -2.02, *SE* = 0.87, *t*(99.92) = 2.329, *p* = .021.

**Experiment 5**

A multilevel analysis, with participants and images as random effects, disgust type, construal level, and their interaction as fixed effects, and disgust ratings as the dependent variable,[[5]](#footnote-5) yielded a main effect of disgust type, *B* = -10.10, *SE* = 4.30, *t*(64.68) = -2.350, *p* = .021, indicating that participants reported higher disgust intensity for moral disgust images than for core disgust images. Importantly, supporting our prediction, level of construal moderated the effect of disgust type, *B* = -12.46, *SE* = 5.96, *t*(166.48) = 2.090, *p* = .038. Supporting our prediction, for moral disgust images, generating the category to which the image belongs (abstract construal) led to higher disgust intensity than describing the features of the image (concrete construal), *B* = 10.19, *SE* = 4.35, *t*(167.88) = 2.341, *p* = .020. However, for core disgust images, abstract construal of the image led to similar disgust intensity as concrete construal of the image, *B* = -2.27, *SE* = 4.07, *t*(164.70) = -0.55, *p* = .577.

1. See [osf.io/6tfh5/](file:///C:\Users\tmoranyo\Downloads\osf.io\6tfh5\) for details on the Excel template that we used for conducting the meta-analysis. [↑](#footnote-ref-1)
2. Dummy coding: core disgust = 0.5, moral disgust = -0.5, abstract = 0.5, concrete= -0.5. Random factors were participants and images (intercepts + slopes for construal). Model fit was better when the intercept and the slope for construal of both participants and images were entered as random factors compared to participants alone, *X2* (3) = 12.25, *p* = .006. [↑](#footnote-ref-2)
3. The simple effect of construal under the core disgust condition was not reliable, probably because of low power (e.g., Westfall, Kenny, & Judd, 2014). Indeed, in a model that uses only intercepts of participants and images as random factors, the simple effect of construal was significant, *B* = -0.18, *SE* = 0.06, *t*(26.73) = -2.61, *p* = .014. [↑](#footnote-ref-3)
4. Dummy coding: core disgust = 0.5, moral disgust = -0.5, BW = 0.5, color = -0.5. Random factors were participants and images (intercepts + slopes for construal). Model fit was better when the intercept and the slope for construal of both participants and images were entered as random factors compared to participants alone, *X2* (3) = 521.97, *p* < .001. [↑](#footnote-ref-4)
5. Dummy coding: core disgust = 0.5, moral disgust = -0.5, abstract = 0.5, concrete = -0.5. Random factors were participants (intercept) and images (intercept + slope for construal). Model fit was better when the intercept and the slope for construal of images and the intercept for participants were entered as random factors compared to participants alone, *X2* (2) = 340.5, *p* < .001. [↑](#footnote-ref-5)