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Aversion towards simple broken patterns predicts moral judgment

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ABSTRACT

To what extent can simple, domain-general factors inform moral judgment? Here we examine whether a basic cognitive-affective factor predicts moral judgment. Given that most moral transgressions break the assumed pattern of behavior in society, we propose that people's domain-general aversion towards broken patterns – their negative affect in response to the distortion of repeated forms or models – may predict heightened moral sensitivity. In Study 1, participants' nonsocial pattern deviancy aversion (e.g., aversion towards broken patterns of geometric shapes) predicted greater moral condemnation of harm and purity violations. This link was stronger for intuitive thinkers, suggesting that this link occurs via an intuitive rather than analytical pathway. Extending these results, in Study 2, pattern deviancy aversion predicted greater punishment of harm and purity violations. Finally, in Study 3, in line with pattern deviancy aversion predicting moral condemnation because moral violations break the pattern of behavior in society, pattern deviancy aversion predicted context-dependent morality. Participants higher in pattern deviancy aversion exhibited a greater shift towards tolerating moral violations when these violations were described as the pattern of behavior in an alternate society. Collectively, these results suggest that something as basic as people's aversion towards broken patterns is linked to moral judgment.

Numerous psychological phenomena suggest that people are averse towards broken patterns – the distortion of repeated forms or models (Gollwitzer, Marshall, Wang & Bargh, 2017). For instance, researchers have noted that people dislike atypical stimuli (see Palmer, Schloss & Sammartino, 2013), resist change (Jost, 2015), prefer familiar and fluent stimuli (Reber, Winkielman & Schwarz, 1998; Zajonc, 1968), avoid and attempt to reduce contradictions (Heidegger, 1953/1996; Heider, 1958), and experience inconsistencies as threatening to their sense of meaning (Heine, Proulx & Vohs, 2006; Heintzelman, Trent & King, 2013). Further, more directly, people are motivated to see order, patterns, and consistencies in the world (Gilovich, 1991; Shermer, 2008; Whitson & Galinsky, 2008). Foreshadowing much of this work, one of the founders of modern social psychology, Kurt Lewin (1946), noted that cognitive and motivational systems pressure the individual and society towards order and predictability, and away from irregularities and inconsistencies.

That people are averse to broken patterns is also suggested outside of the lab. Numerous online media blogposts and articles reference people's irritation towards images depicting broken patterns (e.g. Buzzfeed: "45 photos that will annoy you more than they should"; Jewell, 2014). Moreover, people colloquially, although inappropriately, use the expression "I'm so OCD" to refer to their tendency to embrace order and dislike pattern deviant stimuli.

Though the above research and lay examples suggest that people are largely averse to pattern deviancy – the distortion of repeated forms or models (Gollwitzer et al., 2017) – they do not directly demonstrate this claim. To do so, Gollwitzer et al. (2017) created pattern deviant stimuli stripped down to their basic form and assessed participants' responses to these stimuli. Specifically, they created patterns of nonsocial geometric shapes in line with redundancy (see Garner, 1970) and distorted these patterns in accordance with research on pattern recognition and distortion (see Näätänen, Paavilainen, Titinen, Jiang & Alho, 1993; Posner, 1973; see Fig. 1). American and Chinese adults, as well as children as young as 3-years-old, exhibited a strong aversion towards such pattern deviancy (Gollwitzer et al., 2017). These results, along with other studies assessing attitudes towards nonsocial broken patterns (e.g., geometric shapes, linguistic triads, basic objects), demonstrate that people are generally averse towards pattern deviancy (e.g., Evers, Inbar & Zeelenberg, 2014, Heintzelman et al., 2013; Okimoto & Gromet, 2016; Winkielman, Halberstadt, Fazendeiro & Catty, 2006).[1,2]

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[1] Though people are averse towards broken patterns, researchers have found European Americans (but not Asian Americans and Asians) to exhibit a comparative preference for the *single object* responsible for distorting a pattern when asked to rank all the shapes in a broken pattern (Kim & Markus, 1999). When asked to judge the entire broken pattern in a non-ranked manner, however, European Americans exhibit a clear aversion towards broken patterns (Gollwitzer et al., 2017).

[2] Exceptions to this of course exist. For instance, people's deliberative embracement of abstract art or people's desire for change in deleterious or boring contexts.

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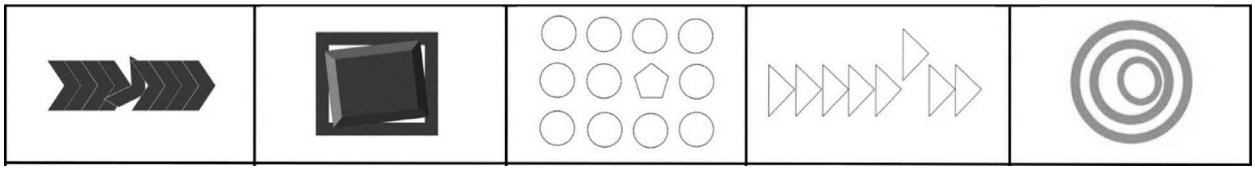

Fig. 1. Example images included in the nonsocial pattern deviancy measure used by Gollwitzer et al., 2017. Each image was presented separately.

From an evolutionary standpoint, people may hold this aversion in the service of survival. Deviations from redundancies and repetition may signal danger (Shermer, 2008) and inconsistent care (Gollwitzer & Clark, 2018). Further, pattern deviancy aversion, as it has been linked to derogating deviant behaviors (Gollwitzer et al., 2017), may encourage group survival by heightening group cohesion.

Past research has linked people's pattern deviancy aversion to social psychological phenomena. For instance, Gollwitzer and Clark (2018) found anxious attachment to relate and lead to higher pattern deviancy aversion. And Gollwitzer et al. (2017) and Gollwitzer, Marshall and Bargh (2019) found that pattern deviancy aversion predicts greater prejudice against social deviancy, including prejudice against stigmatized individuals, social-norm breakers, statistically negative and positive deviants (e.g., someone very poor and someone very rich), and racial minority group members. These findings may help explain why prejudice is largely directed towards people in society who break the "pattern" around them, whether it be in terms of physical appearance (e.g., dwarfism), character (e.g., addiction), or group-identity (e.g., minorities in the United States; Goffman, 1963). Collectively, these findings relating pattern deviancy aversion to social phenomena suggest that several major psychological phenomena can potentially be reframed in terms of regularities and deviations from these regularities.

Before turning to the hypotheses of this article, we provide two clarifications. First, by pattern deviancy aversion, we do not mean individuals' dislike of uncertainty and ambiguity (e.g., Budner, 1962; Webster & Kruglanski, 1994). Simply put, broken patterns are not uncertain or ambiguous; they entail an evident irregularity rather than the potential of an irregularity occurring. Indeed, past research has found that pattern deviancy aversion and variables capturing a dislike of uncertainty and ambiguity only correlate weakly to moderately (Gollwitzer et al., 2017).

Second, pattern deviancy is not the same as novelty. As noted by Gollwitzer et al. (2019): "stimuli that are novel are not necessarily pattern deviant. For instance, consider a grove of many novel, exotic fruits. In this scenario the fruits are novel but not pattern deviant; in the grove, the pattern is the exotic, novel fruits – a common fruit would actually be pattern deviant in this scenario." Indeed, though pattern deviancy aversion and aversion towards novel stimuli correlate, this correlation is not particularly strong ($rs < -0.04 < 0.29$, depending on the study; Gollwitzer & Clark, 2018). Further, multiple studies have found pattern deviancy aversion to relate to social phenomena (e.g., anxious attachment, prejudice) independently of people's aversion towards novelty (Gollwitzer & Clark, 2018; Gollwitzer et al., 2019).

1. Hypotheses

Here, we examine whether people's pattern deviancy aversion – people's aversion towards a perceived pattern being broken, disrupted, or distorted – plays a role in people's moral judgments. From an evolutionary account, morality exists to facilitate human cooperation (Harms & Skyrms, 2008; Nowak, 2006), for instance, via direct and indirect reciprocity (Tomasello & Vaish, 2013), and punishment (Fehr & Fischbacher, 2004). And, certain proximate processes, perhaps in the service of such ultimate motivations, play a role in moral judgment. For example, moral judgment is informed by reason and deliberation (careful reflection of what is wrong and right; e.g., Bloom, 2010; Kohlberg, 1971) as well as emotions (rapid automatic intuitions; Cushman, Young & Greene, 2010; Greene & Haidt, 2002; Haidt, 2001). Heightened threat-sensitivity has also been shown to inform moral judgment (Wright & Baril, 2013), as has people's empathic tendencies (Decety & Cowell, 2014). Despite this past research, however, it remains largely unclear whether simple, "low-level" domain-general factors predict our moral judgment.

We hypothesize that a simple cognitive-affective factor, pattern deviancy aversion, predicts variance in people's moral judgments. Specifically, pattern deviancy aversion should predict judging moral violations as more wrong (moral condemnation) and punishing these actions to a greater extent (punishment) because immoral actions are generally abnormal and atypical behaviors in society. Such actions are not only "novel" but – importantly for our hypothesis – they break the typical pattern of behavior in society (e.g., Mende-Siedlecki, Baron & Todorov, 2013). For instance, moral transgressions such as harm violations (e.g., physically harming someone) and purity violations (e.g., sexual contact with a sibling) are behaviors that break the pattern of how humans usually behave in society – these violations break behavioral redundancies. Additionally, purity violations have been characterized as weird and unusual (Gray & Keeney, 2015), and colloquially, people refer to immoral actions as 'deviant' and 'out of line.' Finally, developmental psychologists have noted that morality (considerations of what is "wrong" and "right") may in part emerge from a system concerned with standards and deviations from those standards, including negative responding towards flawed or out of place physical objects (Kagan, 1981, 1984, 1987; Kochanska, Casey & Fukumoto, 1995). Notably, given the severity of moral violations and the stability of moral judgment (e.g., Smetana, 1981; Turiel, 1983), it would be remarkable if people's aversion towards simple broken patterns predicts their moral judgment. And, in terms of a theoretical contribution, elucidating that something as basic as pattern deviancy aversion relates to moral judgment would demonstrate that moral judgments are at least partially influenced by simple domain-general factors.

Several empirical findings support the proposed link. For one, pattern deviancy aversion and moral judgment both overlap with certain phenomena. For instance, aversion towards nonsocial broken patterns relates to discomfort towards social-norm violations (Gollwitzer et al., 2017), and such violations at least partially overlap with moral violations (e.g., Haidt, Koller & Dias, 1993). Importantly though, given that norm violations and moral violations differ in important ways (e.g., stability; Smetana, 1981), the current studies remain an important extension of this previous work. Additionally, pattern deviancy aversion relates and leads to prejudice (Gollwitzer et al., 2017, 2019), and the processes underlying the development of prejudice and moral beliefs are linked (Rutland, Killen & Abrams, 2010). Finally, pattern deviancy aversion heightens people's desire for society to have rigid social-norms (Gollwitzer, Martel & Bargh, 2019; see Gelfand, 2012; Pelto, 1968), and in such communities, people are more likely to be morally righteous, including endorsing greater punishment of wrongdoers (Gelfand et al., 2011).

In additional support of our hypothesis, people's moral judgment is influenced by the commonness of the behavior being judged. For instance, both altruistic and selfish behaviors are judged as more moral and punished less when these behaviors are more common (the common is moral heuristic; Lindström, Jangard, Selbing & Olsson, 2018). These findings indicate that uncommon actions – actions which tend to break the behavioral patterns in society – are more likely to be

evaluated as immoral. As such, pattern deviancy aversion may be one variable underlying the 'common is moral' heuristic: People may perceive altruistic and selfish behaviors as more moral when these actions are common because common behaviors tend to follow behavioral patterns and people value and prefer such "patterned" actions. Finally, in terms of face-validity, consider that the term *moralization* comes from the Latin root *moralis*, meaning "proper behavior of a person in society," and researchers have observed that what is deemed proper (what "should" be) is substantially influenced by what actually *is*, namely, the actual pattern of behavior in society (i.e., descriptive regularities; e.g., Roberts, Gelman & Ho, 2017).

Finally, we propose that the potential link between pattern deviancy aversion and moral judgment occurs via intuitive rather than deliberative processes. As noted earlier, past research has found moral judgment to be informed both by rapid automatic intuitions (Cushman et al., 2010; Greene & Haidt, 2002; Haidt, 2001) and by deliberation and refection (careful reflection of what is wrong and right; e.g., Bloom, 2010; Kohlberg, 1971). Because pattern deviancy aversion captures an affective response (i.e., *aversion* towards broken patterns) and is a basic domain-general factor, we hypothesized that pattern deviancy aversion and moral judgment are likely linked via intuitive processes – trusting one's gut feelings (e.g., Damasio, 1994; Haidt et al., 1993). Specifically, people's pattern deviancy aversion should incite feelings of discomfort in response to moral violations, and in turn greater moral condemnation. If true, people who rely on their intuitions should exhibit a stronger link between their pattern deviancy aversion and their moral condemnation. Importantly, examining this question may shed light on the forces driving the intuitionist-pathway to moral judgment; though researchers have noted that intuitions inform morality (Greene & Haidt, 2002; Haidt, 2001), it remains unclear where these intuitions originate from.

2. Current studies

Across three studies, we investigated whether pattern deviancy aversion predicts moral judgment. In Study 1, we examined whether pattern deviancy aversion relates to judging harm and purity moral violations as wrong, and whether this link is stronger for more intuitive than analytical thinkers (in line with the intuitionist-pathway to moral judgment). In Study 2, we examined whether the potential link between pattern deviancy aversion and moral judgment extends to a more applied context. We tested whether pattern deviancy aversion relates to endorsing greater punishment of others' moral transgressions. Finally, in Study 3, we examined whether pattern deviancy aversion predicts a greater *tolerance* of moral violations when these violations are described as the pattern of behavior in an alternate society (when these violations are described as common and accepted in an alternate society). Such findings would align with pattern deviancy aversion predicting moral condemnation (at baseline) because moral violations break the pattern of behavior in soicety, and further, would indicate that pattern deviancy aversion predicts context-dependent, flexible moral judgment. Collectively, the three presented studies are theoretically important because they may (1) elucidate that even a basic cognitive-affective factor can be associated with the stable and complex social judgments entailed in morality, (2) illuminate one potential factor underlying the intuitionist-pathway to moral judgment (Haidt et al., 1993), and (3) help explain the malleability of certain moral judgments, that is, why moral judgments depend on the surrounding regularities (Bloom, 2010; Lindström et al., 2018).

3. Study 1

We first examined whether pattern deviancy aversion relates to judging harm and purity violations as more morally wrong. In these studies, we considered both harm and purity violations because these are potentially two distinct moral domains (Haidt & Graham, 2007); though, other researchers argue that harm underlies both purity and harm (Gray & Keeney, 2015). Additionally, in line with the proposed intuitionist pathway to moral judgment, we examined whether the potential link between pattern deviancy aversion and moral judgment is stronger for intuitive thinkers than it is for deliberative thinkers. Critically, we also controlled for two alternate factors that past research has linked to moral judgment: disgust sensitivity (e.g., Horberg, Oveis, Keltner & Cohen, 2009; Rozin, 1999; Schnall, Haidt, Clore & Jordan, 2008) and conservatism (e.g., Graham, Haidt & Nosek, 2009; Haidt & Graham, 2007). And, we additionally controlled for variables capturing method variance and demand bias – participants' aversion towards *un*broken patterns[3] and their degree of socially desirable responding (e.g., Fisher, 1993; Maccoby & Maccoby, 1954).

3.1. Method

3.1.1. Participants

We applied a power analysis based on past findings relating pattern deviancy aversion to a social construct other than moral judgment (prejudice; $r = 0.30$; Gollwitzer et al., 2017). This power analysis revealed that we needed 138 participants to have 95% ($1-\beta$) power (0.05 alpha level). However, to account for participant exclusion and potential differences in the size of these relationships, we aimed to recruit 200 participants. We ended up recruiting 203 participants (119 Female; $M_{age} = 35.64$, $SD_{age} = 10.83$) on Mechanical Turk (MTurk). Seven participants were excluded (see Supplemental Materials). The datasets, analyses, and verbatim materials of the presented studies are available open-access (see Supplements: Data Availability).

3.1.2. Pattern deviancy aversion

We included three measures of pattern deviancy aversion. The first measure, validated by Gollwitzer et al. (2017), included five images of broken patterns comprised of geometric shapes (and their unbroken counterparts as control items). For each image, participants responded to: "How much do you like the above image?" Likert-scale: 1 = *Not at all* to 7 = *A lot* (Fig. 1). We assessed participants' "liking" in order to reduce response-bias in the form of yea and nay-saying. That is, negatively valenced items could have led to a superficial correlation between pattern deviancy aversion and moral judgment via participants responding consistently on the left or right side of both scales (the morality measures, see below, had the following scale endpoints: 1 = *not at all wrong*, 5 = *extremely wrong*). See https://www.antongollwitzer.org/materials-scales for the full measures.

The second measure was a nonvisual, explicit measure validated by Gollwitzer et al. (2019). Participants read: "People feel differently about things that break a pattern, are out of line, and are disordered. How much do you agree with the following statements? Things that break a pattern, are out of line, and are disordered make me feel…" and responded to 3 items: 'Positive,' 'Happy,' and 'Content.' Likert-scale: 1 = *Not at all agree* to 7 = *Strongly agree*.

The third measure, validated by Gollwitzer et al. (2017, 2019), was a mental imagery measure. Participants read: "Imagine a collection of objects where all the objects are very similar to one-another… if an object that is very different from the other objects is added to the collection that would make me feel…" and responded to 3 items: 'Positive,' 'Happy,' and 'Content.' Likert-scale: 1 = *Not at all agree* to 7 = *Strongly agree*.

3.1.3. Moral judgment

We assessed moral condemnation of two different types of moral

[3] We controlled for participants' aversion towards unbroken patterns because such aversion related positively to aversion towards broken patterns. Importantly, controlling for aversion towards unbroken patterns should account for participant response bias in the form of yea- or nay-saying.

violations – harm and purity violations – via 3 validated measures: The MFVQ (Clifford, Iyengar, Cabeza & Sinnott-Armstrong, 2015), and two moral violations vignettes measures (see Chakroff, Russell, Piazza & Young, 2017; Dungan, Chakroff & Young, 2017). Participants judged the moral wrongness ("How morally wrong is this behavior?") of different harm (e.g., "You see a man deprive a boy of food for 2 days") and purity (e.g., "You see a boy pour urine on his lap") violations. Likert-scale: 1 = *not at all wrong*, 2 = *not too wrong*, 3 = *somewhat wrong*, 4 = *very wrong*, 5 = *extremely wrong*.

3.1.4. Intuitive thinking

To assess participants' tendency to engage in intuitive versus deliberative thinking we assessed performance on the cognitive reflection test (CRT) – lower scores indicate greater intuitive thinking and higher scores greater deliberative, analytical thinking (Frederick, 2005; see Supplements).[4]

3.1.5. Alternate predictors of moral judgment

We assessed two variables associated with greater condemnation of purity violations as control variables: Disgust propensity and sensitivity (van Overveld, de Jong, Peters, Cavanagh & Davey, 2006), and conservatism (assessed via a political orientation measure; see Supplemental Material for details).

3.1.6. Attention check item

We indirectly assessed participants' attention via the following item: "People vary in the amount they pay attention to these kinds of surveys. Some take them seriously and read each question, whereas others go very quickly and barely read the questions at all. If you have read this question carefully, please write the word yes in the blank box below labeled other. There is no need for you to respond to the scale below." Participants who failed to write "yes" were excluded from the analyses.

3.1.7. Demographics

Participants reported their biological sex, age, race, and level of education.

3.1.8. Social desirability

To account for demand effects, we included a scale assessing participants' tendency to respond in a socially desirable manner (Haghighat, 2007).

3.1.9. Procedure

Participants completed the pattern deviancy aversion, moral condemnation, and cognitive reflection measures in random order. Thereafter, they completed the disgust, attention check, political orientation, demographics, and social desirability measures (in that order).

3.2. Results

We averaged across the three pattern deviancy aversion measures because they strongly loaded onto a single factor (Eigenvalue of 2.03; Principal Axis Factor Analysis) and exhibited high inter-measure reliability, $\alpha = 0.86$. Raw correlations between the individual measures: Geometric shapes and face-valid measures, $r = 0.69$, geometric shapes and mental imagery measures, $r = 0.62$, face-valid and mental imagery measures, $r = 0.71$. These results indicate that a latent construct – pattern deviancy aversion – underlies these three measures, and further, that measuring pattern deviancy aversion more or less explicitly does not seem to greatly alter participants' responses.

We averaged across the three moral judgment measures in terms of harm and purity violations, respectively, as they exhibited high inter-measure reliability (harm: $\alpha = 0.86$ and purity: $\alpha = 0.88$; see Table S1 for descriptive statistics).

As hypothesized, pattern deviancy aversion predicted greater moral condemnation of harm, $r(194) = 0.22$, $p = .002$, 95% CI[.08, 0.35], and purity violations, $r(194) = 0.20$, $p = .005$, 95% CI[.06, 0.33] (Fig. 2). These results remained, $r(190) = 0.24$, $p = .001$, and $r(190) = 0.25$, $p = .001$, when controlling for disgust sensitivity, political orientation, aversion towards *un*broken geometric patterns, and social desirability.

To test unique predictive validity, we entered pattern deviancy aversion, disgust, and political orientation into multivariate regressions predicting participants' moral condemnation of harm and purity violations, respectively. Only pattern deviancy aversion predicted judging both harm and purity violations as wrong, harm: $\beta = 0.21$, $p = .003$, and purity: $\beta = 0.21$, $p = .002$. Disgust and political orientation predicted judging purity violations as more wrong, $\beta = 0.14$, $p = .031$, and $\beta = 0.34$, $p < .001$, respectively, but did not predict judging harm violations as more wrong, $\beta = 0.08$, $p = .263$, and $\beta = 0.00$, $p = .956$, respectively. These findings indicate that pattern deviancy aversion is associated with both moral judgment types (harm and purity) even when accounting for other predictors of moral judgment, and further, that pattern deviancy aversion is similarly predictive of judging purity violations as wrong ($\beta = 0.21$) as one's disgust sensitivity ($\beta = 0.14$), a major theoretical predictor of purity violation concerns (Schnall et al., 2008).

We next examined participants' reliance on intuitive versus deliberative thinking. First, a link between pattern deviancy aversion and CRT performance was not found, $r(194) = 0.04$, $p = .589$. And, replicating past research (Pennycook, Cheyne, Barr, Koehler & Fugelsang, 2014; Royzman, Landy & Goodwin, 2014), lower CRT scores predicted judging purity violations as more wrong, $r(194) = -0.20$, $p = .006$ (a relationship was not found for harm violations, $r[194] = -0.08$, $p = .256$).

Importantly, in line with our prediction, participants' reliance on intuitive thinking moderated the relationship between pattern deviancy aversion and moral condemnation: The interactions between pattern deviancy aversion and CRT performance predicting condemnation of harm and purity violations were observed, harm, $\beta = -.14$, $t(188) = -1.96$, $p = .052$ (marginal) and purity, $\beta = -.14$, $t(188) = -2.22$, $p = .028$ (Table 1). Further analyses (simple effects) elucidated that, as predicted, participants who performed worse on the CRT (-1 *SD*) exhibited a stronger link between their pattern deviancy aversion and condemnation of harm and purity violations, $ps < 0.001$, than those who had higher scores on the CRT ($+1$ *SD*), $ps > 0.502$ (see Table 1). These findings tentatively suggest that the link between pattern deviancy aversion and moral judgment occurs via intuitive, heuristic based responding rather than via deliberative processes.

Finally, it may seem surprising that pattern deviancy aversion predicted condemning harm and purity violations similarly in terms of effect size ($r = 0.22$ and $r = 0.20$) given that past research has found purity violations to be judged as 'weirder' than harm violations (see Gray & Keeney, 2015). To address this claim, we had independent participants judge the weirdness of the included harm violations and purity violations in a supplemental study (between-participants design [harm, purity]; Study S1; $N = 94$). In line with the similarly sized observed correlations, participants did not judge the purity violations as weirder than the harm violations collapsed across the included morality measures, though, they did do so specifically on the MFVQ measure (Clifford et al., 2015; see Materials above). Moreover, in line with this finding, specifically on the MFVQ, the relationship between pattern deviancy aversion and moral condemnation was stronger for the purity items than the harm items, as expected (see Supplements for details).

[4] We also assessed participants' self-reported – rather than behavioral – reliance on intuitive thinking. Analyses testing whether these responses moderated the relationship between pattern deviancy aversion and moral judgment revealed inconclusive results. These analyses can be found in the Supplements.

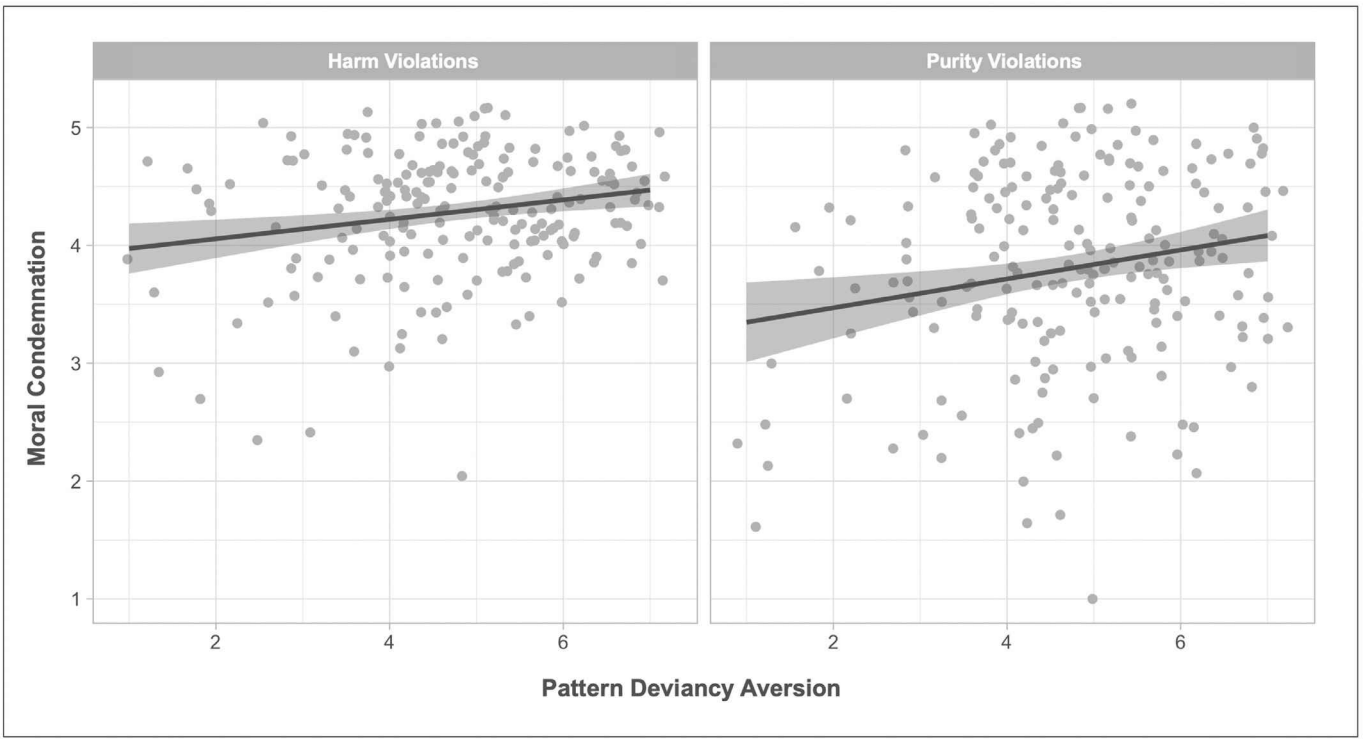

Fig. 2. Study 1: Participants' pattern deviancy aversion predicted their degree of moral condemnation of harm and purity violations.

Table 1
Participants with a Greater Tendency to Engage in Intuitive Thinking Exhibited a Stronger Link Between Pattern Deviancy Aversion and Morally Condemning Harm and Purity Violations in Study 1.

	Link Between PDA and Moral Condemnation
Intuitive Thinking (CRT)	
High Intuitive Thinking (-1 *SD* in CRT)	Harm: $\beta = .36$, $p < .001$ Purity: $\beta = .36$, $p < .001$
Low Intuitive Thinking (+1 *SD* in CRT)	Harm: $\beta = .07$, $p = .502$ Purity: $\beta = .06$, $p = .533$

Note. PDA = Pattern deviancy aversion. CRT = Cognitive reflection test. High intuitive thinking entails low scores on the CRT. Low intuitive thinking entails high scores on the CRT. Participants' disgust, political orientation, aversion towards unbroken patterns, and social desirability were controlled for in these analyses.

3.3. Discussion

In Study 1, we found that pattern deviancy aversion predicts harsher moral judgment. Pattern deviancy aversion (e.g., aversion towards broken pattern of geometric shapes) was associated with greater moral condemnation of both harm and purity transgressions. Notably, pattern deviancy aversion remained a significant predictor of moral judgment even when controlling for two factors previously linked to moral judgment: disgust propensity and sensitivity, and political orientation. Study 1 also found that the link between pattern deviancy aversion and moral condemnation is stronger for people who tend to rely on intuitive thinking (i.e., people who have difficulty overriding intuitive responding). These results suggest that pattern deviancy aversion relates to moral judgment via an intuitionist rather than deliberative pathway (Cushman et al., 2010; Greene & Haidt, 2002; Haidt, 2001).

4. Study 2: punishment

In Study 1, participants higher in pattern deviancy aversion judged moral transgressions as more wrong. Given that moral condemnation predicts punitive behavior (Fehr & Fischbacher, 2004), pattern deviancy aversion may also predict assigning harsher punishment to harm and purity transgressions. Study 2 tested this possibility.

4.1. Method

4.1.1. Participants

A power-analysis based on the relationship between pattern deviancy aversion and moral condemnation in Study 1 ($r = 0.25$) revealed that we needed 202 participants (95% power). We aimed to recruit 215 participants. The final number of recruited participants was 214 participants (MTurk; 130 Female; $M_{age} = 35.40$, $SD_{age} = 11.95$). Four responses were excluded for failing the attention check, and two were excluded because a participant completed the study twice.

4.1.2. Pattern deviancy aversion

We assessed pattern deviancy aversion as in Study 1.

4.1.3. Punishment

Participants were first told to imagine being a courtroom judge. They then reported how harshly they would punish several impurity and harm violations taken from the moral harm and purity vignettes included in Study 1 (from the Dungan et al., 2017 and Chakroff et al., 2017 measures). Likert-scale: 1 = *No punishment*, 2 = *$10 Fine*, 3 = *$50 Fine*, 4 = *$250 Fine*, 5 = *1 Day Jail Time*, 6 = *1 Week Jail Time*, 7 = *1 Month Jail Time*. Similar scales have been used in past research (e.g., Carlsmith, Darley & Robinson, 2002). For more details regarding the punishment measure, see Supplements.

4.1.4. Other variables

Again, we assessed participants' political orientation and tendency to engage in socially desirable responding. To reduce the length of the

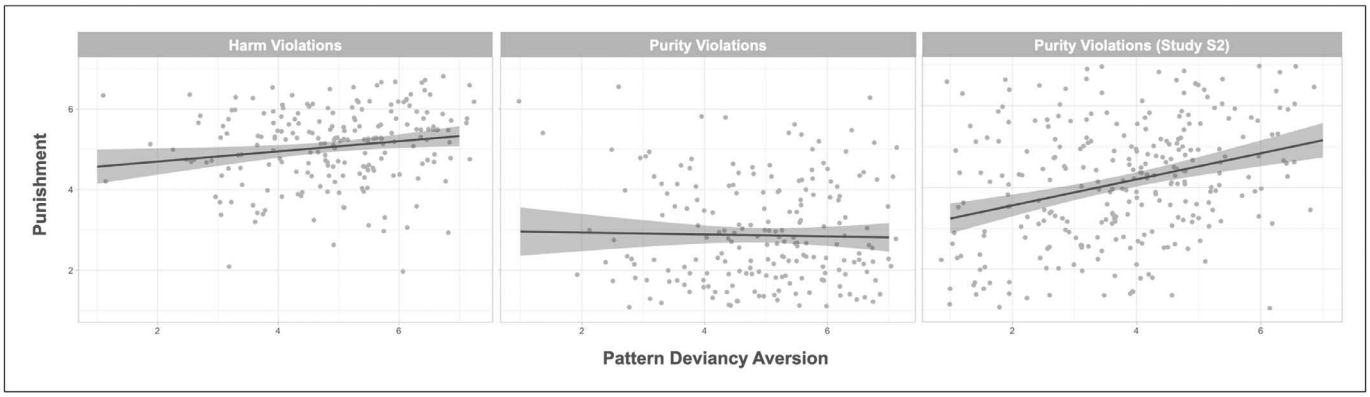

Fig. 3. In Study 2 (left two graphs), participants' pattern deviancy aversion predicted greater endorsement of punishing moral violations in terms of harm violations but not in terms of purity violations. In Study S2 (far right graph), however, participants' pattern deviancy aversion did predict greater punishment of purity violations when using a more appropriate scale of punishment.

study, we did not assess participants' disgust sensitivity and propensity.

4.1.5. Procedure

Participants completed the pattern deviancy aversion measures (clustered together) and the punishment measure in random order. They then completed the attention check item, demographics (including political orientation), and the social desirability measure (as in Study 1).

4.2. Results

Pattern deviancy aversion (collapsed across the three measures as in Study 1; $\alpha = 0.79$) related to harsher punishment of harm violators, $r(206) = 0.17$, $p = .016$, 95% CI[.03, 0.30] (Fig. 3; see Table S1 for descriptive statistics). This relationship remained, $r(203) = 0.19$, $p = .007$, when controlling for political orientation, aversion towards *un*broken patterns, and social desirability. In contrast to harm violations, pattern deviancy aversion did not predict punishing purity violations, $r(206) = -0.02$, $p = .749$, 95% CI[−0.16, 0.12] (Fig. 3).

In hindsight, it is possible this null relationship arose because the scale we used to assess punishment was inappropriate for purity violations. For instance, it is odd to punish someone with a monetary fine or jail time for 'pouring urine on themselves' or 'smearing cat poop on themselves.' We thus conducted a supplemental study largely similar to Study 2 in which the response-scale was altered to "How strongly do you think the following actions should be punished" 1 = *Not at all Punished* to 7 = *Punished a Lot* (Study S2; $N = 282$). This revised scale leaves open the possibility of punishment without monetary fine or imprisonment, but perhaps via verbal condemnation or another form of emotional expression (e.g., Xiao & Houser, 2005). In this supplemental study, we observed the predicted relationship between pattern deviancy aversion and punishing purity violations, $r(280) = 0.30$, $p < .001$, 95% CI[.19, 0.40] (Fig. 3, rightmost graph).

4.3. Discussion

Study 2 expanded upon Study 1 by demonstrating that pattern deviancy aversion not only predicts greater condemnation of moral transgressions, but also predicts greater punishment of moral transgressions. This relationship at first did not hold for purity transgressions. We believe this link did not originally appear because we assessed punishment via fine or jail time, and these forms of punishment were inappropriate for punishing purity violations. Indeed, when using a revised scale in Study S2, we found the predicted relationship between pattern deviancy aversion and greater punishment of purity violations. Taken together, our findings extend the findings of Study 1 to an applied moral domain (punishment), and suggest that pattern deviancy aversion may even be linked to moral behavior.

5. Study 3

Collectively, the findings of Studies 1 and 2 demonstrate that pattern deviancy aversion predicts harsher moral judgment of harm and purity violations. Yet, it remains unclear why this relationship exists. In the introduction, we proposed that pattern deviancy aversion should predict harsher moral judgment because immoral actions (including harm and purity violations) overwhelmingly break the assumed pattern of behavior in society. If this reasoning is true, then pattern deviancy aversion should actually predict greater *tolerance* of immoral actions when these actions do *not* break the pattern of behavior in an alternate society.

We tested this possibility in Study 3. Specifically, we examined whether pattern deviancy aversion predicts a decrease in individuals' condemnation of moral violations from baseline (in one's own society) to when these violations are described as common and accepted (in an alternate society). Such findings would support our claim that pattern deviancy aversion and moral judgment are linked (Studies 1 and 2) because immoral actions in society (at baseline) break the pattern of regular behavior. Additionally, these findings would indicate that pattern deviancy aversion predicts context-dependent moral judgments – moral judgments that are closely attuned to the surrounding behavioral regularities (moral flexibility, Bartels, 2008; moral relativism; e.g., Shaw & Wainryb, 1999). Furthermore, these findings would raise the possibility of pattern deviancy aversion as one factor underlying the common-is-moral heuristic – that common actions are generally judged as more moral (Lindström et al., 2018). And finally, these findings may help explain why moral judgments can vary over contexts, time, and communities – immoral actions that are pattern deviant in one context may not necessarily be pattern deviant in another (Bartels, 2008; Bloom, 2010).

5.1. Method

5.1.1. Participants

We applied the power-analysis from Study 2. We aimed to recruit 215 participants, and ended up with 215 participants (122 Female; $M_{age} = 35.61$, $SD_{age} = 11.92$) on MTurk. Ten responses were excluded. For detailed methods see Supplemental Material.

5.1.2. Pattern deviancy aversion

Pattern deviancy aversion was assessed as in Studies 1 and 2 except the valence of some of the items were reversed to ensure that our results remain consistent across oppositely valenced items (see Supplements).

5.1.3. Context-dependent moral judgment: baseline

Participants' baseline moral judgment (i.e., in their own culture) was evaluated by having participants respond to three of the harm violations and three of the purity violations from the Chakroff et al. (2017) and Dungan et al. (2017) measures. Participants were presented the three harm ("John cuts his brother with a sharp knife."; "John intentionally pours a cup of boiling hot water on his brother's lap."; "John calls his brother worthless and insults him.") and the three purity violations ("John kisses his brother on the mouth."; "John strokes his brother's bare inner thigh."; "John changes his phone background to a picture of a man having sex with a horse."), and asked "How morally wrong is this behavior?" Likert-scale: 1 = *not at all wrong*, 2 = *not too wrong*, 3 = *somewhat wrong*, 4 = *very wrong*, 5 = *extremely wrong*.

5.1.4. Context-dependent moral judgment: alternate society

Participants' moral condemnation was measured identically to the baseline measure except that participants were told that the moral violations occurred in a society in which such actions were normative – accepted as well as common: (e.g. "John is in a society where it is completely acceptable for siblings to cut each other with sharp knives. All siblings typically cut each other with sharp knives, and it is common practice to do this. John cuts his brother with a sharp knife." "How morally wrong is this behavior?" Likert-scale: 1 = *not at all wrong*, 2 = *not too wrong*, 3 = *somewhat wrong*, 4 = *very wrong*, 5 = *extremely wrong*.

5.1.5. Context-dependent moral judgment (explicit)

Four items explicitly assessed participants' endorsement of context-dependent, flexible moral judgment. The items were: "Morals are flexible – what is immoral in one culture is not necessarily immoral in another culture," "When it comes to figuring out what is moral and what is immoral I tend to look at the actions of those around me," "To figure out what is immoral you have to look at the actions of those around you," and "Morals are absolute – what is immoral in one culture is also immoral in another culture" (reverse-coded). Likert-scale: 1 = *Not at all agree* to 7 = *Strongly agree*.[5]

5.1.6. Procedure

Participants completed the pattern deviancy aversion measures (randomized; clustered together) and the context-dependent moral judgment measures (baseline and alternate society) in random order. They then completed the explicit context-dependent moral judgment, attention check, demographics, and social desirability measures in that order.

5.2. Results

In line with past research (e.g., Shaw & Wainryb, 1999), participants rated moral violations as less immoral when these violations were described as common and accepted in an alternate society, harm: $t(204) = 9.54$, $p < .001$, $d = 0.75$, impurity: $t(204) = 13.22$, $p < .001$, $d = 1.16$ (see Supplemental Table S1 for descriptive statistics). Importantly, as predicted, pattern deviancy aversion moderated this effect for both harm and purity violations. A repeated measures GLM with pattern deviancy aversion as a continuous predictor, moral violation (baseline vs. alternate society) as a within-participants variable, and moral condemnation as the dependent variable found that participants' pattern deviancy aversion predicted a greater change in moral judgment from baseline to when moral violations were described as common and accepted in an alternate society, harm: $p = .004$, and purity: $p = .042$, respectively (Table 2; Fig. 4). More specifically, in line with our hypotheses, participants higher in pattern deviancy aversion were more likely to judge moral violations as less wrong, compared to baseline, when these violations were described as common and accepted in an alternate society (see Table 2 for simple effects).[6]

Crucially, the observed interactions did not significantly differ depending on the type of moral violation (harm versus purity violations); that is, a three-way interaction including moral violation type was not found, $p = .120$. Additionally, these findings did not substantially change when controlling for political orientation, aversion to *un*broken patterns, and social desirability. Interactions terms: harm violations, $p = .005$, and purity violations, $p = .085$. Furthermore, the order in which participants completed the baseline and alternate society moral items did not impact the results; three-way interactions including measure order (baseline versus alternate society moral items presented first) were not significant, harm: $p = .854$, and purity: $p = .400$.

To provide additional support for these results, we re-analyzed these findings when calculating context-dependent, flexible moral judgment via change-scores. That is, when calculating difference-scores between participants' moral judgments at baseline and when the same moral violations were described as common and accepted in the alternate society (rather than using a repeated measures design as above). In line with our hypothesis, pattern deviancy aversion predicted a larger decrease in moral condemnation from baseline to when moral violations were described as common and accepted, harm: $r(203) = 0.203$, $p = .004$, and impurity: $r(203) = 0.14$, $p = .042$ (see Fig. 4).

Finally, aligning with these findings, pattern deviancy aversion also marginally predicted participants' explicit endorsement of context-dependent, flexible moral judgment, $r(203) = 0.13$, $p = .059$. We conclude that pattern deviancy aversion may encourage people to align their moral judgment to the behavioral regularities in their environment.

5.3. Discussion

In Study 3, pattern deviancy aversion predicted context-dependent, flexible moral judgment. Individuals high (versus low) in pattern deviancy aversion evaluated moral transgressions as comparatively less egregious when these transgressions were described as common and accepted in society as compared to at baseline (when judging the moral transgressions in their own culture). These results tentatively indicate that pattern deviancy aversion may help explain why moral judgments can vary over contexts, time, and communities (Bartels, 2008; Bloom, 2010) – actions that break the pattern of behavior in one context do not necessarily break the pattern in another context.

6. General discussion

Across three studies, we demonstrated that pattern deviancy aversion – negative affect in response to a perceived pattern being broken, disrupted, or distorted – predicts harsher moral judgment. In Studies 1 and 2, participants' dislike of simple, socially-irrelevant broken patterns predicted their moral condemnation and punishment of harm and purity violations. And, this link seemed to occur via an intuitionist

[5] One of the four items exhibited poor inter-item reliability ("Morals are absolute – what is immoral in one culture is also immoral in another culture"). Therefore, we did not include this item when calculating participants' explicit context-dependent, flexible moral judgment (including the item did not change the results).

[6] Regarding these simple effects, participants' responses to the common and accepted purity violations did not greatly differ depending on pattern deviancy aversion ($M = 2.76$ vs $M = 2.88$). However, importantly for our hypothesis, the interaction was significant. That is, the *change* from baseline to alternate society moral impurity judgments was larger for participants higher in pattern deviancy aversion (see also the difference scores analyses). We are specifically interested in this change as it represents the construct we wished to assess – the moral flexibility of participants (i.e., the tendency for their moral judgments to shift depending on the surrounding context).

Table 2
Study 3: Pattern Deviancy Aversion Predicts Context-Dependent, Flexible Moral Judgment.

Interaction Terms: Pattern Deviancy Aversion * Moral Judgment (Baseline Vs. Alternate Society)		
	Harm: $F(1, 203) = 8.69$, $p = .004$, $\eta p^2 = .041$ Purity: $F(1, 203) = 4.18$, $p = .042$, $\eta p^2 = .020$	
Simple Effects		
High Pattern Deviancy Aversion (+1 *SD*)	Harm: $F(1, 203) = 80.12$, $p < .001$, $\eta p^2 = .283$ Purity: $F(1, 203) = 117.92$, $p < .001$, $\eta p^2 = .367$	
Low Pattern Deviancy Aversion (-1 *SD*)	Harm: $F(1, 203) = 22.82$, $p < .001$, $\eta p^2 = .101$ Purity: $F(1, 203) = 63.42$, $p < .001$, $\eta p^2 = .238$	
Descriptive Statistics		
	Moral Judgment: Baseline	Moral Judgment: Alternate Society
High Pattern Deviancy Aversion (+1 *SD*)	Harm: $M = 4.43$, $SD = 1.16$ Purity: $M = 3.97$, $SD = 1.15$	Harm: $M = 3.34$, $SD = 1.90$ Purity: $M = 2.79$, $SD = 1.76$
Low Pattern Deviancy Aversion (-1 *SD*)	Harm: $M = 4.36$, $SD = 1.16$ Purity: $M = 3.72$, $SD = 1.15$	Harm: $M = 3.78$, $SD = 1.90$ Purity: $M = 2.85$, $SD = 1.76$

greater context-dependent, flexible moral judgment. Specifically, pattern deviancy aversion predicted a greater shift towards *tolerating* moral violations when these violations were described as common and accepted in an alternate society. Collectively, these three studies demonstrate that a cognitive-affective factor as simple as people's aversion towards broken patterns is linked to moral judgment.

Notably, our findings remained when controlling for alternate factors predicting moral judgment, including disgust (Schnall et al., 2008; Study 1), political orientation (Graham et al., 2009; Haidt & Graham, 2007), and social desirability (e.g., Fisher, 1993; Maccoby & Maccoby, 1954). Moreover, past research has demonstrated that pattern deviancy aversion is unrelated or only weakly related to other potential third-variables (e.g., need for closure; disliking novel stimuli; Gollwitzer et al., 2017). Response bias also does not seem to explain our results; differently valenced response items were utilized across the studies, and further, participants' socially desirable responding did not account for our results. Finally, in Study 1, we observed hypothesis concordant results when assessing participants' reliance on intuitive thinking using the cognitive reflection test – a behavioral performance measure that is unlikely to be influenced by response or demand bias (Frederick, 2005).[7]

Our findings contribute to research on moral judgment by introducing a basic domain-general, cognitive-affective factor – people's pattern deviancy aversion – as one predictor of the variance observed in people's moral judgment (e.g., Bloom, 2010; Cushman et al., 2010; Greene & Haidt, 2002; Haidt, 2001; Kohlberg, 1971). Notably, of the predictors of moral judgment included in our studies (disgust sensitivity and political orientation), only pattern deviancy aversion predicted moral condemnation of divergent types of moral violations – both harm

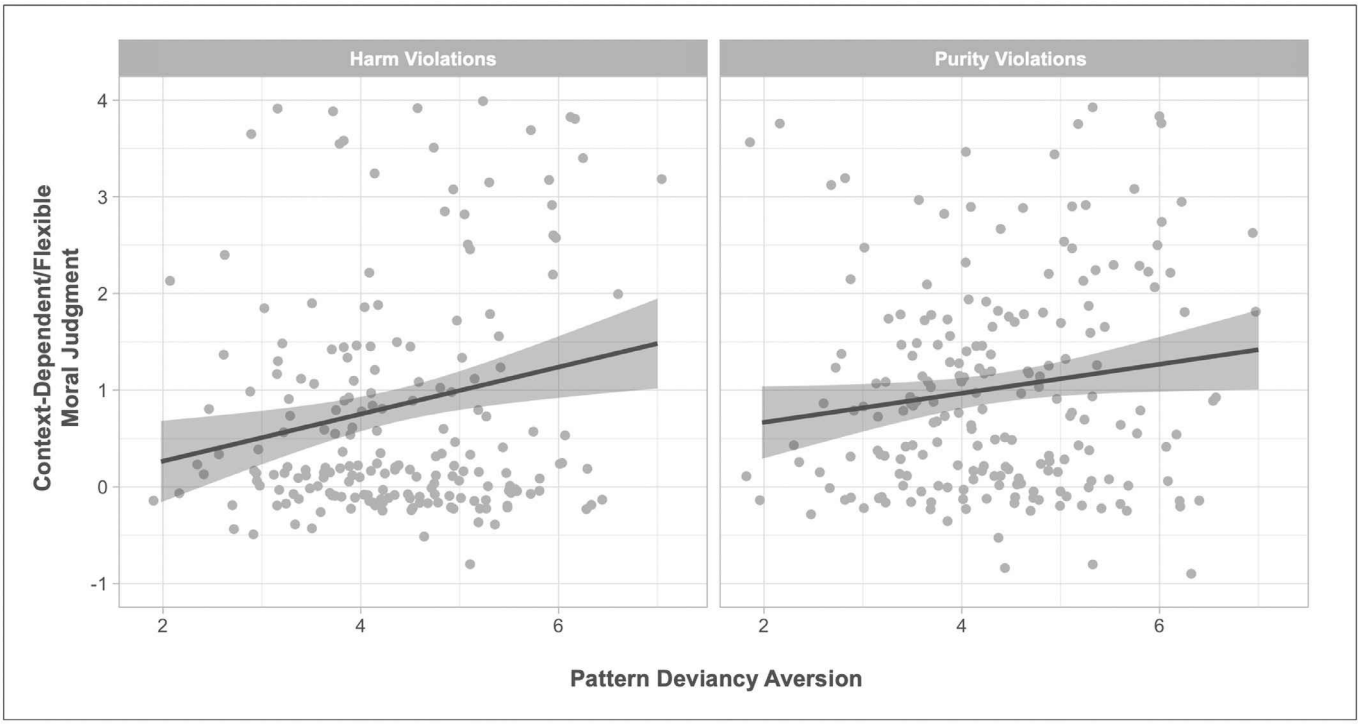

Fig. 4. Study 3: Pattern deviancy aversion predicted context-dependent, flexible harm and purity moral judgments. Pattern deviancy aversion positively related to judging moral violations as less egregious when these violations were described as common and accepted in an alternate society as compared to baseline (in one's own society). Flexible moral judgment was calculated via difference scores (see the results section of Study 3) for the purposes of this figure.

pathway to moral judgment (Haidt et al., 1993); in Study 1, we found the link between pattern deviancy aversion and moral condemnation was stronger for more intuitive thinkers than deliberative, analytical thinkers. Finally, in Study 3, pattern deviancy aversion predicted

[7] Our findings are unlikely to arise via anthropomorphism (i.e., that participants personified the geometric shapes). Gollwitzer et al. (2017) found participants' tendency to anthropomorphize not to moderate the link between pattern deviancy aversion and prejudice. Further, the pattern deviancy aversion

and purity violations. Additionally, pattern deviancy aversion predicted moral condemnation of purity violations to a similar extent as disgust propensity and sensitivity, a major theoretical predictor of moral purity concerns (e.g., Schnall et al., 2008). Taken together, our findings suggest that pattern deviancy aversion may motivate greater moral sensitivity which, importantly, can facilitate human cooperation and cohesion (Harms & Skyrms, 2008; Nowak, 2006).

Though researchers have noted that intuitive processes inform morality (Greene & Haidt, 2002; Haidt, 2001), it remains unclear where such "gut" responding originates from. Potentially, pattern deviancy is one factor that informs the intuitionist pathway to moral judgment. That is, pattern deviancy aversion heightens negative affect towards moral violations (given their irregularity), which in turn induces harsher moral judgments. In line with this possibility, in Study 1, the relationship between pattern deviancy aversion and moral judgment was stronger for more intuitive thinkers; indeed, analytical, reflective thinkers were able to attenuate or even eliminate the predictive power of pattern deviancy aversion on their moral judgment. Nonetheless, interpreting the results of Study 1 in terms of the intuitionist pathway to moral judgment should be approached cautiously. For one, we did not directly test the intuitionist pathway – we did not test whether causally heightening pattern deviancy aversion increases negative affect towards moral violations and in turn induces harsher moral responding. Second, we did not control for participants' numerical ability, a factor commonly controlled for in studies involving the CRT (see Pennycook & Ross, 2016). Future research should more directly examine whether pattern deviancy aversion qualifies as an antecedent of the intuitionist pathway to moral judgment (Haidt et al., 1993).

Our findings encourage the adoption of an interactionist perspective when studying morality – psychological phenomena emerge from an interaction between the individual and the environment (Lewin, 1946). In Study 3, participants' pattern deviancy aversion interacted with the behavioral regularities in a society to predict their moral judgment; pattern deviancy aversion predicted a greater shift (from baseline) towards tolerating moral violations when these violations were described as common and accepted in an alternate society. The findings of Study 3 also indicate that pattern deviancy aversion may in part underlie or at least moderate the common is moral heuristic – that selfish as well as altruistic acts are evaluated as more moral when they are more common (Lindström et al., 2018). And finally, the findings of Studies 3 and 1, considered collectively, suggest that pattern deviancy aversion is an intuitive, automatic factor potentially contributing to moral relativism – previous research has only identified reflective, deliberative causes (e.g., reasoning that a moral violation accepted in an alternate society must be beneficial and consensual in that society; Shaw & Wainryb, 1999).

Our findings may help elucidate why immoral actions such as lying and cheating are judged as less morally wrong than other moral violations (DePaulo, Kashy, Kirkendol, Wyer & Epstein, 1996; McCabe & Trevino, 1993) – these immoral actions do not break the pattern of behaviors in society per se. Pattern deviancy aversion may also help explain antisocial punishment – punishment of people exhibiting extreme pro-sociality (Du & Chang, 2015; Herrmann, Thöni & Gächter, 2008; Lindström et al., 2018). That is, extremely pro-social actions, similarly to anti-social actions, break the regular pattern of behavior in society, and thus, people's pattern deviancy aversion should drive them to disapprove of and punish such actions. Indeed, Irwin and Horne (2013) explicitly created descriptive regularities in economic game paradigms (i.e., set amounts that players contributed to other players) and found that participants punished players who altruistically broke these regularities.

The current research is limited in certain ways. First, we did not examine the difference between pattern deviancy aversion (distortions of repeated forms or models) and prototype deviancy aversion (deviations from people's perceived 'perfect' mental representation of a category; Palmer et al., 2013). Future research should seek to do so. Second, the current findings are largely restricted to self-report measures, and thus, the generalizability of the current findings regarding actual behavior (e.g., actual judges' sentencing; Study 2) should be approached cautiously. Third, the scenario presented to participants in Study 3, that immoral actions are accepted and common in an alternate society, was largely artificial. That is, we did not actually change the moral environments of participants, rather, we asked participants to imagine these changes. Fourth, we examined the link between pattern deviancy aversion and moral judgment solely in a correlational manner. Future research should examine the potential causality of this link. Fifth, we did not examine whether personality type plays a role in our results. For instance, pattern deviancy aversion may be linked negatively to the personality trait of openness to experience, which may, in part, contribute to why pattern deviancy aversion predicted harsher responses to moral violations in our studies.

Finally, a few points deserve to be emphasized. First, numerous factors aside from pattern deviancy aversion underlie variance in people's moral judgment (e.g., rational thought, religious beliefs). These different factors may override and interact with pattern deviancy aversion in predicting certain moral judgments. Second, we do not claim that moral judgments are 'scaffolded' off of pattern deviancy aversion. That is, pattern deviancy aversion does not need to arise earlier in development or be more 'rudimentary' than people's moral judgment for such aversion to inform moral judgment. Third, we do not claim that the predictive power of pattern deviancy aversion is specific to moral judgments or the moral domain. That is, pattern deviancy aversion may also predict judging *non*-moral norm violations as wrong and punishing these violations. Such results would support our argument that pattern deviancy aversion predicts harsher moral judgment because moral violations break the normative pattern of behavior in society.

Across three studies, we demonstrated that pattern deviancy aversion predicts individual differences in moral judgment (Studies 1 and 2), and plays a role in the context-dependency and flexibility of moral judgment (Study 3). Taken together, the current results endorse the notion that, though seemingly unrelated, simple cognitive-affective factors – such as people's pattern deviancy aversion – may inform morality.

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Supplementary materials

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(*footnote continued*)
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