# The Impact of Testimony on Children's Moralization of Novel Actions

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What leads children to moralize actions that cause no apparent harm? We hypothesized that adults' verbal instruction ("testimony"), as well as emotions such as disgust, would influence children's moralization of apparently harmless actions. To test this hypothesis, 7-year-old children were asked to render moral judgments of novel, seemingly victimless, body-directed or nature-directed actions after being exposed to adults' testimony or to an emotional induction. Study 1 demonstrated that children became more likely to judge actions as "wrong" upon being verbally presented with testimony about disgust or anger—but not upon being directly induced to feel disgusted. Study 2 established that principle-based testimony is an even more powerful source of moralization, and additionally found long-term retention of newly formed moral beliefs. These studies also indicated that children frequently lack introspective insight into the sources of their newly acquired moral reactions; they often invoked welfare-based concerns in their explanations regardless of experimental condition. In sum, this research demonstrates that children rapidly and enduringly moralize entirely unfamiliar, apparently innocuous actions upon exposure to a diverse array of morally relevant testimony.

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While McDonald's has sold billions of Big Macs to beef eaters worldwide, a significant proportion of the world's population views eating hamburgers as abhorrent. How is it that some individuals come to view this act as morally permissible, whereas others feel that it is morally problematic? When Hinduism underwent a doctrinal shift from treating cows as being edible to being sacred (see Harris, 1985), how did new generations of Hindus learn to treat beef so differently? If a parent wanted to raise her child to refrain from eating meat for moral reasons, how might she succeed in encouraging a vegetarian ethic? In general, how do young children initially develop unique arrays of culturally specific moral beliefs?

Moralization involves the formation of a value where one did not previously exist (Rozin, 1999). In the present research, we investigated the efficacy of various mechanisms that have been previously argued to facilitate this process of initially acquiring moral beliefs. In particular, we examined the role of different kinds of verbal assertions (i.e., "testimony") and also emotions as nonexclusive contributors to the formation of new moral beliefs about novel and apparently victimless behaviors.

## Research on Moral Development

Cognitive developmentalists have previously identified children's perspective taking abilities, their firsthand experiences with moral violations, and their progressive advances in domain-general cognition as contributing to their developing moral competence (for reviews, see Damon, 1977; Killen & Smetana, 2015; Kohlberg, 1971; Piaget, 1932; Smetana, 2006; Turiel, 1983). In addition, recent developmental research has found that children begin to evaluate and sanction norm violations from a very young age (for reviews, see Rakoczy & Schmidt, 2013; Tomasello, 2016), with other studies suggesting that there are precocious—perhaps inborn—moral aptitudes present even from infancy (for reviews, see Baillargeon et al., 2014; Bloom, 2013; Hamlin, 2013).

Much of this research has suggested that children formulate moral evaluations by attending to negative outcomes in the aftermath of harmful or unjust actions. Indeed, children can use evidence of distress as a cue to moral wrongness (Blair, 1995; Smetana, 1985; Zelazo, Helwig, & Lau, 1996). However, children sometimes exhibit moral concern in the absence of distress cues and, moreover, do not always believe that moral concern is war-

ranted even when distress cues are present (Chiarella & Poulin-Dubois, 2013; Leslie, Mallon, & DiCorcia, 2006; Vaish, Carpenter, & Tomasello, 2009; Weisberg & Leslie, 2012; for a review, see Heiphetz & Young, 2014). Furthermore, adults frequently exhibit moral aversions to actions independently of aversions to the actual or potential outcomes of the actions (Cushman, Gray, Gaffey, & Mendes, 2012; Miller, Hannikainen, & Cushman, 2014; for a review, see Miller & Cushman, 2013). Finally, the link between distress and moral judgment cannot account for a significant proportion of folk moral concerns that involve nonconsequentialist sacred values regarding actions with no obvious impact on others' welfare (Baron & Spranca, 1997; Graham et al., 2013; Haidt, Koller, & Dias, 1993; Shweder, Mahapatra, & Miller, 1987; Tetlock, 2003).

Therefore, while firsthand perceptions of pain and suffering are certainly crucial sources of moral development in certain instances, assessments of harmful consequences cannot always be necessary or sufficient for children's moral acquisition. We hypothesize here that verbal claims and instruction from adults (henceforth, "testimony") can serve as an alternative mechanism of moralization (e.g., Edwards, 1987; Haidt & Joseph, 2007; Harris, 2012; Nichols, 2004; Shweder et al., 1987; Sripada & Stich, 2006; Tappan, 1997). Although previous research has yielded evidence for a role of testimony in influencing children's moral *behaviors* (e.g., Rosenhan, Frederick, & Burrowes, 1968; Rushton, 1975; Sagotsky, Wood-Schneider, & Konop, 1981; but see Bryan & Walbek, 1970), experimental evidence is lacking for the role of testimony in the acquisition of moral *beliefs*.

## The Role of Testimony in Children's Moral Acquisition

Acquiring information through firsthand experience is often costly and sometimes impossible. Humans have recurrently circumvented this adaptive problem by deriving knowledge from listening to what others tell them. In general, learning from socially transmitted testimony is a major source of conceptual development and knowledge acquisition throughout childhood (for reviews, see Gelman, 2009; Harris, 2012; Harris & Koenig, 2006; Mills, 2013; Sobel & Kushnir, 2013). Learning from testimony occurs across a wide range of domains, including understanding gravity and physical causality (Bascandziev & Harris, 2010; Jaswal, 2010; Klahr & Nigam, 2004), selecting what foods to eat (Lumeng, Cardinal, Jankowski, Kaciroti, & Gelman, 2008; Shutts, Kinzler, & DeJesus, 2013), and forming ontological beliefs about the reality status of unobservable and counterintuitive biological and religious entities (Canfield & Ganea, 2014; Harris, Pasquini, Duke, Asscher, & Pons, 2006; Lane, Harris, Gelman, & Wellman, 2014).

It is therefore plausible that children acquire many moral values from testimony. Indeed, it has been proposed that language evolved largely because it allowed for moralistic gossip rather than the exchange of merely factual knowledge (Dunbar, 2004), suggesting that testimony is especially useful within the moral domain. Notably, the forms of testimony that children typically receive about moral values are markedly different from typical forms of testimony in epistemic domains. For instance, when parents talk to their children about moral issues, their testimony includes fewer appeals to evidence than when they talk to their

children about scientific issues (Luce, Callanan, & Smilovic, 2013). Because children identify emotionally sensitive people as being better at solving moral dilemmas than highly knowledgeable people (Danovitch & Keil, 2007, 2008), it is possible that emotion-laden testimony plays a particularly significant role in children's moral acquisition. Alternatively, children's preoccupation with moral rules and obligations (e.g., Riggs & Kalish, 2016) suggests the alternative hypothesis that principle-based testimony is especially impactful for moralization.

The only experimental study to date on children's moralization of novel, arbitrary actions offers tentative evidence in support of the hypothesis that both emotion-laden testimony and normative testimony can facilitate moral acquisition. This experiment found that, when children heard testimony that actions set in an alien environment were "disgusting" and "gross" (and were tested in a smelly room), they were more likely to morally condemn the actions. Moralization was also facilitated by testimony that the novel actions were "unnatural" and was particularly robust when disgust information was combined with testimony about the unnatural qualities of these actions (Rottman & Kelemen, 2012). However, interpreting these results is far from straightforward, as Rottman and Kelemen did not specifically set out to explore the effects of testimony on children's moralization. This is particularly underscored by the fact that disgust was invoked by simultaneously invoking olfactory and verbal cues. Because of this experimental confound, the effect of hearing emotionally relevant testimony cannot be assessed in isolation because children's judgments could have been impacted by their concurrent exposure to a noxious odor that induced the visceral experience of disgust. In Study 1, we adapted this paradigm to explore the nature and degree of the independent impacts of emotional testimony versus induced disgust. Induced disgust was a focus because many social psychologists have identified the experience of disgust as highly relevant to moral beliefs and decision-making, as described below.

## The Role of Disgust in Moral Acquisition

Emotions have been heavily implicated in work on adult moral cognition (for reviews, see Greene & Haidt, 2002; Monin, Pizarro, & Beer, 2007; Young & Koenigs, 2007), and much of the recent surge of research addressing the role of emotions in moral judgment has highlighted the relevance of disgust in particular (for a review, see Olatunji & Puncochar, 2014). A number of influential studies have indicated that experimentally inducing disgust can elevate adults' levels of moral condemnation—whether the disgust is induced through a noxious odor (Adams, Stewart, & Blanchar, 2014; Schnall, Haidt, Clore, & Jordan, 2008), video footage (Horberg, Oveis, Keltner, & Cohen, 2009; Schnall et al., 2008; Ugazio, Lamm, & Singer, 2012), photographs (Moretti & di Pellegrino, 2010), hypnosis (Wheatley & Haidt, 2005), gustatory sensations of bitterness (Eskine, Kacinik, & Prinz, 2011), or the sounds of vomiting (Seidel & Prinz, 2013). However, these findings are controversial. Several papers have offered a range of methodological, analytic, and interpretive challenges (e.g., Case, Oaten, & Stevenson, 2012; Huebner, 2015; May, 2014). Furthermore, a recent meta-analysis has suggested that the effect of induced disgust on moral judgment is vanishingly small (Landy & Goodwin, 2015), and this conclusion has been substantiated by a large-scale replication failure (Johnson et al., 2016).

Although the causal role of disgust in *amplifying* moral condemnation is under intense scrutiny, there have been few studies investigating whether this emotion can facilitate the *creation* of new moral beliefs. Nonetheless, the emotion of disgust has been identified as a plausibly powerful factor in the process of moralization (e.g., Chapman & Anderson, 2014; Rottman & Kelemen, 2012; Rozin, 1999; but see Pizarro, Inbar, & Helion, 2011). For example, disgust is associated with the moralization of cigarette smoking and meat eating (Rozin & Singh, 1999; Rozin, Markwith, & Stoess, 1997), and is a stronger predictor of moral beliefs about these issues than are health concerns. It is therefore possible that people begin to treat smoking and vegetarianism as moral issues upon feeling repulsed by the acts of inhaling tobacco or eating animals. Alternatively, other survey results suggest that feelings of disgust are generally a consequence rather than a cause of moral change (Fessler, Arguello, Mekdara, & Macias, 2003). Ultimately, the most rigorous way to explore the direction of causation is via an experimental investigation of children's initial acquisition of moral beliefs—the approach taken in the current research.

## Overlaps and Differences Between Moral Disgust and Moral Anger

There has been much debate about whether different condemnatory emotions—particularly disgust and anger—exert specific effects in the moral domain. On the one hand, accumulating evidence supports the idea that disgust and anger play distinct roles in moral cognition, presumably because they solve different adaptive problems (e.g., Cottrell & Neuberg, 2005; Rozin, Lowery, Imada, & Haidt, 1999; Seidel & Prinz, 2013; for reviews, see Horberg, Oveis, & Keltner, 2011; Prinz, 2007; Russell & Giner-Sorolla, 2013). On the other hand, some researchers have found support for an opposing hypothesis that there are no specific effects exerted by discrete emotions in the moral domain (e.g., Cheng, Ottati, & Price, 2013; Kayyal, Pochedly, McCarthy, & Russell, 2015; for a review, see Cameron, Lindquist, & Gray, 2015). All of this research has been conducted with adults. Determining whether or not different discrete emotions play distinct roles in children's moralization—for instance, by leading to higher or lower overall levels of moral acquisition, or by impacting individual children differently—can help to inform this debate from a new angle.

Along with disgust, anger is considered to be a primary moral emotion. Some research suggests that moral transgressions are more prominently associated with anger than with disgust (Royzman, Atanasov, Landy, Parks, & Gepty, 2014). It is therefore possible that appeals to anger could impact moralization to the same extent, or perhaps even a greater extent, as appeals to disgust. Alternatively, other research suggests that anger is less relevant for moralization than disgust, particularly for actions that involve no direct victims (e.g., Horberg et al., 2009). Study 1 tested these opposing hypotheses by investigating the relative effectiveness of testimony about anger and testimony about disgust in moralizing novel body-directed and nature-directed actions.

## Processes of Moral Acquisition

Irrespective of the mechanisms by which moral beliefs are acquired, the acquisition process could be effortful or automatic. Traditional accounts of moral development (e.g., Piaget, 1932) predict that children consciously reason their way to moral judgments. Thus, the sources of moral acquisition should remain easily accessible to children when they explain why they made particular judgments (Turiel, 1983). Even if moral beliefs eventually become intuitive, it is predicted that this occurs through a protracted process of automatization; the initial formation of moral beliefs is thought to be fully deliberative (e.g., Saltzstein & Kasachkoff, 2004).

Evolutionary accounts of moral development (e.g., Krebs, 2008) instead tend to assert that children acquire moral beliefs with little reflection. This prediction has been supported by studies with adults, which have repeatedly found that moral explanations often appear to be post hoc rationalizations rather than veridical descriptions of reasoning processes (e.g., Cushman, Young, & Hauser, 2006; Haidt & Hersh, 2001; Hauser, Cushman, Young, Jin, & Mikhail, 2007; Rottman, Kelemen, & Young, 2014; also see Haidt, 2001; Nisbett & Wilson, 1977). In some cases, attempts to explain moral judgments seem to result in "moral dumbfounding"—such that individuals resolutely hold to their judgments despite being at a loss to explain them (Haidt, 2012; Haidt & Hersh, 2001). However, recent research has demonstrated that true moral dumbfounding is rare; for example, people simply do not accept that actions such as sibling incest could be truly harmless and therefore persist in referring to possible harms as justification (Royzman, Kim, & Leeman, 2015). Nevertheless, it is still possible for explanations to be post hoc in the sense that they are confabulated after moral judgments are made rather than being reflective of actual judgment processes (e.g., Shaw & Olson, 2012).

We sought to determine whether reflective or automatic processes tend to underlie the moralization of seemingly harmless acts by analyzing the content of children's explanations. If moral acquisition occurs reflectively, then participants' explanations should be genuine accounts of their initial judgment processes: Either participants should accurately invoke the experimental manipulations that led to heightened moral acquisition, or they should appeal to the further inferences they made based on the information provided—such that their explanations should differ in accordance with the experimental conditions. Alternatively, if participants lack introspective access into their prior judgment processes, then their explanations should produce signatures of being post hoc: Their explanations will be unlikely to appeal to salient aspects of the experimental manipulations, their explanations will not differ across conditions, and the content of their explanations should appeal to folk theories about why acts are wrong or permissible.

## Overview of the Present Research

Because developmental investigations of moralization have previously focused on considerations of others' welfare, almost nothing is known about how young children acquire moral beliefs about actions that do not involve direct harm to third-party victims. The present research investigates the degree to which the moralization of novel, apparently harmless behaviors can be produced through various forms of verbal communication and condemnatory

moral emotions such as disgust. In order to examine a clear-cut case of moralization, all of the actions that participants were asked to evaluate were outwardly innocuous and set in an alien environment (as in Rottman & Kelemen, 2012). By utilizing unfamiliar, seemingly victimless actions, children were not able to rely on direct perceptions of distress or strong associations with known moral behaviors in forming their new moral beliefs.

This research involved 7-year-olds to gain precise insight into the mechanisms leading to the formation of new moral values, as children provide a unique window into understanding the processes by which behaviors are initially moralized. In contrast to adults, children's reactions to novel situations are less likely to be influenced by analogies to prior experience or other heuristics. Seven-year-olds are a particularly appropriate age group to study for various reasons. First, there is evidence that cross-cultural differences in certain moral beliefs become pronounced around age 7, suggesting an increase in children's tendencies to learn local norms at this age (House et al., 2013). Second, although little is known about the development of disgust (for a review, see Rottman, 2014), some findings suggest that disgust toward sociomoral elicitors does not begin to appear until 7 years of age (Stevenson, Oaten, Case, Repacholi, & Wagland, 2010).

In Study 1, we followed up on research described earlier (Rottman & Kelemen, 2012) and investigated whether a range of arbitrary actions would be moralized in the presence of disgust-laden or anger-laden testimony versus exposure to an olfactory disgust induction. We also investigated the moral relevance of dispositional, trait emotions in addition to transient, state emotions; however, because of low internal reliability in our trait emotion measures, these results are presented only in online supplementary materials and not discussed further. Study 2 then measured the influence of principled, less emotional forms of moral testimony and investigated whether moralization would persist across a prolonged time delay of three months. In all of these studies, participants were additionally asked to explain their moral judgments, which allowed for a direct assessment of whether children were able to appeal to the immediate sources of their moral judgments after moralization had occurred. In sum, this research systematically tested a wide array of potential mechanisms of moralization, thus informing several prominent theories of how moral beliefs are acquired during childhood.

## Study 1: Moralization Upon Exposure to Emotion-Laden Testimony Versus a Disgusting Odor

Study 1 evaluated two distinct theoretical accounts of how moralization typically occurs. In particular, this study disambiguated the unique moralizing effects of both emotion-laden testimony and induced emotional experience (previously confounded in Rottman & Kelemen, 2012) by teasing apart the relative influence of these factors. This investigation is particularly timely in light of increasing failures to replicate findings that disgust manipulations can amplify adults' moral judgments (Case et al., 2012; Johnson et al., 2016; Landy & Goodwin, 2015). The present study thus serves as a contribution to the intensely debated question of whether disgust is a moralizing emotion (Pizarro et al., 2011) in addition to contributing to the literature on the utility of testimony, which has also experienced a recent resurgence in the empirical literature (Harris, 2012). To investigate the specificity of different

condemnatory emotions on moralization, we tested the efficacy of both disgust-based and anger-based testimony. Due to methodological and ethical concerns, only disgust was directly induced.

## Method

**Participants.** One hundred twenty 7-year-old children (60 females; $M_{age}$ = 7 years, 5.3 months, $SD$ = 3.7 months) were recruited from the greater Boston area via a large participant database. These participants were primarily Caucasian and from middle- to upper-middle-class backgrounds. An equal number of boys and girls were randomly assigned to each of four conditions.[1]

**Materials and procedure.** Following Rottman and Kelemen (2012), all participants were introduced to a fictional planet and were then shown a series of 12 pictures, each of which portrayed a group of anthropomorphic aliens engaged in an unfamiliar behavior that was either body-directed (e.g., covering their heads with sticks; drinking from straws instead of using their spoon hands) or nature-directed (e.g., sprinkling blue water into a big puddle; building machines to make the air more misty). None of the pictures portrayed any victims or involved any obvious negative consequences. These scenarios were presented in random order. (See the Appendix for the full set of stimuli.) Each picture was introduced through a brief verbal description ("Look at this! All [creatures engage in the specified action].") After being presented with each action, participants were prompted to judge whether it was "wrong" or "OK".

In the Induced Disgust condition, the visceral experience of disgust was elicited by spritzing an abundant amount of a commercially available fart spray into a trashcan in the testing room before participants arrived at the lab. In addition to the powerful smell emanating from the trashcan, this product was also sprayed into a small box that participants were asked to sniff at the onset of the experimental session, allegedly to find out what the planet smelled like. In the Disgust Testimony condition, the smell was not present. Instead, participants heard the following information immediately after being presented with the brief description of each behavior: "It's really disgusting for [creatures to engage in the specified action]. Acting like this is really gross." In the Anger Testimony condition, participants heard the following information immediately after being presented with the brief description of each behavior: "It's really angering for [creatures to engage in the specified action]. Acting like this is really irritating."[2] None of these manipulations were present in the Control condition, which simply involved introducing children to each action and prompting them to make a judgment.

The contribution of individual differences in disgust sensitivity and/or anger proneness was additionally investigated at the end of

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[1] This sample size was determined by a power analysis conducted on the effect of the Disgust Only condition compared with the Control condition in Rottman and Kelemen (2012) ($d$ = 0.76; power = .55), which indicated that at least 29 participants per condition would be needed to provide adequate power (.80) in subsequent research.

[2] Although the term "angering" is substantially less frequent than other lexical forms of this word, presumably because this emotion often refers to the abstract state of an experiencing subject rather than a quality of an action or object (Russell & Giner-Sorola, 2013), this language was used to closely parallel the testimony from the Disgust Testimony condition. Informal questioning of participants after the conclusion of the study confirmed that they understood the testimony.

the testing session (refer to the online supplementary materials for details). After these measures, the drawings were again presented one by one, and participants were asked to explain why they had previously said that each of the 12 actions was "wrong" or "OK." This was done to determine the extent to which the participants appeared to have accurate introspective access into the sources of their moral judgments. Finally, as a manipulation check, all children were asked to rate how bad the room smelled on a five-point Likert scale.

## Results

**Preliminary analyses.** There was good internal consistency among the 12 items that the participants evaluated (Cronbach's alpha = .81). Trait Disgust and Trait Anger scores were computed by summing participants' ratings of the administered scale items, reverse scoring where appropriate such that higher scores indicated higher sensitivity to disgust or anger. Unfortunately, these scales demonstrated low internal reliability (Trait Disgust: Cronbach's alpha = .40; Trait Anger: Cronbach's alpha = .67), which precluded straightforward interpretation of the results. Therefore, the findings from these measures are reported only in the online supplementary materials.

To determine whether the Induced Disgust manipulation was effective in eliciting feelings of disgust, a one-way ANOVA was conducted on children's ratings of how bad the room smelled, and this yielded a significant difference across conditions, $F(3, 116) = 20.14$, $p < .001$, $\eta_p^2 = .342$. Whereas children in the Control ($M = 1.43$, $SD = 0.77$), Disgust Testimony ($M = 1.60$, $SD = 1.00$), and Anger Testimony ($M = 1.20$, $SD = 0.48$) conditions were equally unlikely to report the room smelling bad, $ps > .10$, children in the Induced Disgust condition ($M = 3.03$, $SD = 1.50$) gave significantly higher ratings, $ps < .001$. Although only 14 of the 30 children in the Induced Disgust condition gave ratings above the midpoint (3) of the scale (compared to one or zero children in each of the other conditions), there was no correlation between ratings of how bad the room smelled and "wrong" judgments in this condition, $r(28) = .002$, $p = .993$. This indicates that individual differences in the experienced potency of the manipulation did not impact the results.

**Primary experimental findings.** To determine whether the experimental manipulations were effective in elevating participants' wrongness judgments above Control levels, the data were analyzed with a mixed logistic regression model fit by Laplace approximation.[3] The model was specified to predict moral judgments from the fixed effect of Condition and the random effects (intercepts) of Subject and Item. Using the Control condition as a reference group, the analysis found no significant effect of Induced Disgust, logistic $b = 0.62$ ($SE = 0.45$), $z = 1.39$, $p = .165$, $OR = 1.86$ (95% CI: 0.77, 4.47). However, there were significant (and approximately equivalent) effects of both Disgust Testimony, logistic $b = 1.07$ ($SE = 0.45$), $z = 2.39$, $p = .017$, $OR = 2.92$ (95% CI: 1.21, 7.02), and Anger Testimony, logistic $b = 1.11$ ($SE = 0.45$), $z = 2.50$, $p = .012$, $OR = 3.05$ (95% CI: 1.27, 7.31). Model-implied probabilities for each condition are presented in Figure 1. In sum, emotion-laden testimony—but not a potent emotional induction—reliably elevated children's likelihood of morally condemning novel actions relative to baseline.
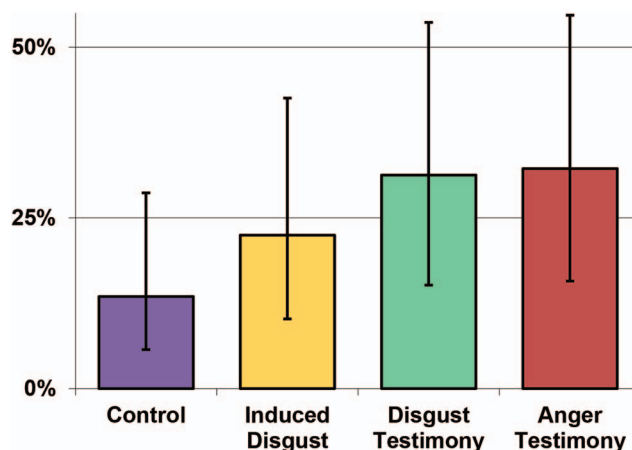


*Figure 1.* Probability estimates from the mixed logistic regression model, predicting the likelihood of making a "wrong" judgment, split by condition. Error bars represent 95% CIs. See the online article for the color version of this figure.

**Explanations of moral judgments.** Participants' explanations for all "wrong" judgments ($N = 473$) were coded for the presence or absence of content involving appeals to disgust and anger (see Table S2 in the online supplementary materials for examples of these explanations). There was excellent agreement between two independent coders ($\kappa = .91$), and disagreements were resolved through discussion. In this and all other cases, the two coders conferred about their first 10 codes, and worked fully independently thereafter to each code 100% of children's explanations. Findings demonstrated that only 5.9% of explanations in the Disgust Testimony condition (2.1% of explanations across conditions) described the behavior as being disgusting or gross. Only 8.6% of explanations in the Anger Testimony condition (2.5% of explanations across conditions) appealed to the behavior being angering or irritating.

Because participants rarely explained their moral judgments by invoking the sentiments conveyed by the emotional testimony, all explanations were coded a second time to determine the general pattern of responses that participants typically gave when explaining why they had considered a given behavior to be wrong. Initial examinations of the data led to the selection of five predefined coding categories that appeared representative. Because some explanations appealed to several of these coding categories, it was decided that each would be assigned a single code according to the principle that the child mentioned first. There was high agreement between the two coders ($\kappa = .81$), and all disagreements were resolved through discussion. Overall, a large proportion of explanations referred to considerations of harm or injustice. In total, 24.5% of explanations were coded as "causing harm to others,"

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[3] The data were analyzed with R software, Version 3.2.2 (R Core Team, 2014) using the *lme4* package, Version 1.1-10 (Bates, Maechler, Bolker, & Walker, 2015). The command syntax was: Model1 ← glmer(Judgment ~ Condition + (1 | Item) + (1 | SubjectNumber), family = binomial, data = Study1). Analogous patterns of results were obtained when averaging across the 12 trials and using ANOVA. Similar patterns were also found when only analyzing participants' judgments of the first action they viewed (see the online supplementary materials).

24.5% were coded as "causing unfairness or obstruction," 15.9% were coded as "causing harm to the self," 23.9% were coded as "being weird or unnecessary," and 11.2% were coded as "other/uncodable" (see Figure 2a and refer to Table S2 in the online supplementary materials for examples). There was no difference in the distribution of these codes across the four conditions, as confirmed by an independent-samples Kruskal-Wallis test, $p = .797$. However, there was a striking difference in distributions of codes across different items (see Figure 2b).

An expanded coding scheme, including three new categories in addition to the five coding categories used to code "wrong" explanations, was used to classify participants' "OK" explanations ($N = 904$).[4] Two new independent coders coded these explanations ($\kappa = .74$), and disagreements were resolved through discussion. In total, 4.5% of explanations were coded as "(not) causing harm to others," 3.0% were coded as "(not) causing unfairness or obstruction," 1.0% were coded as "(not) causing harm to the self," 7.4% were coded as "(not) being weird or unnecessary," 25.2% were coded as "freedom to act in accordance with desires," 40.6% were coded as "improving wellbeing or the state of the world," 7.6% were coded as "having no impact," and 10.6% were coded as "other/uncodable." There was no difference in the distribution of these codes across the four conditions, as confirmed by an independent-samples Kruskal-Wallis test, $p = .106$.

## Discussion

This study demonstrated that testimony about disgust and about anger exerted an immediate moralizing effect on children's evaluations of novel actions. This finding suggests that, at least in the case of learning new moral beliefs, it is necessary to reconsider previous assertions that moral testimony is likely to be limited in its scope and plodding in its time course (e.g., Grusec & Goodnow, 1994; Smetana, 1999). Rather, testimony can be a potent source of moralization.

In contrast to the significant elevation in judgments of moral wrongness caused by disgust-laden and anger-laden testimony, induced disgust produced a nonsignificant effect on moralization. This pattern of findings suggests that the increase in "wrong" judgments caused by the disgust manipulation in previous work by Rottman and Kelemen (2012) was likely driven by social communication about disgust rather than the presence of a foul odor. More broadly, these findings suggest that incidental disgust does not lead to robust moralization, a conclusion that converges with recent work in philosophy and psychology (e.g., Huebner, 2015; Johnson et al., 2016; Landy & Goodwin, 2015). This finding also converges with research demonstrating that disgust-laden testimony, but not nonverbal communications of disgust, increases children's disgust toward novel animals (Muris, Mayer, Borth, & Vos, 2013).

Additionally, although exposure to testimony constituted the entire underlying reason that the participants in the Disgust Testimony and Anger Testimony conditions made significantly more "wrong" judgments than participants in the Control and Induced Disgust conditions, children in these conditions rarely talked about the actions as being "disgusting"/"gross" or "angering"/"irritating" when explaining their judgments of moral wrongness. Instead, irrespective of experimental condition and despite no direct evidence that the moralized actions impinged on the welfare of others, children typically explained their newly formed beliefs in proto-

typically "moral" language by appealing to welfare concerns. This finding that children's explanations were strikingly orthogonal to the information that was socially communicated in the Disgust Testimony and Anger Testimony conditions leads to three conclusions. First, this result is consistent with the hypothesis that moralization occurs through automatic processes of which children lack introspective access (see the General Discussion). Second, this result dovetails with previous research showing that moral condemnation is often associated with perceptions of harm (e.g., Gray, Schein, & Ward, 2014). Finally, this result raises the possibility that moralization could be facilitated even more strongly with testimony that is consistent with children's typical rationales for why actions are wrong. This was tested in Study 2.

## Study 2: Moralization Upon Exposure to Different Forms of Principle-Based Testimony

The results of Study 1 revealed that two kinds of emotion-laden testimony can significantly influence moral acquisition. However, does morally relevant testimony need to be emotional to be effective? Study 2 examined this question by exploring the moralizing effects of other types of morally relevant testimony, which did not directly appeal to emotions. In particular, participants in this study were provided testimony involving moral principles that were directly adapted from the explanations provided by Study 1 participants: causing harm to others, causing unfairness or obstruction, causing harm to the self, and being weird or unnecessary. Of note, the first two principles (causing harm to others; causing unfairness or obstruction) are inherently *interpersonal* by invoking victims, and are descriptors that are typically associated with anger-inducing violations. Conversely, the final two principles (causing harm to the self; being weird or unnecessary) are *non-interpersonal* and victimless, and are descriptors that are typically associated with disgust-inducing violations (Chakroff, Dungan, & Young, 2013; Giner-Sorolla, Bosson, Caswell, & Hettinger, 2012; Rottman et al., 2014; Rozin et al., 1999). Because the division between interpersonal and non-interpersonal actions has been found to be a psychologically meaningful distinction in previous research, and because these two categories directly map onto the two emotions examined in Study 1 (anger and disgust, respectively), the effectiveness of testimony belonging to each of these broad subtypes were compared.

Study 2 also examined a common assumption in cognitive developmental approaches to moral psychology: the notion that, to the extent children utilize testimony in the process of acquiring new moral beliefs, they will be sophisticated in its application. In particular, children are thought to shrewdly interpret and evaluate testimony in the process of actively reasoning their way to an ultimate rational judgment, such that they will judiciously reject testimony that they consider to be irrelevant or inappropriate (Grusec, Chaparro, Johnston, & Sherman, 2014; Grusec & Goodnow, 1994; Nucci, 1984; Smetana, 1999; also see Sobel & Kushnir, 2013). This suggests that they should learn from testimony that fits well with the kind of action being described, and not from testimony that fits poorly with a particular action. To examine

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[4] The first 12 participants were inconsistently asked to provide explanations for their "OK" judgments, and therefore explanations were not obtained for all 967 "OK" judgments.
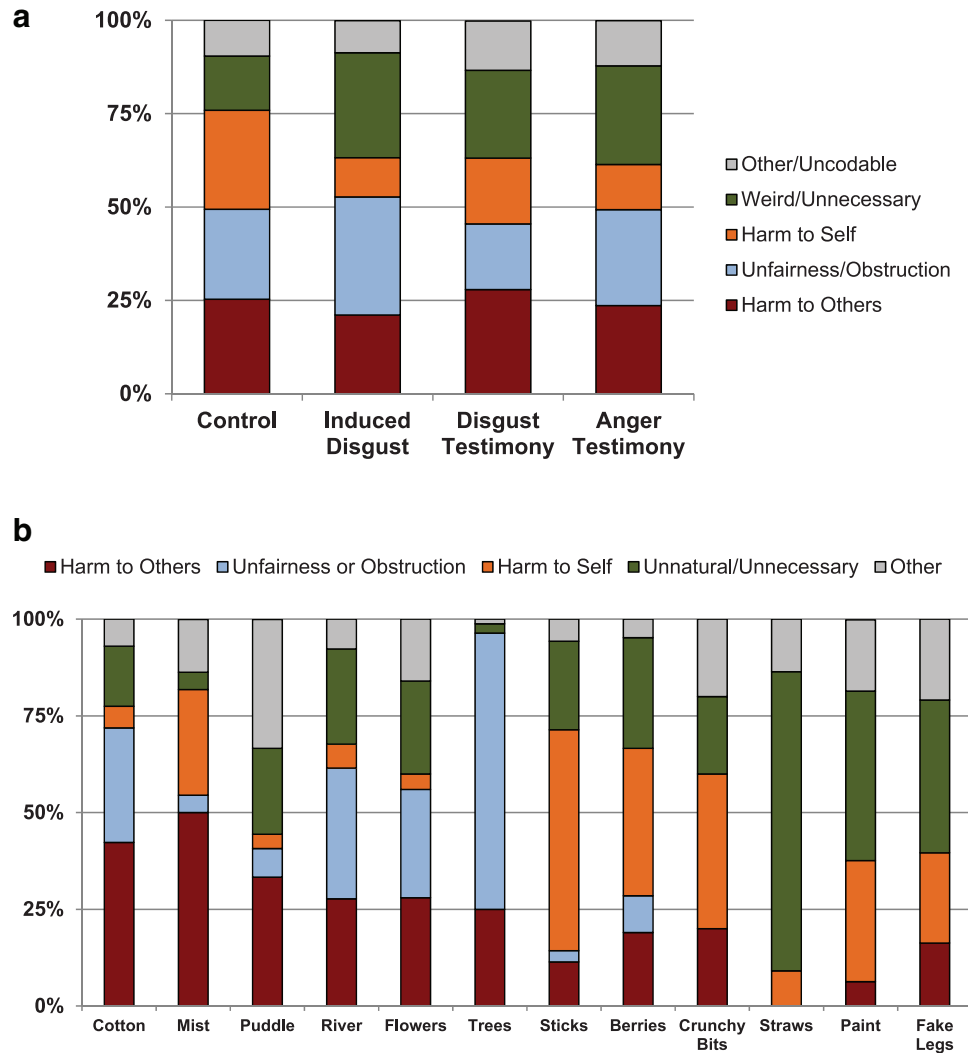
*Figure 2.* (a) Percentage of explanations for "wrong" judgments coded into each of the five predefined categories, split by condition. (b) Percentage of explanations for "wrong" judgments coded into each of the five predefined categories, split by item. See the online article for the color version of this figure.

whether this was the case, some of the testimony provided to children was well fitted to the behavior being described, and some of the testimony was poorly fitted. This level of fit was determined by the extent to which a particular principle was frequently or infrequently invoked in children's previous explanations for their moral judgments of each action (see Figure 2b).

Finally, given that Study 1 demonstrated that different kinds of testimony have at least momentary impacts on children's moral beliefs, Study 2 additionally explored whether these newly formed moral judgments would persist after a delay and in the presence of a novel adult. In disparate other domains in which fast mapping occurs (e.g., language acquisition, artifact knowledge), newly acquired conventional knowledge has been found to persist across an extended period of time and/or across different experimental contexts (e.g., Carey & Bartlett, 1978; Casler & Kelemen, 2005; Király, Csibra, & Gergely, 2013). This kind of long-term retention has also been found in other domains of learning, such as for

biology understanding (Kelemen, Emmons, Schillaci, & Ganea, 2014). In one study of the impact of testimony on pro-social behavior, testimony exerted a *stronger* effect after a 2-month delay (Rushton, 1975). To explore the durability of children's rapid moral acquisition, participants were asked to return for a follow-up session after a prolonged time delay of approximately three months.

## Method

**Participants.** Thirty 7-year-old participants (14 females; $M_{age} = 7$ years, 4.2 months, $SD = 3.2$ months) were recruited from a large participant database as in Study 1.

**Materials and procedure.** Participants were tested using the same procedure as in the previous study. However, rather than hearing the same type of testimony for 12 scenarios in a row, as was the case in the Disgust Testimony and Anger Testimony

Table 1
*Instances of Testimony Used in Study 2*

| | Examples of interpersonal testimony | Examples of non-interpersonal testimony |
|---|---|---|
| Examples of well-fitting testimony | It really hurts others when Bonzers fill the forest with cotton balls. Acting like this is harmful to other things. | Quimples really hurt themselves when they put crunchy bits in their food. Acting like this is harmful to them. |
| | It's really unfair for Quimples to block the river to make it flow in a different direction. Acting like this prevents others from getting what they need. | It's really weird for Kulvaws to walk around with fake legs. Acting like this goes against how things are supposed to be. |
| Examples of poor-fitting testimony | It really hurts others when Kulvaws paint their faces white. Acting like this is harmful to other things. | Kulvaws really hurt themselves when they sprinkle blue water into the big puddle. Acting like this is harmful to them. |
| | It's really unfair for Bonzers to cover their heads with sticks. Acting like this prevents others from getting what they need. | It's really weird for Bonzers to build machines to make the air mistier. Acting like this goes against how things are supposed to be. |

conditions, participants in Study 2 were presented with four types of testimony. These respectively described the actions as causing harm to others, causing unfairness and obstruction, causing harm to the self, or being weird and unnecessary. This testimony was designed to closely resemble the explanations that children themselves provided in Study 1 (see Table 1 for examples; see Table S3 in the online supplementary materials for the full set of stimuli)—thus testing the hypothesis that "yesterday's post hoc rationalizations could be the basis for today's moral reasoning" (Paxton & Greene, 2010, p. 519). Each of these four principles was repeated for three scenarios each, such that half of the testimony was "interpersonal" and half was "non-interpersonal." Additionally (and orthogonally), half of the testimony was "well-fitting" and half was "poor-fitting" with respect to the actions being described. The Trait Disgust and Trait Anger measures were again administered at the conclusion of the study session, after which children were again asked to provide explanations for their previous 12 judgments.

Participants were asked to return for a second visit roughly three months after the first visit ($M_{delay} = 97.6$ days, $SD = 31.8$ days). At this follow-up visit, a novel experimenter asked participants to judge the 12 behaviors as "wrong" or "OK" without providing any testimony, such that the protocol exactly matched that of the Control condition from Study 1. Two participants from the original sample of 30 did not return for a second visit and were excluded from all further analyses.

## Results

**Primary experimental findings.** There was high internal consistency among the 12 actions that were presented to the participants (Cronbach's alpha = .75). The data were analyzed with a mixed logistic regression model fit by Laplace approximation.[5] The model was specified to predict moral judgments from the fixed effects of Time (Time 1 vs. Time 2), Type (Interpersonal vs. Non-Interpersonal), and Fit (Well-Fitting vs. Poor-Fitting), and the random effects (intercepts) of Subject and Item. The analysis uncovered a significant effect of Time, logistic $b = -1.33$ ($SE = 0.20$), $z = -6.70$, $p < .001$, $OR = 0.27$ (95% CI: 0.18, 0.39), indicating that "wrong" judgments decreased after the delay, as could be expected due to the passage of time and the absence of testimony at Time 2. The analysis also yielded a significant effect of Type, logistic $b = -0.51$ ($SE = 0.19$), $z = -2.62$, $p = .009$,

$OR = 0.60$ (95% CI: 0.41, 0.88), indicating that interpersonal testimony led items to be judged as more wrong than non-interpersonal testimony. There was additionally a significant interaction between Type and Time, logistic $b = 1.11$ ($SE = 0.38$), $z = 2.89$, $p = .004$, $OR = 3.04$ (95% CI: 1.43, 6.47), as only the effects of interpersonal testimony were attenuated after the time delay (such that the average number of "wrong" judgments was equivalent across both testimony types at Time 2). There was no significant effect of Fit, logistic $b = -0.13$ ($SE = 0.19$), $z = -0.67$, $p = .501$, $OR = 0.88$ (95% CI: 0.60, 1.28), and there was no significant interaction of Time and Fit, logistic $b = 0.34$ ($SE = 0.38$), $z = 0.89$, $p = .372$, $OR = 1.41$ (95% CI: 0.67, 2.97). The interactions between Type and Fit and between Time and Type and Fit were not included in the model, as the nature of these manipulations meant that the 12 items were not evenly distributed across levels of Type and Fit (see Table S3 in the online supplementary materials). Model-implied probabilities are presented in Figure 3a and 3b.

**Delayed internalization.** To determine whether any long-term internalization of the Time 1 testimony occurred, children's judgments at Time 2 were compared with the judgments of the children in the Control condition from Study 1. Because these sessions involved identical protocols, it was expected that they would yield equivalent levels of condemnation if the testimony provided at Time 1 was merely priming children's judgments in the moment rather than leading to any enduring beliefs. However, results of a model[6] specified to predict moral judgments from the fixed effect of Group and the random effects (intercepts) of Subject and Item demonstrated that children's "wrong" judgments at Time 2 were significantly elevated above Control participants' "wrong" judgments from Study 1, logistic $b = 0.88$ ($SE = 0.41$), $z = 2.17$, $p = .030$, $OR = 2.42$ (95% CI: 1.09, 5.36). Although

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[5] The data were again analyzed with R software, Version 3.2.2 (R Core Team, 2014) using the *lme4* package, Version 1.1–10 (Bates et al., 2015). The command syntax was: Model2 ← glmer(Judgment ~ Fit + Type + Time + Fit*Time + Type*Time + (1 | Item) + (1 | SubjectNumber), family = binomial, data = Study2).

[6] Again, the data were analyzed with a mixed logistic regression model fit by Laplace approximation, using R software, Version 3.2.2 (R Core Team, 2014) and the *lme4* package, Version 1.1–10 (Bates et al., 2015). The command syntax was: Model3 ← glmer(Judgment ~ Group + (1 | Item) + (1 | SubjectNumber), family = binomial, data = Study1CntrlStudy2T2).
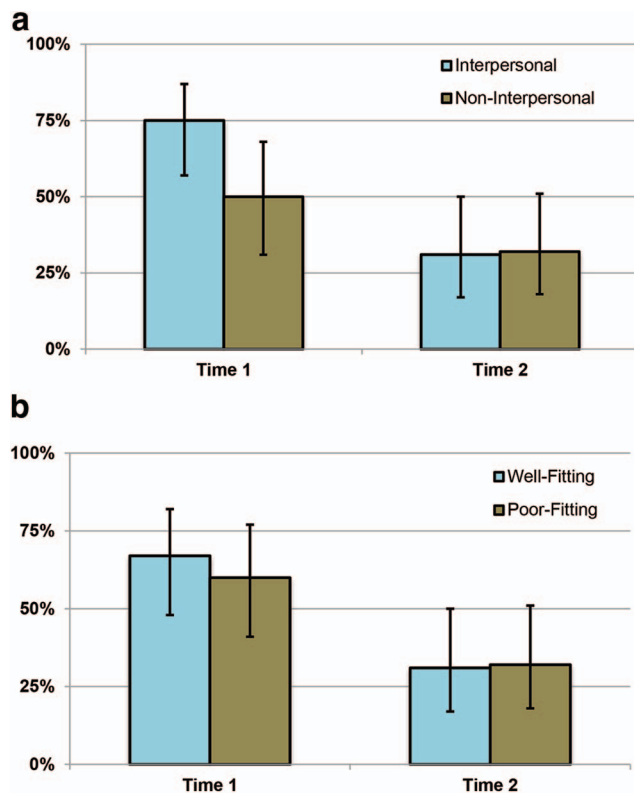
*Figure 3.* (a) Probability estimates from the logistic regression model, predicting the likelihood of making a "wrong" judgment as determined by Time and Type. Error bars represent 95% CIs. (b) Probability estimates from the logistic regression model, predicting the likelihood of making a "wrong" judgment as determined by Time and Fit. Error bars represent 95% CIs. See the online article for the color version of this figure.

these results must be interpreted with caution because they rely on the comparison of two different samples, this analysis suggests long-term retention of some of the moral beliefs that participants formed during their initial visit.

Additionally, there was a significant correlation in "wrong" judgments between Time 1 and Time 2 in the present study, $r(26) = .457$, $p = .014$. This relationship remained intact in an item-wise partial correlation, controlling for baseline levels of wrongness, $r(9) = .747$, $p = .008$. Of the 336 items that were judged as "wrong" or "OK" across the 28 usable participants, 66.4% of later judgments remained consistent with the original judgments. Despite the large range of time ($min_{delay} = 55$ days; $max_{delay} = 175$ days) elapsing for individual participants between testing sessions, there was no significant correlation between the length of delay between Time 1 and Time 2 and the change in wrongness judgments between Time 1 and Time 2, $r(26) = .212$, $p = .280$. Taken as a whole, these results demonstrate that, although the actions were deemed substantially more permissible at Time 2 than at Time 1, some enduring learning occurred such that children continued to judge the actions as more wrong than would be expected from baseline levels even after a considerable delay.

**Explanations of moral judgments.** Explanations of "wrong" judgments from Time 1 ($N = 197$) and Time 2 ($N = 122$) were coded to determine the general pattern of responses that participants typically gave when judging a given behavior to be wrong. The same five predefined categories from Study 1 were used. There was high agreement between the two coders ($\kappa = .81$), and all disagreements were resolved through discussion. Explanations of "OK" judgments were not coded, as they proved to be largely uninformative in Study 1.

Given that the testimony in Study 2 was derived from children's explicit explanations in Study 1, it was hypothesized that they would display greater accuracy when explaining their judgments in this study. To determine whether this was the case, the frequencies of explanation categories provided in Study 2 were compared to the relative frequencies in Study 1, and it was found that Study 2 explanations deviated from the Study 1 frequencies at Time 1, $\chi^2(4) = 13.46$, $p = .009$, but not at Time 2, $\chi^2(4) = 3.97$, $p = .411$. This means that the similar proportions of explanation types that were found across all four conditions in Study 1 were once again found at Time 2, while the principle-based testimony led children to explain their judgments differently than observed previously at Time 1.

The differences in these explanation patterns at Time 1 were further explored with chi-square tests comparing the observed frequencies to the expected (Study 1) frequencies within each testimony type. These tests demonstrated that, for three of the four testimony types, the Time 1 explanation patterns matched the testimony that was provided more often than predicted by the expected frequencies (Harm to Others: $\chi^2(4) = 20.33$, $p < .001$; Unfairness/Obstruction: $\chi^2(4) = 47.38$, $p < .001$; Harm to Self: $\chi^2(4) = 62.33$, $p < .001$). However, this was not true for the Weird/Unnecessary testimony: $\chi^2(4) = 2.62$, $p = .623$. Overall, therefore, children at Time 1 generally explained their moral judgments in accordance with the type of input they were provided. However, at Time 2 their explanations no longer tended to match the testimony that had initially been given, but rather more closely approximated the explanation patterns that were observed in Study 1 (see Figure 4).

## Discussion

In Study 2, we found that testimony invoking moral principles (e.g., harmfulness, weirdness) generated rapid and robust moral acquisition for novel, arbitrary, seemingly victimless actions. The mean level of moral condemnation in the wake of hearing these morally relevant principles was considerably higher than that yielded by the emotion-based testimony in Study 1; an average of 7/12 actions were judged to be "wrong" at Time 1 in the present study, compared to an average of approximately 4.5/12 actions judged as "wrong" in the previous Disgust Testimony and Anger Testimony conditions. In other words, testimony appealing to principles is highly effective, and this kind of testimony is even more potent than testimony appealing to emotions. In addition, this study demonstrated that the sort of moralization produced in this paradigm was at least somewhat robust and resilient, as moral beliefs persisted to some degree for multiple months and in the presence of a novel adult.

Furthermore, at least initially, interpersonal testimony was more powerful than non-interpersonal testimony. This result is in line with findings that negative interpersonal consequences constitute the prototype of morality (Gray et al., 2014), and with findings that disciplinary techniques invoking interpersonal consequences are effective in shaping children's moral behaviors (Hoffman, 1975; Parke, 1969). This finding also vindicates the claim of dyadic theories of morality that perceived harmfulness most readily leads to moralization (e.g., Schein & Gray, 2015). Nevertheless, it is
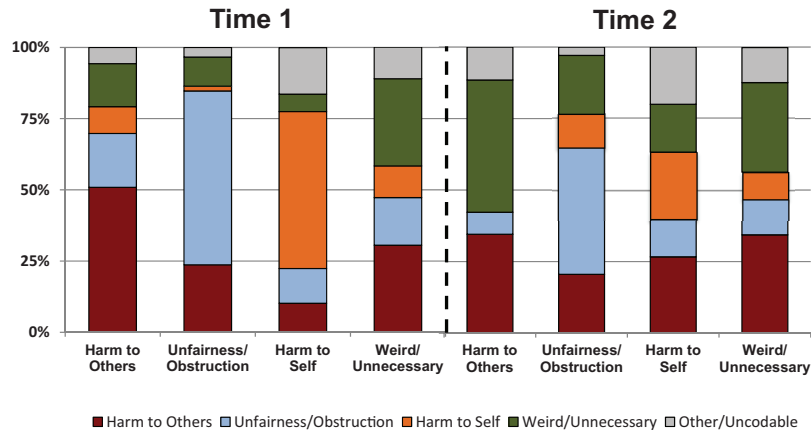
*Figure 4.* Explanation types provided for each form of testimony, at Time 1 and at Time 2. See the online article for the color version of this figure.

notable that non-interpersonal testimony led to comparable levels of condemnation after a time delay.

This study additionally demonstrated that children are not especially discerning when learning new moral beliefs from adults' testimony, as participants did not make a reasoned distinction between well-fitting and poor-fitting forms of testimony during moralization. The complete lack of any effect of Fit suggests that children did not attend to the rationality of the testimony they were provided, contrary to reason-based models of moral acquisition. However, this interpretation is tentative and in need of further exploration, particularly as it is possible that the strangeness of the alien context invoked different standards of rationality. Additionally, the finding that children are differentially susceptible to internalizing different types of content in the testimony they are provided (e.g., being more receptive to principle-based testimony than emotion-laden testimony) shows that children are not entirely indiscriminate when learning from moral testimony.

Unlike in Study 1, participants at Time 1 often appealed to the testimony that they were provided when explaining their "wrong" judgments, at least when the information pertained to harm to others, unfairness/obstruction, or harm to the self. Their explanations no longer remained differentiated at Time 2, however, suggesting that moral judgments sometimes endure even in the absence of initial rationales.

## General Discussion

This research has demonstrated that children can acquire moral beliefs about novel, apparently victimless actions from a very brief intervention. Contrary to a widespread idea that the internalization of morals is likely to be gradual and protracted (e.g., Grusec & Goodnow, 1994), the present data support claims that children are prone to learn norms readily and promiscuously (e.g., Rakoczy & Schmidt, 2013; Schmidt, Rakoczy, & Tomasello, 2011). These studies have additionally built upon previous research (Rottman & Kelemen, 2012) to further uncover the specific mechanisms that can lead to these changes in moral beliefs. Overall, this research offers the strongest experimental evidence to date demonstrating that testimony can play a central causal role in children's moral acquisition, thus providing a corrective to frequent suppositions in

the cognitive developmental literature that children are autonomous in their construction of moral beliefs (for reviews, see Harris, 2012; Rottman & Young, 2015). Because members of different societies provide different informational content in their social communication with children, this finding helps to explain the broad cultural diversity in moral beliefs—especially the broad range of moralization that is found for seemingly arbitrary actions. Future research should involve developmental and cross-cultural investigations to determine whether the present findings generalize to children of different ages and backgrounds.

Although a wide assortment of testimony was found to lead to moral acquisition, not all testimony was treated equally. Study 1 found that emotion-based testimony (involving appeals to disgust and anger) significantly elevated participants' tendencies to judge novel actions as morally wrong. Study 2 demonstrated that various forms of principled, non-emotional testimony provided an even more powerful impetus for moralization than the emotion-laden testimony in Study 1. Whereas principles describing interpersonal offenses were initially more effective than principles describing non-interpersonal qualities of actions, well-fitting testimony was not more effective than poor-fitting testimony, suggesting that superficial content matters more than rational consistency in children's moral acquisition. Study 2 additionally established that, once these new moral beliefs were acquired, they persisted to some extent for a period of several months. This suggests that the present effects reflect chronic moralization, rather than temporary moral construal (e.g., Van Bavel, Packer, Haas, & Cunningham, 2012).

### Implications for Proposed Links Between Emotions and Morality

In Study 1, a strong disgust induction similar to that used in previous studies (e.g., Schnall et al., 2008) failed to produce moralization. The ineffectiveness of this manipulation, paired with the Study 2 finding that principled, non-emotional testimony is a highly effective facilitator of moralization, demonstrates that raw feeling is neither necessary nor sufficient for acquiring new moral beliefs. It stands to reason that the mere experience of disgust should not be sufficient for moral acquisition to occur, as there are many actions that elicit feelings of revulsion but would be maladaptive to deem immoral

(e.g., garbage collection). Furthermore, research has demonstrated that deviant actions matched for their disgustingness are judged differently depending on whether there is a social norm against their occurrence (Royzman, Leeman, & Baron, 2009). This suggests that phenomenological experiences need to be associated with learned norms—or at least explicit learning that an action is gross—for moral acquisition to reliably occur (Kagan, 1984; Nichols, 2004; Rozin, 1999). Rather than being incidental (i.e., triggered by an irrelevant external stimulus), it seems that emotions must be specifically attributed to the properties of an action being judged (e.g., Wisneski & Skitka, in press). This reveals a major difference between the emotion induction and the emotion-laden testimony; whereas the induction manipulation was nonspecific insofar as it did not link the odor to any particular behaviors, the testimony was directly linked to the actions being discussed.

Although previous theorizing and research regarding the role of emotion in moralization has focused specifically on the role of disgust (e.g., Chapman & Anderson, 2014; Pizarro et al., 2011; Rottman & Kelemen, 2012; Rozin et al., 1997; Rozin & Singh, 1999), implying that disgust might be uniquely involved in the acquisition of new moral beliefs, the present results suggest that disgust-based testimony does not play a privileged role in the moral domain. Indeed, anger-based testimony produced comparable mean changes in moral acquisition. These equivalent effects of anger-based and disgust-based testimony challenge domain-specific hypotheses asserting that distinct emotions are uniquely relevant for moralization. Instead, these results support the hypothesis that emotions like disgust and anger exert redundant effects on moral judgments (e.g., Cameron et al., 2015; Cheng et al., 2013).

Yet, evidence of similar main effects does not conclusively demonstrate that the underlying processes are isomorphic. Although the current evidence largely favors a domain-general account (but see the online supplementary materials), further studies are necessary before drawing any firm conclusions. In particular, it is unclear what results would be produced by other forms of emotion-laden testimony. We believe it is unlikely that *any* kind of emotion-laden testimony would have similar moralizing effects, particularly as Rottman and Kelemen (2012) found that testimony about actions being "boring" produced moral condemnation at levels comparable to the present Control condition. However, as boredom is a low-arousal negative emotion (Russell, 1980), future research should investigate the impact of testimony appealing to negatively valenced but high-arousal emotions (e.g., fear) and testimony conveying general disapproval.

## Appeals to Harm in Explanations of Moral Judgments

As far as we are aware, the current research represents the first demonstration of a dissociation between moral judgments and moral explanations in children. Specifically, participants who were provided with emotion-based testimony in Study 1 did not invoke this information when explaining why they judged the actions to be wrong. Instead, participants frequently tended to appeal to welfare-based reasons in their explanations. (Participants in Study 2, who were provided with principle-based testimony that largely involved harm or injustice, also frequently explained their moral evaluations with appeals to welfare. In this case, their explanations were directly in accordance with the information they were provided, suggesting that children do sometimes display introspective

access to the sources of their moral judgments.) This high proportion of welfare-based explanations suggests that children's "wrong" judgments were reflective of a *moral*, rather than conventional, stance (e.g., Turiel, 1983).

Although the behaviors under evaluation caused no apparent harm and participants in Study 1 were not provided with evidence of any perceptible suffering, it is possible that participants automatically intuited the presence of injured victims or a more abstract form of harm upon learning that the actions were disgusting or angering. Under this interpretation, participants' explanations were veridical interpretations of the testimony they were provided. In other words, learning that something is gross or irritating could have triggered subjective intuitions of harm (Gray et al., 2014), while simultaneously increasing moral evaluations of wrongness. Alternatively, imagined harm (rather than the emotion-laden testimony itself) could have directly amplified evaluations of wrongness (Schein, Ritter, & Gray, 2016; Turiel, Hildebrandt, & Wainryb, 1991; Turiel, Killen, & Helwig, 1987; Wainryb, 1991).

However, although explanations of moral judgments often include appeals to harm or victims, actual or imagined harm are not necessarily the true causes of those judgments (DeScioli, Gilbert, & Kurzban, 2012; Ditto, Liu, & Wojcik, 2012; Gutierrez & Giner-Sorolla, 2007). Rather than reflecting beliefs that harm actually occurred, formed upon hearing that actions were disgusting or angering, the Study 1 data suggest that participants' explanations were rooted in a priori folk theories about what is central to moral blame, and did not accurately reflect underlying causal processes of moral reasoning (Haidt, 2001; Nisbett & Wilson, 1977). Just as children are sometimes unaware of the processes underlying their social learning in nonmoral domains (e.g., Chudek, Heller, Birch, & Henrich, 2012), and just as adults have difficulties generating accurate moral explanations when justifying condemnations of offenses stipulated to be harmless (Haidt & Hersh, 2001; Rottman et al., 2014; Uhlmann & Zhu, 2014), participants in this research did not demonstrate robust introspective awareness into the sources of their moral judgments. In particular, across all four conditions in Study 1, there were no substantial differences in children's patterns of explanations for their moral judgments. This suggests that participants did not perceive more harm after hearing particular forms of testimony (e.g., about actions being irritating). Although presumptions of harm often occur in the wake of feelings of anger (Gutierrez & Giner-Sorolla, 2007), there were no differences in the extent to which harm-based explanations were invoked in the Anger Testimony condition compared with the other conditions (including the Control condition). This lack of differences in explanatory content between the Control condition and the experimental conditions, combined with participants' failure to report the relevance of the crucial information in the testimony conditions, tentatively suggests that the study manipulations influenced moral evaluations in ways that participants did not realize.

In sum, rather than explaining their judgments through accurate introspection, it is quite possible that children were confabulating plausible explanations by relying on beliefs about what prototypically constitutes a moral wrong (Haidt, 2001; Nisbett & Wilson, 1977) and their recognition that explanations should center upon cultural common ground (Liebal, Carpenter, & Tomasello, 2013). Harm is the most common principle in Americans' moralistic rhetoric and the most easily recalled form of morality, and is thus a highly plausible candidate explanation for judging an action to be

wrong (Schein & Gray, 2015). These patterns of explanation can therefore provide insight into children's concepts of what prototypically (and perhaps acceptably) defines the moral domain—suggesting that they explicitly believe that the immorality of actions is (and perhaps should be) derived from their harmful outcomes, but not from their disgusting or irritating nature.

## Conclusion

A recent proposal to build a gondola tramway in a pristine swath of the Grand Canyon is abhorrent to many who value nature for its own sake, while rising levels of apostasy have fueled the enmity of the Islamic State (ISIS). In general, seemingly victimless actions can cause righteous outrage when they are moralized, and many harmless acts that are considered by some to be moral transgressions (e.g., polytheism, polygamy, homosexuality, obscenity, stem cell research) represent the root of the "culture wars" that have sparked violent disagreements across ideological divides both intranationally and internationally (Haidt, 2012; Haidt & Hersh, 2001; Jensen, 1998; Koleva, Graham, Iyer, Ditto, & Haidt, 2012). The present research has demonstrated that testimony—a powerful source of cultural learning—can lead children to rapidly acquire moral beliefs about actions that similarly lack apparent victims.

The implications of these findings are manifold, and might be seen as alarming, encouraging, or perhaps both. On the one hand, this research suggests a need for parents and teachers to monitor what they say to their children and students, given that passing testimony about harmless actions—whether rational or not—can lead to enduring condemnation. On the other hand, these findings show that children can be readily taught to form moral beliefs about matters that have only recently become critical moral issues, such as climate change. If moral beliefs are neither fully innate nor fully derived from maturation and autodidactic constructive processes, but can be influenced by adults in a measureable way, then conversations with younger generations can indeed be a crucial element in facilitating positive moral change.

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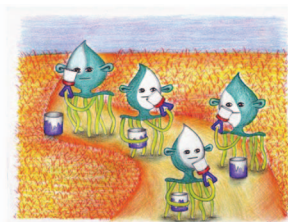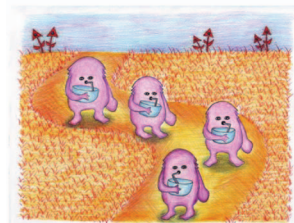
# Appendix

## Experimental Stimuli

### Body-Directed Behaviors
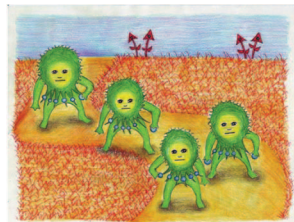


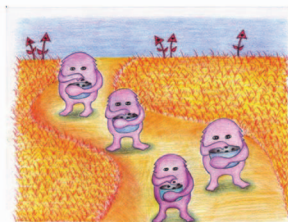Keeping berries on their protective spines

Painting their faces white

Drinking from straws instead of spoon hands

Covering their heads with sticks
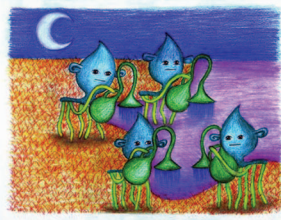
Walking around with fake legs

Putting crunchy bits in their food

*(Appendix continues)*

## Nature-Directed Behaviors



Sprinkling blue water into the big puddle
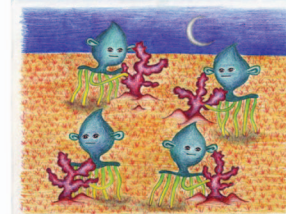
Filling the forest with cotton balls

Building machines to make the air mistier

Watering flowers to make them big and square

Blocking the river so it flows elsewhere

Replanting trees from other planets

See the online article for the color version of this appendix.

## S1. Individual Differences Measures

In our research, we additionally tested a trait-based hypothesis that elevated *dispositional* tendencies to feel specific moral emotions would increase susceptibility to testimony invoking these emotions.  Previous studies have found that individual differences in adults' trait sensitivity to disgust elicitors, such as feces and cockroaches, are reliably related to individual differences in their morally relevant judgments.  For example, high levels of trait disgust are correlated with more negative implicit associations with homosexuality (Inbar, Pizarro, Knobe, & Bloom, 2009). Additionally, disgust sensitivity is associated with unfavorable attitudes toward immigrants and foreigners (Hodson & Costello, 2007; Navarrete & Fessler, 2006), higher levels of political conservatism (Inbar, Pizarro, Iyer, & Haidt, 2012), and conservative positions on specific political issues such as abortion and gay marriage (Inbar, Pizarro, & Bloom, 2009; Terrizzi, Shook, & Ventis, 2010).  Individuals with heightened trait disgust also have generally lowered thresholds for attributing moral culpability (Chapman & Anderson, 2014; Jones & Fitness, 2008).

### S1.1. Study 1

The Trait Disgust measure involved Likert-scale ratings of four child-friendly items adapted from a previously existing adult questionnaire: the 32-item Disgust Scale (Haidt, McCauley, & Rozin, 1994; Olatunji et al., 2007).  A Trait Anger measure was additionally

administered to participants in the Anger Testimony condition, and involved Likert-scale ratings of four child-friendly items selected from a longer 22-item adult measure (Spielberger, Jacobs, Russell, & Crane, 1983).[1] The items are reproduced in Table S1.

The Trait Anger and Trait Disgust scales ranged from 4 (low) to 20 (high). Results yielded a Trait Disgust mean of 14.89 ($SD = 3.16$) and a Trait Anger mean of 9.77 ($SD = 3.99$). Overall, there was a significant positive correlation between Trait Disgust and wrongness judgments, $r(118) = .184, p = .045$. While this correlation was non-significant in the Control condition, $r(28) = -.025, p = .896$, the Induced Disgust condition, $r(28) = .028, p = .882$, and the Anger Testimony condition, $r(28) = .247, p = .187$, there was a significant positive correlation between Trait Disgust scores and wrongness judgments in the Disgust Testimony condition, $r(28) = .399, p = .029$. This suggests that the children who were particularly prone to experiencing disgust were the most receptive to the moralizing effects of disgust-based testimony. Moreover, the relevance of disgust sensitivity was specific to the effectiveness of the testimony, as dispositional tendencies to experience disgust were not related to harsher moral judgments in the other conditions.

For participants in the Anger Testimony condition (the only condition in which the Trait Anger scale was administered), there was a significant positive correlation between Trait Anger scores and wrongness judgments, $r(28) = .391, p = .033$, and no relationship detected between levels of Trait Disgust and levels of Trait Anger, $r(28) = -.066, p = .728$. This suggests that the

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[1] Data collection for the Anger Testimony condition began after much of the other data in this study had already been collected, and therefore we were not able to measure Trait Anger in the other conditions. However, this was the final measure presented and therefore could not impact children's other responses.

children who were particularly prone to experiencing anger were especially receptive to the moralizing effects of anger-based testimony.

Due to the low internal consistencies of these scales, correlations with each of the individual items were additionally explored. These analyses demonstrated that there were no significant correlations between any items in the Trait Disgust measure and "wrong" judgments in the Control condition, the Induced Disgust condition, or the Anger Testimony condition. The significant correlation in the Disgust Testimony condition was driven primarily by a single item ("If your friend gave you a piece of chocolate and it was shaped like dog doo, would you eat it?"), $r(28) = .466$, $p = .009$.[2] Additionally, the only significant correlation between "wrong" judgments and specific items in the Anger Testimony condition was found for an item from the Trait Anger measure: "When you get mad, do you say nasty things?", $r(28) = .537$, $p = .002$.

Overall, these data have yielded tentative but suggestive evidence of subtle domain-specific effects. Children with greater tendencies to feel revulsion toward non-moral disgust elicitors (e.g., feces-shaped chocolate) were more likely to acquire moral beliefs upon hearing that actions were disgusting and gross, and children who were highly prone to experience anger in their everyday lives were more likely to acquire moral beliefs upon hearing that actions were

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[2] This could be due to the fact that monkey meat, cockroaches, and flyswatters may have failed to invoke the appropriate reactions in a subset of the sample, as suggested by the fact that some children asked for clarification about what these three elicitors were. Additionally, the "chocolate shaped like dog doo" item is the only item that involves ideational disgust, which could be more important for morality than the more concrete pathogen vectors examined in the other questions in the measure.

angering and irritating.  However, because these trait measures of emotional sensitivity had low internal consistency, this finding should be regarded as provisional and preliminary.

### *S1.2. Study 2*

Correlational analyses demonstrated that there were no significant relationships between Trait Disgust and wrongness judgments, $r(26) = .127$, $p = .520$, or between Trait Anger and wrongness judgments, $r(26) = -.103$, $p = .602$.  This again suggests that emotional dispositions do not globally predict moralization, affirming the previous conclusion that there is instead a specific link between particular emotional dispositions and receptivity to particular kinds of emotion-laden testimony.

**S2. Analyses of First Trials in Study 1**

   In order to control for potential order effects caused by factors such as repetition of the testimony and possible habituation to the smell, and in line with Martin and Olson (2015)'s recommendation to report results from first trials in addition to presenting findings from across trials, a one-way ANOVA was additionally conducted on participants' judgments of the first action they viewed.  This analysis was significant, $F(3, 116) = 9.31$, $p < .001$, $\eta^2_p = .194$. Planned $t$-tests demonstrated that the proportion of "wrong" judgments was significantly different between the Disgust Testimony condition and the Control condition, $t(36.90) = 3.49$, $p = .001$, $d = 0.91$ (95% CI: 1.68, 6.32), and between the Anger Testimony condition and the Control condition, $t(36.35) = 4.73$, $p < .001$, $d = 1.23$ (95% CI: 3.20, 8.00).  There were also significant increases in "wrong" judgments between the Induced Disgust condition and both the Disgust Testimony condition, $t(48.54) = 2.53$, $p = .015$, $d = 0.65$ (95% CI: 0.66, 5.75), and the Anger Testimony condition, $t(47.48) = 3.69$, $p = .001$, $d = 0.95$ (95% CI: 2.18, 7.42).  There were no significant differences between the Induced Disgust condition and the Control condition, $t(47.41) = 1.03$, $p = .310$, $d = 0.27$ (95% CI: -0.77, 2.36), or between the Anger Testimony condition and the Disgust Testimony condition, $t(58) = 1.03$, $p = .305$, $d = 0.26$ (95% CI: -1.50, 4.69).  In general, responses in the Disgust Testimony and Anger Testimony conditions remained relatively constant across the 12 trials, while responses in both the Induced Disgust and Control conditions became elevated with additional trials, perhaps due to regression to the mean.

**Table S1**. *Individual difference measures. Items were rated on a five-point Likert scale ranging from "not at all / definitely not" to "a lot / yes, definitely".*

| TRAIT DISGUST MEASURE | TRAIT ANGER MEASURE |
|---|---|
| Do you think that you would ever try eating monkey meat? | When you get mad, do you say nasty things? |
| If you saw a cockroach in somebody else's house, how much would that bother you? | When you get frustrated, do you feel like hitting someone? |
| If you were really hungry and someone gave you a bowl of your favorite soup, but it had been stirred by a fly swatter, would you drink it? | Do you get angry when somebody tells you that you're doing something wrong? |
| If one of your friends gave you a piece of chocolate that was shaped like dog doo, would you eat it? | Do you have a bad temper that makes you get angry easily? |

**Table S2**. *Representative examples of children's justifications in each coding category.*

| Category | Representative Justifications |
|---|---|
| Disgusting/ Gross | "You're not supposed to do that; it makes the grass look disgusting in the other place." <br> "It looks like they're painting their faces with marshmallows; that's really gross." <br> "It's nasty." |
| Angering/ Irritating | "It's irritating to other creatures." <br> "Everybody got annoyed." <br> "It was really angering and they didn't like it." |
| Causing Harm to Others[1] | "Animals that live there can get sick from it or die." <br> "It tricks people and that's mean." <br> "The mist machines might be built with a chemical that hurts the grass." |
| Unfairness or Obstruction[2] | "Duh – that would be stealing trees." <br> "It stops other animals from getting what they need to build other things." <br> "They're keeping berries all to theirself." |
| Causing Harm to the Self[3] | "They could break their teeth." <br> "What if it gets in their eyes and they just go crazy?" <br> "People could laugh at them and call them names; they wouldn't want to be teased." |
| Being Weird or Unnecessary[4] | "It's supposed to be blue; that's how they were born." <br> "Cotton balls are for people who want to wipe make-up off." <br> "Why would they? There's no reason." |
| Other/ Uncodable | "It's not good manners." <br> "It's just wrong; I can't say the reason." <br> "You could do it on Earth so you probably can't do it on Glinhondo." |

[1] Defined as wrongdoing involving physical or psychological harm inflicted upon moral patients.
[2] Defined as wrongdoing involving unfairly restricting moral agents from access to resources.
[3] Defined as wrongdoing involving diminishing one's own physical or psychological welfare.
[4] Defined as wrongdoing involving acting in non-normative ways that are strange or pointless.

**Table S3**. *All stimuli used for Study 3. "Poor-fitting" testimony is italicized. Each set of stimuli was administered to a total of 15 participants.*

| Type | Set 1 | Set 2 |
|---|---|---|
| Harm to Others (Interpersonal) | It really hurts others when Bonzers fill the forest with cotton balls. Acting like this is harmful to other things. | It really hurts others when Bonzers build machines to make the air more misty. Acting like this is harmful to other things. |
| Harm to Others (Interpersonal) | It really hurts others when Kulvaws sprinkle blue water into the big puddle. Acting like this is harmful to other things. | *It really hurts others when Kulvaws paint their faces white. Acting like this is harmful to other things.* |
| Harm to Others (Interpersonal) | *It really hurts others when Quimples drink out of straws instead of using their spoon hands. Acting like this is harmful to other things.* | *It really hurts others when Bonzers keep berries on their protective spikes. Acting like this is harmful to other things.* |
| Unfairness/ Obstruction (Interpersonal) | It's really unfair for Quimples to block the river to make it flow in a different direction. Acting like this prevents others from getting what they need. | It's really unfair for Quimples to pour river water on the flowers to make them big and square. Acting like this prevents others from getting what they need. |
| Unfairness/ Obstruction (Interpersonal) | *It's really unfair for Kulvaws to walk around with fake legs. Acting like this prevents others from getting what they need.* | It's really unfair for Kulvaws to take trees from other planets and plant them on Glinhondo. Acting like this prevents others from getting what they need. |
| Unfairness/ Obstruction (Interpersonal) | *It's really unfair for Bonzers to cover their heads with sticks. Acting like this prevents others from getting what they need.* | *It's really unfair for Quimples to put crunchy bits in their food. Acting like this prevents others from getting what they need.* |
| Harm to Self (Non-interpersonal) | Quimples really hurt themselves when they put crunchy bits in their food. Acting like this is harmful to them. | Bonzers really hurt themselves when they cover their heads with sticks. Acting like this is harmful to them. |
| Harm to Self (Non-interpersonal) | Bonzers really hurt themselves when they keep berries on their protective spikes. Acting like this is harmful to them. | *Quimples really hurt themselves when they block the river to make it flow in a different direction. Acting like this is harmful to them.* |
| Harm to Self (Non-interpersonal) | *Quimples really hurt themselves when they pour river water on the flowers to make them big and square. Acting like this is harmful to them.* | *Kulvaws really hurt themselves when they sprinkle blue water into the big puddle. Acting like this is harmful to them.* |
| Weird/ Unnecessary (Non-interpersonal) | It's really weird for Kulvaws to paint their faces white. Acting like this goes against how things are supposed to be. | It's really weird for Kulvaws to walk around with fake legs. Acting like this goes against how things are supposed to be. |
| Weird/ Unnecessary (Non-interpersonal) | *It's really weird for Kulvaws to take trees from other planets and plant them on Glinhondo. Acting like this goes against how things are supposed to be.* | It's really weird for Quimples to drink out of straws instead of using their spoon hands. Acting like this goes against how things are supposed to be. |
| Weird/ Unnecessary (Non-interpersonal) | *It's really weird for Bonzers to build machines to make the air more misty. Acting like this goes against how things are supposed to be.* | *It's really weird for Bonzers to fill the forest with cotton balls. Acting like this goes against how things are supposed to be.* |

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