



Specks of Dirt and Tons of Pain: Dosage Distinguishes Impurity from Harm

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Abstract

Levels of moral condemnation often scale with outcome severity (e.g., extreme destruction is morally worse than moderate damage), but this may not always be true. We investigated whether judgments of purity transgressions are more or less sensitive to variation in dosage than judgments of harm transgressions. In two studies, adults made moral evaluations of harm and purity transgressions that systematically varied in dosage (frequency/magnitude). Pairs of low-dosage and high-dosage versions of these transgressions were presented between-subjects (Study 1) or within-subjects (Study 2), with the same sets of modifiers (occasionally/regularly, small/large, etc.) reused across moral domains. Statistical interactions between Domain and Dosage indicated robust distinctions between the perceived wrongness of high-dosage and low-dosage harms, while moral evaluations of impure acts were uninfluenced by dosage. Our findings support the existence of a cognitive distinction between purity-based and harm-based morals and challenge current wisdom regarding relationships between intentions and outcomes in moral judgment.

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Keywords: moral cognition; purity; harm; scope insensitivity; magnitude; frequency

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More is more, generally speaking, and this is typical of many moral evaluations.

Uncontroversially, greater wrongdoings tend to yield harsher appraisals: serial killers are judged more severely than murderers of a single victim (Boehm, 2012), and allowing a trolley to hit five innocent victims is evaluated as worse than diverting it toward one person (Greene, 2013). Yet, in certain contexts, people display a surprising insensitivity to magnitude or frequency (Baron & Spranca, 1997; Hsee, Rottenstreich, & Xiao, 2005). In this paper, we find that harm violations (e.g., violence, maltreatment) are sensitive to variations in outcome extremity, whereas this is not true for purity violations (e.g., sacrilege, deviant sexual acts). Our findings demonstrate that purity transgressions are insensitive to changes in frequency and magnitude, indicating that different cognitive processes are employed when judging harm transgressions and purity transgressions.

Moral evaluations are sensitive to many factors beyond the outcomes of bad actions, including mental states (for a review, see Young & Tsoi, 2013). The roles of intent and outcome are generally proposed to exist in a hydraulic relationship, such that they balance out in determining moral evaluations (e.g., Cushman, 2008; Hamlin, 2013; McNamara, Willard, Norenzayan, & Henrich, 2019; Piaget, 1932). This “Trade-Off Hypothesis” predicts that, if intent is important in the moral evaluation of a particular kind of transgression, this should diminish the relevance of outcomes. Although intuitive, the supporting evidence is inconsistent, as researchers tend to hold outcomes constant and manipulate intentions rather than testing the converse.

Previous research has indicated that the role of intentions varies across different kinds of normative judgments (Giffin & Lombrozo, 2018). In particular, intentionality is a crucial factor

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3 in determining the perceived wrongness of intrinsically harmful actions (Cushman, 2008;
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5 Guglielmo, Monroe, & Malle, 2009; Young, Cushman, Hauser, & Saxe, 2007). However, the
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7 effect of intentions is considerably less pronounced for moral evaluations of impure, taboo, or
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9 disgusting acts (Barrett et al., 2016; Chakroff, Dungan, Koster-Hale, Brown, Saxe, & Young,
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11 2016; Young & Saxe, 2011), as well as for self-directed transgressions, which tend to be
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13 considered more impure than harmful (Chakroff, Dungan, & Young, 2013). Similarly, disgust,
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15 which is typically associated with purity violations (Wagemans, Brandt, & Zeelenberg, 2018), is
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17 less impacted by intentions than anger, which is typically associated with harm violations
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19 (Russell & Giner-Sorolla, 2011a). Therefore, according to the Trade-Off Hypothesis, it stands to
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21 reason that purity violations should be particularly sensitive to the role of outcomes.
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26 While this conclusion may appear logical, existing data suggest the opposite may be true.
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28 First, purity violations – and the associated emotion of moral disgust – are generally rigid and
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30 unaffected by a wide range of potentially mitigating or aggravating factors (Russell & Giner-
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32 Sorolla, 2013). Because the insensitivity of moral disgust (and, less reliably, moral evaluations
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34 of purity violations) can be observed across a wide range of extenuating circumstances (Piazza,
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36 Russell, & Sousa, 2013; Russell & Giner-Sorolla, 2011b), variation in outcomes may similarly
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38 fail to impact the harshness of purity judgments.
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42 Second, moral judgments of purity violations are primarily an assessment of underlying
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44 character traits rather than the action itself or its subsequent outcome (Uhlmann & Zhu, 2014).
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46 Impure actions are more readily attributed to stable dispositions, whereas harmful actions are
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48 more likely to be attributed to situational factors (Chakroff & Young, 2015). Because virtues
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50 and vices can be assessed independently of outcomes, this feature of moral purity can lead to a
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52 surprising inattentiveness to outcomes in certain situations. In some cases, purity transgressions
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3 are condemned even when they are merely imagined and produce no effects at all. Whereas the
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5 mere act of imagining a harm violation in a fictional context is judged to be considerably less
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7 wrong than engaging in a real-world harm violation, imagining oneself to engage in a fictional
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9 purity violation (without any outcome) is judged to be nearly as bad as engaging in an actual
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11 purity violation (Sabo & Giner-Sorolla, 2017).
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15 Third, assessments of pollution generally exhibit dose insensitivity and operate according
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17 to a step function. The introduction of a small contaminant or imperfection into a system can
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19 produce extreme aversion, as if the system was maximally laden with contaminants (see Rozin &
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21 Royzman, 2001). Thinking about wearing a sweater that was owned by an unsavory individual
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23 is judged to be extremely disagreeable, even if the sweater has been thoroughly laundered,
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25 suggesting that the *amount* of contamination is irrelevant for deeming an object to be highly
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27 impure (Rozin, Nemeroff, Wane, & Sherrod, 1989). Because tiny amounts of impurity – or even
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29 an immaterial essence – can render an entity irrevocably impure, we propose the “Mere Trace
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31 Hypothesis.” This hypothesis predicts that evaluations of purity violations, as compared to
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33 evaluations of harm violations, will be generally unaffected by changes in the frequency or
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35 magnitude of outcomes.
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41 The two opposing hypotheses investigated here each predict that the computations
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43 underlying moral judgments of harms and impurities are likely to be differentially sensitive to
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45 outcome severity. The Trade-Off Hypothesis proposes that the reduced influence of intent on
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47 judging purity violations (as uncovered in prior work) would suggest a corresponding increase in
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49 the relevance of outcomes for judging purity violations. In contrast, the Mere Trace Hypothesis
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51 proposes that – in addition to being relatively unaffected by intentions – evaluations of purity
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53 violations should be relatively unaffected by outcomes. A third hypothesis – the Domain
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3 General Hypothesis – arises from skeptics of the extent to which different cognitive mechanisms
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5 underlie moral judgments in different content domains (e.g., Gray & Keeney, 2015). This final
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7 hypothesis proposes that there will be no reliable difference between harm violations and purity
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9 violations in the extent to which outcomes impact moral evaluations.
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12 In two experiments, we tested these competing hypotheses by manipulating the frequency
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14 and magnitude of harmful and impure actions. Participants judged a range of moral violations
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16 designed to exemplify the harm and purity domains. Each violation had a low-dosage and high-
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18 dosage version, and these were exactly matched across harm and purity violations, such that the
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20 same sets of modifiers (occasionally/regularly, small/large, etc.) were reused for each moral
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22 domain (e.g., if a purity violation was manipulated to occur “once” or “frequently,” these same
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24 adjectives were used for a corresponding harm violation).
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Study 1**Methods**

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35 Participants were 189 United States residents (82 female; $M_{age} = 33.96$; $SD_{age} = 11.03$)
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37 who were tested on Amazon Mechanical Turk. Twelve additional participants completed the
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39 study but were excluded for failing attention checks by providing responses from 1–49 (on a
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41 100-point scale) when evaluating the moral wrongness of “A person destroys the entire planet”
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43 ($n = 4$) and/or for providing responses from 51–100 when evaluating the moral wrongness of “A
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45 person gives money to a charitable organization” ($n = 8$). The sample size was determined *a*
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47 *priori*, and can be estimated to provide sufficient power (.80) given an average effect size in
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49 social psychological research ($f = 0.21$; Funder et al., 2014).
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Materials and procedure

Upon providing consent, each participant was presented with 16 violations that varied by Domain (Harm vs. Purity), Dosage (High vs. Low), and Dosage Type (Magnitude vs. Frequency), such that they saw two violations from each of eight possible conditions (see Table 1). The two attention check questions were also randomly presented within this sequence. After each transgression was presented, participants were simply asked “How morally wrong was this action?” and then were prompted to respond on a 1 (“not at all”) – 100 (“extremely”) slider scale. The presentation of these violations was counterbalanced across participants such that each participant saw either a low- or high-dosage version of each transgression and saw the opposite dosage from a corresponding transgression in the other content domain. For example, participants who judged “A person throws a large rock at a farm animal” did not see “A person throws a small rock at a farm animal” but instead saw “A person eats a small amount of flesh from a dead person.” Participants were then asked to provide basic demographic information and were debriefed.

The harm and purity violations were carefully matched for overall severity during stimulus construction, thus reducing the potential for confounding factors (Gray & Keeney, 2015), and their equivalence was confirmed in a pilot study (see the Online Supplementary Materials). Because atypicality is a feature of the purity domain (i.e., impurity is often a function of the perceived unnaturalness of actions; Giner-Sorolla, Bosson, Caswell, & Hettinger, 2012; Graham, 2015), actions were not matched on this dimension.

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Table 1. All stimuli presented to participants for evaluation. Modifiers are underlined here for readers' ease, but were not underlined for participants. In Study 1, participants saw one of two sets of stimuli, which contained 2/4 items from each cell (16 transgressions total), divided so that each participant saw one item from each row. In Study 2, participants saw all 32 transgressions.

	High Severity	Low Severity
Harm Violations (Manipulated by Frequency)	A person starves a goat <u>frequently</u> .	A person starves a goat <u>once</u> .
	A person bullies a colleague <u>every week</u> .	A person bullies a colleague <u>every so often</u> .
	A person <u>regularly</u> holds meetings in a room with high asbestos levels.	A person <u>occasionally</u> holds meetings in a room with high asbestos levels.
	A person purposely knocks a sibling <u>unconscious on many occasions</u> .	A person purposely knocks a sibling <u>unconscious on one occasion</u> .
Harm Violations (Manipulated by Magnitude)	A person throws a <u>large</u> rock at a farm animal.	A person throws a <u>small</u> rock at a farm animal.
	A person punches <u>20 other</u> people.	A person punches <u>another</u> person.
	A person angrily gives somebody a <u>huge</u> bruise on their leg.	A person angrily gives somebody a <u>tiny</u> bruise on their leg.
	A person kills <u>50</u> deer while hunting.	A person kills <u>two</u> deer while hunting.
Purity Violations (Manipulated by Frequency)	A person has intercourse with a goat <u>frequently</u> .	A person has intercourse with a goat <u>once</u> .
	A person uses heroin <u>every week</u> .	A person uses heroin <u>every so often</u> .
	A person <u>regularly</u> masturbates with a chicken carcass.	A person <u>occasionally</u> masturbates with a chicken carcass.
	A person has protected sex with a sibling on <u>many occasions</u> .	A person has protected sex with a sibling on <u>one occasion</u> .
Purity Violations (Manipulated by Magnitude)	A person eats a <u>large</u> amount of flesh from a dead person.	A person eats a <u>small</u> amount of flesh from a dead person.
	A person inappropriately touches <u>20</u> corpses.	A person inappropriately touches <u>a</u> corpse.
	A person builds a <u>huge</u> house on ground that is considered sacred.	A person builds a <u>tiny</u> house on ground that is considered sacred.
	A person draws graffiti on <u>50</u> churches.	A person draws graffiti on <u>two</u> churches.

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Results

The difference between the High Dosage and Low Dosage versions of the scenarios was substantially higher for the Harm transgressions ($M_{diff} = 14.312$; $SD_{diff} = 20.213$) than the Purity transgressions, ($M_{diff} = 4.384$; $SD_{diff} = 15.956$), such that the average difference between these differences was 9.929 ($SD = 25.490$). Descriptive statistics are presented in Fig. 1.

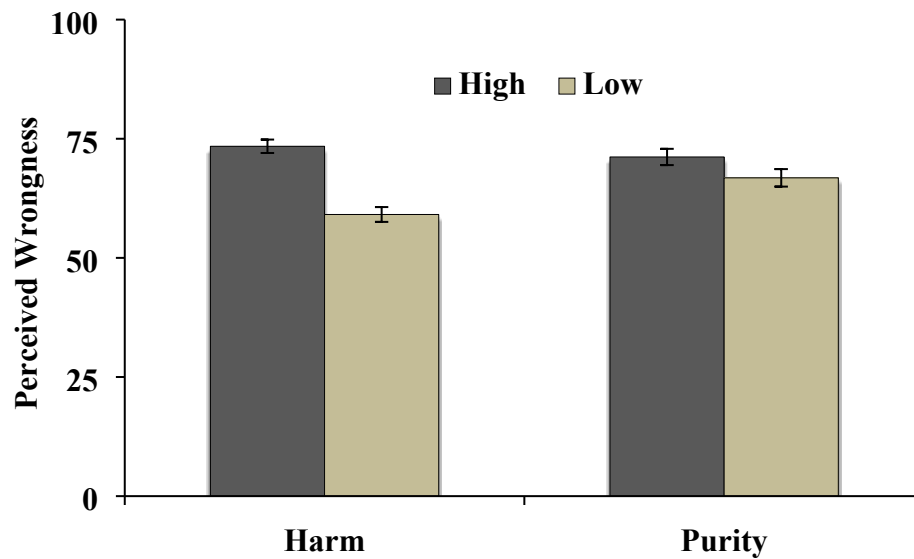


Fig. 1. Average ratings of wrongness across transgressions, split by Domain and Dosage. Error bars indicate standard errors of the mean.

To more carefully examine the interaction between Domain and Dosage, the data were analyzed with a linear mixed model fit by restricted maximum likelihood. The model was specified to predict moral judgments from the fixed effects of Domain (Harm vs. Purity) and Dosage (Low vs. High), the two-way interaction between these variables, and the random

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intercepts of Subject and Item.¹ Including random intercepts for Scenario and Participant provides the ability to generalize these findings to a broader range of stimuli and individuals (Judd, Westfall, & Kenny, 2012), precluding arguments that the results are an artifact of the particular scenarios that were presented or the particular samples that were tested. The random effect of Participant additionally accounts for the non-independence of multiple judgments being made by each participant.

Crucially, there was a significant interaction between Domain and Dosage, $B = 9.672$, $SE_B = 1.759$, $t = 5.500$, $p < .001$, reflecting participants' greater sensitivity to dosage for harm-based transgressions. Re-running this model without the interaction term (to ensure more interpretable main effects) indicated that there was no overall effect of Domain, $B = 2.734$, $SE_B = 6.626$, $t = 0.411$, $p = .687$, thus revealing that the Harm and Purity transgressions were well matched for severity. Unsurprisingly, there was a clear effect of Dosage, $B = 9.290$, $SE_B = 0.884$, $t = 10.512$, $p < .001$, as High Dosage transgressions were judged to be more wrong than Low Dosage transgressions. Overall, these results provide strong support for the Mere Trace Hypothesis; evaluations of purity transgressions were strikingly insensitive to variations in magnitude and frequency.

¹ The model initially included Dosage Type (Frequency vs. Magnitude) as an additional factor, along with all interactions involving this factor. This analysis yielded a significant three-way interaction, $B = 9.426$, $SE_B = 3.503$, $t = 2.691$, $p = .007$, driven by a decrease in wrongness for Low Magnitude Harms, which rendered the estimates of main effects and two-way interactions uninterpretable. Because we had no predictions about the effects of Dosage Type, this variable was dropped from the model.

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Study 2

Study 2 served as a replication of Study 1, but with two primary differences. First, in addition to evaluating moral wrongness, participants were asked to appraise the harmfulness and impurity of each transgression. Second, participants were presented with both levels of each stimulus (i.e., the high- and low-dosage versions). This provides a stronger test of the Mere Trace Hypothesis, as sensitivity to differences in scope increases when two levels of the stimuli are jointly evaluated (Hsee & Rottenstreich, 2004; Hsee et al., 2005).

Methods*Participants*

Because each participant evaluated twice as many transgressions as Study 1 participants, we aimed for a sample that was half the size as the previous study. Participants were 96 United States residents (51 female; $M_{age} = 36.93$; $SD_{age} = 12.72$) who were tested on Amazon Mechanical Turk. Eight additional participants completed the study but were excluded for failing the same attention check as in Study 1 (“A person destroys the entire planet”: $n = 3$; “A person gives money to a charitable organization”: $n = 5$).

Materials and procedure

The same stimuli from Study 1 were used, but this time all 32 items from Table 1 were presented to each participant. However, because judgments of different degrees of moral transgressions are rarely simultaneous in everyday life, we did not fully juxtapose these versions. Rather, the stimuli were split into the two sets that were presented between-subjects in Study 1, such that participants did not see both versions of each transgression back-to-back, and one attention check question was included in each set. Between the two sets, there was a brief delay

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3 in the form of a short transcription task (participants were asked to type 65 words of handwritten
4 text about penpals). In addition to being asked “How morally wrong was this action?” for each
5 transgression, participants were also asked “How harmful is this action?” and “How impure is
6 this action?” and responded to each on the same 1 (“not at all”) – 100 (“extremely”) slider scale.
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8 Participants were then asked to provide basic demographic information and were debriefed.
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Results

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19 The 16 Harm transgressions (Cronbach’s $\alpha = .902$) were rated as more harmful ($M =$
20 67.612 , $SD = 17.528$) than impure ($M = 51.354$, $SD = 27.737$), $t(95) = 7.288$, $p < .001$.
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24 Conversely, the 16 Purity transgressions (Cronbach’s $\alpha = .954$) were rated as more impure ($M =$
25 69.488 , $SD = 23.955$) than harmful ($M = 55.736$, $SD = 24.292$), $t(95) = 7.155$, $p < .001$. Thus,
26 these items were appropriately categorized.
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31 Overall, the difference between High Dosage and Low Dosage versions of the scenarios
32 was substantially higher for the Harm transgressions, $M_{diff} = 11.281$ ($SD_{diff} = 9.995$) than the
33 Purity transgressions, $M_{diff} = 3.190$ ($SD_{diff} = 6.945$), such that the average difference between
34 these differences was 8.091 ($SD = 11.637$). Descriptive statistics are presented in Fig. 2.
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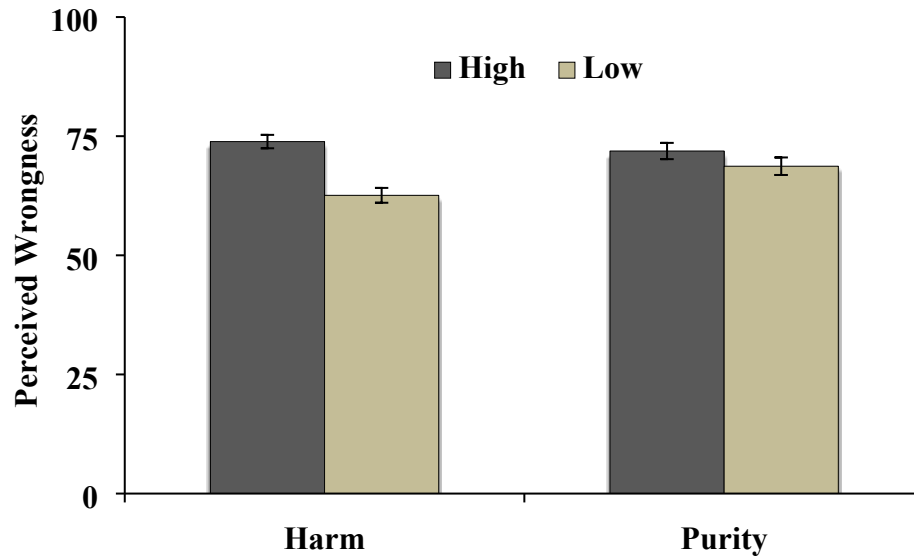


Fig. 2. Average ratings of wrongness across transgressions, split by Domain and Dosage. Error bars indicate standard errors of the mean.

As in Study 1, the data were analyzed with a linear mixed model fit by restricted maximum likelihood. The model was again specified to predict moral judgments from the fixed effects of Domain (Harm vs. Purity) and Dosage (Low vs. High), the two-way interaction between these variables, and the random intercepts of Subject and Item. This model initially included Dosage Type (Frequency vs. Magnitude) as an additional factor, along with all interactions involving this factor. Unlike in Study 1, this analysis yielded no significant effects involving this factor ($ps > .10$). In this case because of its irrelevance, we once again dropped the factor from the model to improve the interpretability of other effects.

Crucially, there was a significant interaction between Domain and Dosage, $B = 8.091$, $SE_B = 1.719$, $t = 4.708$, $p < .001$, which was once again caused by participants' greater sensitivity to dosage for harm-based transgressions. Re-running this model without the interaction term (to ensure more interpretable main effects) replicated Study 1 by yielding no main effect of Domain,

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3 B = 2.065, $SE_B = 5.503$, $t = 0.375$, $p = .713$, and a robust main effect of Dosage, B = 7.236, SE_B
4 = 0.862, $t = 8.390$, $p < .001$, as High Dosage transgressions were judged to be more wrong than
5
6 Low Dosage transgressions overall. Once again, this analysis plainly favored the Mere Trace
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8 Hypothesis over the Trade-Off and Domain-General Hypotheses. Indeed, these results were
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10 strikingly similar to those yielded by the Study 1 dataset, indicating that this effect is robust and
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12 replicable.
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17 Finally, itemwise analyses were conducted to determine whether appraisals of harm
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19 predicted larger effects of Dosage or whether appraisals of impurity predicted smaller effects of
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21 Dosage. The average harmfulness rating of each item (collapsed across High and Low Dosage
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23 versions) and the average impurity rating of each item (collapsed across High and Low Dosage
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25 versions) were in turn correlated with the average Dosage Effect of each item (operationalized as
26
27 the difference score in wrongness between the High and Low versions of the transgressions).
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29 These correlations indicated that the harmfulness of a transgression does not predict the extent to
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31 which moral judgments will be influenced by varying dosage, $r(14) = -.236$, $p = .378$. However,
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33 the more impure a transgression is perceived to be, the less likely moral judgments are to be
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35 influenced by varying dosage, $r(14) = -.688$, $p = .003$. The perceived harmfulness and impurity
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37 of these transgressions were largely orthogonal, $r(14) = .111$, $p = .683$.
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Discussion

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47 In two studies, adult participants judged the moral wrongness of harm and purity
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49 transgressions that varied in frequency (e.g., occasionally vs. regularly) or magnitude (e.g., small
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51 vs. large) with the same sets of modifiers across content domains. Both studies found that
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53 evaluations of purity violations were considerably less sensitive to variations in scope than
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3 evaluations of harm violations, yielding robust statistical interactions between Domain and
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5 Dosage.
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8 These findings clearly support the Mere Trace Hypothesis, adding to a body of literature
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10 indicating that evaluations of transgressions associated with moral disgust operate categorically
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12 and rigidly (Russell & Giner-Sorolla, 2013). Specifically, our results show that judgments of
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14 purity transgressions are on a hair-trigger, such that the slightest hint of impurity leads to instant
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16 condemnation, rendering further evidence of additional depraved or unchaste actions irrelevant.
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18 Thus, people who engage in actions that are considered impure will tend to be condemned
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20 regardless of their intent or the extremity of the outcome (also see Uhlmann & Zhu, 2014).
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22 These findings dovetail with previous research on contagion (e.g., Rozin et al., 1989) implying
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24 that even the smallest degree of contamination will result in the perception that a person is
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26 tainted. This stigma will tend to surround them just as much as if they had engaged in an action
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28 that was many times more severe.
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34 Our finding that purity violations are less sensitive to outcomes than harm violations
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36 mirrors previous findings that purity violations are less sensitive to intentions than harm
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38 violations (e.g., Young & Saxe, 2011). When considered together, this set of results contradicts
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40 the predictions of the Trade-Off Hypothesis. The present research therefore necessitates a
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42 rethinking of the relationship between intent and outcome in moral judgment. In particular,
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44 rather than a competition existing between intentions and outcomes, such that people focus
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46 largely on one or the other when making moral evaluations, it appears that moral purity
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48 transgressions simultaneously reduce focus on both of these factors. Whereas moral judgments
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50 of harm violations may involve balancing considerations between intent and outcome, this
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52 hydraulic model of moral cognition appears to be generally inapplicable to the purity domain.
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3 These findings do not support the Domain-General Hypothesis either: we find that the
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5 computations underlying moral judgments of purity violations are distinct from the computations
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7 underlying moral judgments of harm violations. Our research is instead consistent with the
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9 existence of multiple moral domains that can be identified by distinct cognitive signatures
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11 (Graham et al., 2013). This is unlikely to be a methodological artifact of the study design,
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13 particularly as we controlled for severity across harm and purity violations (see Gray & Keeney,
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15 2015).
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19 Further studies should investigate the mechanisms driving the effect reported here.
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21 Because purity judgments focus on considerations of a person's character and the extent to which
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23 a person adheres to local cultural norms (Chakroff & Young, 2015), one explanation for the
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25 present pattern of findings is that character assessments were similar across High and Low
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27 Dosage for purity violations but not for harm violations, such that evaluations of the
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29 perpetrators' character may have essentially substituted for evaluations of their actions. Another
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31 possible explanation is that the purity violations were more viscerally disturbing, and thus
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33 participants assessed them when in the grip of strong feelings, a state which has previously been
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35 associated with magnitude insensitivity (Hsee & Rottenstreich, 2004). It is notable then that
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37 results from an exploratory pilot study are not consistent with either of these explanations. In
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39 particular, these pilot data indicate that character judgments are similarly influenced by Dosage
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41 across Harm and Purity domains, and that both Harm and Purity transgressions elicit similarly
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43 strong emotional reactions (see the Online Supplementary Materials). Therefore, we think it is
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45 unlikely that our results are wholly due to differences in character assessments or affect between
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47 the harm and purity transgressions, and future research is needed to uncover other candidate
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49 mechanisms underlying this effect. One intriguing possibility is that the perceived amount of
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3 reparation to “set things right” is more greatly differentiated between low-dosage and high-
4 dosage harm transgressions than between low-dosage and high-dosage purity transgressions.
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8 Beyond informing theoretical models of moral cognition, this research carries practical
9 implications. The Mere Trace Hypothesis is chillingly reminiscent of the One-Drop Rule from
10 the Antebellum South, which proclaimed that “racial purity” was negated by having a distant
11 African ancestor. Additionally, there is a widespread belief that “sexual purity” is irrevocably
12 lost upon one’s first sexual experience. In the other direction, scope insensitivity may cause
13 people to feel licensed to pollute natural ecosystems if these landscapes are already slightly
14 degraded. While these precepts and practices may resonate with folk moral intuitions, a better
15 understanding of these intuitive tendencies could facilitate rethinking them and searching for
16 more optimal possibilities for attaining social justice, evaluating perceived wrongdoing, and
17 promoting an ethical society.
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