aps ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

Perspectives on Psychological Science
2016, Vol. 11(3) 315–324

DOI: 10.1177/1745691615621275
pps.sagepub.com
SAGE

Evidence for Absolute Moral Opposition to Genetically Modified Food in the United States

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Abstract
Public opposition to genetic modification (GM) technology in the food domain is widespread (Frewer et al., 2013). In a survey of U.S. residents representative of the population on gender, age, and income, 64% opposed GM, and 71% of GM opponents (45% of the entire sample) were "absolutely" opposed—that is, they agreed that GM should be prohibited no matter the risks and benefits. "Absolutist" opponents were more disgust sensitive in general and more disgusted by the consumption of genetically modified food than were non-absolutist opponents or supporters. Furthermore, disgust predicted support for legal restrictions on genetically modified foods, even after controlling for explicit risk–benefit assessments. This research suggests that many opponents are evidence insensitive and will not be influenced by arguments about risks and benefits.

Keywords
genetic modification, genetic engineering, biotechnology, disgust, moralization, protected values, sacred values

Opposition to genetically modified food is widespread (Frewer et al., 2013; Priest, 2000), even for crops with great potential to benefit the world's least well-off. For example, vitamin A deficiency is a major health problem in developing countries, but genetic modification (GM) opponents have strongly resisted programs to provide subsistence farmers in Africa and Asia with genetically modified "golden rice" that produces the Vitamin A precursor beta-carotene (Harmon, 2013). In the European Union, the use of genetically modified organisms in agriculture is subject to extensive restrictions, and eight European nations have used the so-called "safeguard clause" to bar the cultivation of specific crops (United States Department of Agriculture, 2015). Some of this opposition is grounded in concerns about unknown ecological or health consequences of GM technology. Genetically modified foods have only been in general use for about 20 years (Bruening & Lyons, 2000), so a follower of the precautionary principle—which holds that an action that might cause harm should not be undertaken without near-certainty about its safety—might be opposed to genetically modified food on the basis of possible unknown risks (Taleb, Read, Douady, Norman, & Bar-Yam, 2014).

Nonetheless, the scientific consensus is that genetically modified crops are no more dangerous than conventionally bred alternatives. For example, the American Association for the Advancement of Science (AAAS) writes that "the World Health Organization, the American Medical Association, the U.S. National Academy of Sciences, the British Royal Society, and every other respected organization that has examined the evidence has come to the same conclusion: Consuming foods containing ingredients derived from GM crops is no riskier than consuming the same foods containing ingredients from crop plants modified by conventional plant improvement techniques" (AAAS, 2012). Likewise, independent scientific reviews of the environmental risks of GM agriculture have not yet uncovered meaningful risks to the natural environment above and beyond those of conventional (i.e., non-GM) agriculture (Nicolia, Manzo, Veronesi, & Rosellini, 2014; Sanvido, Romeis, & Bigler, 2007).

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The U.S. public, however, does not share this sanguine attitude. Although U.S. consumers may be more accepting of GM than Europeans (Gaskell, Bauer, Durant, & Allum, 1999; Rozin, Fischler, & Shields-Argelès, 2012), opposition in the U.S. is widespread and has remained so over time (Hallman, Cuite, & Morin, 2013; Hallman, Hebden, Aquino, Cuite, & Lang, 2003). A recent survey of U.S. adults and scientists found that only 37% of the public thought genetically modified food was safe to eat, whereas 88% of AAAS members thought it was (Pew Research Center, 2015). This 51-point gap between scientists and the public was the largest of any issue tested, including anthropogenic climate change and human evolution. This divergence between scientific and public opinion is striking and has stimulated a great deal of research on public acceptance of GM. Much of this research has proceeded from the explicit or implicit premise that consumers logically reason about costs and benefits to arrive at their attitudes and thus has focused on rational or quasi-rational factors such as beliefs about GM risks and benefits (Siegrist, 2000), trust in GM-related institutions (Frewer, Scholderer, & Bredahl, 2003), and scientific literacy (Frewer et al., 2003). A recent meta-analysis of these studies has identified a set of factors consistently associated with GM opposition, including higher perceived risks than benefits and lower trust in institutions (Frewer et al., 2013).

As productive as this approach has been, it has significant limitations. Beliefs about GM risks and benefits may often be the result of preexisting attitudes toward GM rather than independent determinants of those attitudes (Costa-Font & Mossialos, 2007; Finucane, Alhakami, Slovic, & Johnson, 2000; Scholderer & Frewer, 2003), and values such as moral convictions about nature or technology are important determinants of GM attitudes for many (Bredahl, 2001). Indeed, the same meta-analysis of correlates of GM opposition identified moral concerns as consistent predictors, particularly in the United States (Frewer et al., 2013).

Furthermore, an approach that focuses primarily on reasoning about risks and benefits is difficult to reconcile with how little people seem to know about GM. When U.S. citizens were given a 4-item quiz of basic true–false questions about biotechnology (e.g. "It is possible to transfer animal genes into plants"), the average score was 60.8%—about 10 points better than chance (Gaskell et al., 1999). And people seem to realize how little they know: In a 2013 U.S. survey, 54% said they knew "very little" or "nothing at all" about biotechnology (Hallman et al., 2013). What could explain the coexistence of minimal public knowledge about GM (both actual and professed) with the widespread belief that genetically modified foods are unsafe and undesirable?

We argue that this combination of minimal knowledge and strong conviction is sensible if, for many people, attitudes about GM are the result of absolute moral values rather than consequence-based calculations. Psychologists have called these kinds of moral values "sacred" or "protected" values (Baron & Spranca, 1997; Tetlock, 2003). Their defining characteristic is the unconditional proscription of certain actions (e.g., "Do not cause the extinction of a species" or "Do not kill another human being"). Absolute moral values are explicitly regarded as axiomatic, requiring no further justification, and are protected from trade-offs with nonmoral (secular) values—especially money. Many people believe, for example, that buying and selling human organs is intrinsically morally wrong and should be prohibited regardless of whether organ markets might make people better off on average (Roth, 2007). Violations of absolute moral values evoke strong emotions, such as anger and disgust (Baron & Spranca, 1997; Tetlock, Kristel, Elson, Lerner, & Green, 2000).

A separate literature has examined the role of disgust as a cause and consequence of perceived moral violations. Violations of moral standards often evoke disgust, especially when the value involves food or the body. For example, moral vegetarians are disgusted by the idea of eating meat, more so than vegetarians who avoid meat for health reasons (Rozin, Markwith, & Stoess, 1997). Furthermore, some behaviors seem to be morally proscribed because they are disgusting (Horberg, Oveis, Keltner, & Cohen, 2009). When people are asked whether disgusting but putatively harmless behaviors—such as consensual sex between siblings or a family consuming its deceased pet dog—are morally wrong, the answer is typically a quick "yes" (Haidt & Hersh, 2001; Haidt, Koller, & Dias, 1993). People are extremely reluctant to abandon this moral condemnation even when any harmful consequences (e.g., the siblings might get pregnant, dog flesh might make you ill) are explicitly eliminated. Just like sacred or protected values, these moral judgments seem to be evidence insensitive—they are based on an absolute proscription of the behavior in question, rather than an evaluation of good or bad consequences. Disgust-based proscription seems to occur largely for behaviors that violate values pertaining to sex, food, and the body or those that evoke notions of unnaturalness, impurity, or contamination (Haidt et al., 1993; Rozin, Haidt, & McCauley, 2008). Consequently, disgust-based proscription may be especially likely for GM. Consistent with this possibility, genetically modified food is often described by opponents as unnatural (e.g., "Frankenfood"), as contaminating people by ingestion, and as contaminating the natural environment by contact (see McWilliams, 2015).

In this survey, we examined the roles of disgust and moral absolutism in Americans' attitudes toward

genetically modified food. We used measures from the literature on protected values (Baron & Leshner, 2000; Baron & Ritov, 2009; Baron & Spranca, 1997; Ritov & Baron, 1999) to answer three main questions:

1. How widespread is American opposition to GM, and how much of that opposition is absolute moral opposition?
2. What role does disgust play—as a cause and/or consequence—in moral opposition to GM?
3. What is the relationship between disgust and support for legal restrictions on GM food?

The most important findings of our survey are described below. However, many details of the measures, participants, statistical analyses, and extended robustness checks can be found in the online Supplemental Materials.

Participants

In June and July of 2013, 1,022 participants representative of the U.S. population on age, gender, and income were recruited and paid by Qualtrics.com, an online survey hosting and panel recruitment service, to complete the study online (for more information about recruitment, see Supplementary Materials). We specified a minimum sample size of 1,000 participants based on effect sizes from a pilot study, and we ceased data collection when our minimum sample size was reached. We decided *a priori* to exclude individuals who did not pass two attention-check questions.[1] The final sample was 859 participants (51.7% female; M_{age} = 46.9, SD = 16.5).

Most GM Opposition Is "Absolute"

Absolute moral values are defined as injunctions to be upheld regardless of consequentialist considerations (Baron & Spranca, 1997; Tetlock, 2003). These absolute values are universalized, elicit more emotion, and lead to more judgment errors, such as the omission bias (Baron & Ritov, 2009; Baron & Spranca, 1997; Ritov & Baron, 1999). To assess absolute moral opposition to GM, we presented participants with four agree/disagree statements (adapted from Baron & Spranca, 1997) about genetically engineering plants and animals. These were (a) "I do not oppose this," (b) "This should be prohibited no matter how great the benefits and minor the risks from allowing it," (c) "It is equally wrong to allow some of this to happen as to allow twice as much to happen. The amount doesn't matter," and (d) "This would be wrong even in a country where everyone thought it was not wrong." Participants were classified as "supporters" if they answered "no" to Question 1 (Q1). Our primary classification of participants as nonabsolutist or absolutist opponents was based on responses to Q2, as agreement with this question is a face-valid statement of absolutism. However, our results were not sensitive to this specification. Answers to Qs 2, 3, and 4 were the same for 80% of participants, and alternate classifications (e.g., based on Qs 3 and 4) also yielded very similar results to those reported below (full details are available in the Supplemental Materials).

In our primary analyses, participants were classified as supporters if they answered "yes" to Q1 and "no" to Q2, as nonabsolutist opponents if they answered "no" to both questions, and as absolutist opponents if they answered "no" to Q1 and "yes" to Q2. (Data from 56 individuals with inconsistent responses—i.e., "yes" to both questions—were excluded.) Thus, participants were classified as moral absolutists if they were opposed to GM and said that they would maintain their opposition regardless of consequences. According to this classification scheme, which is based on the one used by Baron and Spranca (1997), most participants (515/803; 64%) were opposed to GM, and most opposition (366/515; 71%; i.e., 46% of the entire sample) was absolute.

Moral Absolutists Are More Disgusted by Genetically Modified Food

We presented participants with four scenarios describing consumption of genetically modified foods (tomatoes, apples, tuna, and milk) to assess their affective reactions (see Supplemental Materials for the full scenarios). Each scenario had two versions: one in which the individual intentionally consumed the food, and another in which the individual unintentionally consumed the food. For example, the tomato scenarios read: "Mary eats tomatoes that have been genetically modified. She knows [does not know] the tomatoes have been genetically modified. Scientists have inserted genes in them so that they stay fresh longer." For each scenario, participants were randomly assigned to see either the intentional or unintentional version. Immediately after reading each scenario, participants were asked to either select a word ("disgust" or "anger") or a facial expression (a disgusted or angered face, from Rozin, Lowery, Imada, & Haidt, 1999) that best captured their reaction upon imagining the scenario. Finally, all participants were asked to rate (from 1 to 9) how disgusted and how angered they were when imagining the scenario (1 = *not at all angry/disgusted*, 9 = *extremely angry/disgusted*).

Our first set of analyses concerned these disgust and anger ratings. We averaged disgust ratings (α = .91) across the four scenarios to create composite scores. Moral absolutists were most disgusted by scenarios describing genetically modified food consumption. The

left panel of Figure 1 shows composite disgust reactions averaged across the four scenarios. Absolutists were more disgusted (M = 5.48, SD = 2.03) than were nonabsolutist GM opponents, M = 4.42, SD = 2.01; $t(513) = 5.42$, $p < .001$, $d = .53$, and GM supporters, M = 2.62, SD = 1.76; $t(652) = 18.98$, $p < .001$, $d = 1.51$.

Furthermore, moral absolutism was associated with disgust more than anger. We averaged anger ratings across the four scenarios to create anger composite scores ($\alpha = .90$). We then conducted a multinomial logistic regression in which absolutist opponents were the reference category and entered disgust and anger composites simultaneously as predictors. (Both composites were standardized to facilitate interpretation of effect sizes.) Both disgust ($b^* = -.960$, Wald $\chi^2 = 17.89$, $p < .001$) and anger ($b^* = -.815$, Wald $\chi^2 = 12.61$, $p < .001$) distinguished absolutist opponents from supporters, but only disgust ($b^* = -.802$, Wald $\chi^2 = 11.01$, $p = .001$) distinguished absolute from nonabsolute opposition (anger $b^* = .266$, Wald $\chi^2 = 1.25$, $p > .10$).

These effects held when controlling for demographics and individual differences. In a multinomial regression with absolute moral opposition as the reference category, we entered the following as predictor variables: disgust, two measures of the extent to which people feel close and connected to the natural world (connectedness to nature, Mayer & Frantz, 2004; and inclusion of nature in self, Schultz, 2001), perceived risks and benefits of GM and trust in GM-related institutions (Siegrist, 2000), gender, age, income, religiosity, education, political orientation, and ethnicity. Disgust was the best predictor for distinguishing nonabsolute opposition and support from absolute moral opposition (see Table S2 in the Supplemental Materials).

To check robustness to an alternative emotion measure, we examined whether participants were more likely to choose disgusted rather than angry faces after reading each of the genetically modified food consumption scenarios. (Recall that half of participants chose between facial expressions; the other half chose between the verbal labels "disgust" and "anger.") Ratings of disgust and anger in response to moral violations are almost always highly correlated, and consequently researchers generally examine the effect of one emotion controlling for the other (e.g., Gutierrez & Giner-Sorolla, 2007; Russell & Giner-Sorolla, 2011a, 2011b). A forced choice between the two is therefore a very conservative test of our hypothesis. Nonetheless, participants were more likely to choose disgusted faces than angry faces (57.2% for Scenario 1, $p = .003$; 59.1% for Scenario 2, $p < .001$; 53.7% for Scenario 3, $p > .10$; 56.3% for Scenario 4, $p = .01$, all two-tailed binomial sign tests). This pattern was statistically indistinguishable from the responses of those participants who were asked to choose between verbal labels. Furthermore, for two of the four scenarios, GM opponents were more likely to choose disgusted faces than GM supporters (see Supplementary Materials for the full results). It is therefore unlikely that the current results are an artifact of the use of the word "disgust" in English.

We also compared scenarios that involved intentional and unintentional consumption of genetically modified food. For three of four scenarios, disgust was significantly higher for unintentional consumption. Although we did not anticipate this result *a priori*, we suspect

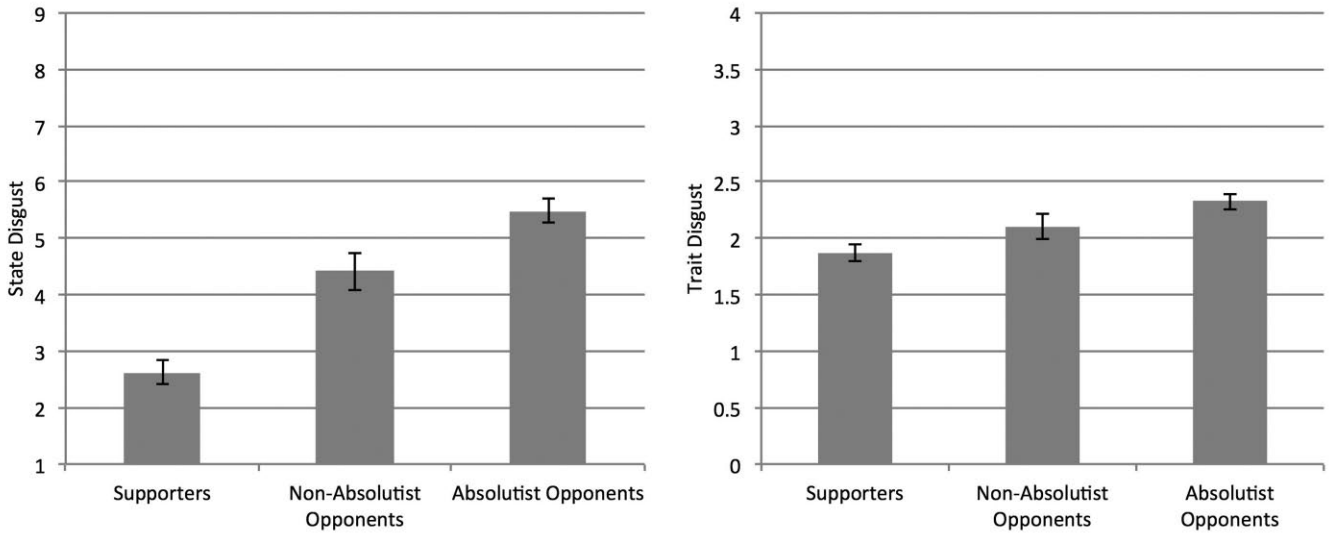

Fig. 1. Disgust reactions to genetically modified food consumption scenarios (averaged across four scenarios; left panel) and trait disgust sensitivity (DS-R; right panel) for GM supporters, nonabsolutist opponents, and absolutist opponents. Error bars are 95% confidence intervals.

participants were more disgusted by inferred deception on the part of the firms selling the food. There were no reliable interactions between the effects of intentionality manipulation and level of opposition (i.e., absolutist opponent, non-absolutist opponent, supporter) on disgust and anger. Analyses with disgust ratings from only the intentional consumption scenarios (that is, the scenarios in which someone was described as knowingly consuming genetically modified food) were nearly identical to those reported here. Further analyses of the intentionality manipulation are available in the Supplemental Materials.

Disgust Is Specifically Associated With GM Absolutism

It is possible that disgust is central to any strong moral aversion and that the relationship between moral absolutism and disgust is simply a specific example of this more general phenomenon. To examine this alternative explanation for our results, we also asked people the same moral absolutism questions about "fishing in a way that leads to the death of dolphins" and classified people as supporters (56/789; 7.1%), nonabsolutist opponents (165/789; 20.9%), or absolutist opponents (568/789; 72.0%) of this practice. (We excluded 70 people due to inconsistent responses.) Absolute opposition to dolphin killing elicited more anger (M = 6.89, SD = 2.19) than disgust, M = 6.62, SD = 2.28; $t(859) = 4.91$, $p < .001$, d = .17. In a multinomial logistic regression with absolutist dolphin-killing opponents as the reference category and standardized disgust and anger scenario ratings as predictors, disgust ($b^* = -.444$, Wald $\chi^2 = 4.84$, $p = .028$) and anger ($b^* = -1.006$, Wald $\chi^2 = 27.11$, $p < .001$) distinguished absolutist opponents from supporters, but only anger ($b^* = -.444$, Wald $\chi^2 = 11.89$, $p = 0.001$) distinguished absolutist from nonabsolutist opponents (disgust; $b^* = -.177$, Wald $\chi^2 = 1.83$, $p > .10$). Thus, it appears that there are specific features of GM—such as connection with food and health, "unnaturalness," or potential for contamination—that make disgust-based moral absolutism especially likely.

Disgust Sensitivity Predicts Absolute GM Opposition

Thus far, we have shown that moral absolutist GM opponents are more disgusted by the consumption of genetically modified food and that disgust is more predictive of moral absolutism than anger. This relationship between disgust and moral absolutism was not observed for fishing in a way that kills dolphins, suggesting that disgust is not simply a downstream consequence of the perceived violation of any moral value (Pizarro, Inbar, & Helion, 2011). Rather, GM absolutism in particular seems to entail disgust. Furthermore, the causal arrow likely goes in both directions: If some people think that GM is intrinsically disgusting—perhaps because it is seen as "unnatural" and creepy (Tenbült, De Vries, Dreezens, & Martijn, 2005) or evokes contamination-related imagery—they may be more inclined toward absolute moral opposition. One way to test this idea is compare the overall (i.e., domain-general) disgust sensitivity of absolutist and nonabsolutist GM opponents. If absolute GM opposition results in part from disgust, then disgust-sensitive individuals—those who are especially likely to attend to disgust cues and react with disgust to ambiguous cues—should be more inclined to absolute opposition.

We measured trait disgust sensitivity with the widely used 25-item Disgust Scale–Revised (Haidt, McCauley, & Rozin, 1994, modified by Olatunji, Williams, Tolin, & Abramowitz, 2007). As the right panel of Figure 1 shows, absolutist GM opponents were more disgust sensitive (M = 2.33, SD = .65) than were nonabsolutist GM opponents, M = 2.11, SD = .68, $t(513) = 3.41$, $p = .001$, d = 0.33, and GM supporters, M = 1.88, SD = .64, $t(652) = 8.87$, $p <$ .001, d = .70. Again, this association was robust to controlling for demographics, explicit risk-benefit assessments, and individual differences (see Table S3 in the Supplemental Materials).

Disgust Predicts Support for Genetically Modified Food Restrictions

To measure support for GM-related legal restrictions, we assessed support for five different regulations restricting genetically modified foods (e.g., "Your government forbidding any sale of GM foods within the nation's borders"). Ratings of the five regulations were highly correlated (α = .85), and we therefore averaged them to form a single composite in which higher scores indicate greater support for GM restrictions. Support for restrictions correlated positively with disgust at genetically modified food consumption, $r(857) = .36$, $t = 11.33$, $p < .001$, and with disgust sensitivity, $r(857) = .21$, $t = 6.13$, $p < .001$.

To investigate whether disgust predicted support for GM restrictions over and above explicit beliefs about risks and benefits, we adapted scales created by Siegrist (2000). These asked participants to rate the perceived severity of four possible risks of genetically modified food (e.g., "genetically modified foods being more toxic or less nutritious, harming people who consume them"); the promise of four possible benefits (e.g., "genetically modified plants increasing crop yields"); and their trust in five GM-related institutions (e.g., "agricultural companies"). A principal components analysis with varimax rotation on these items revealed the expected three components (risks, benefits, and trust in institutions), with every item loading most

strongly on the expected component (see Table S4 in the Supplemental Materials). We therefore created separate composites for perceived risks (four items, $\alpha = .91$), perceived benefits (four items, $\alpha = .92$), and trust in GM-related institutions (five items, $\alpha = .87$).

We estimated two least-squares regression models that assessed whether averaged disgust ratings across the four scenarios (Model 1) and disgust sensitivity (Model 2) predicted support for GM restrictions when controlling for explicit assessments of risks, benefits, and trust in institutions. Neither model showed substantial multicollinearity (all variance inflation factors were less than 1.3, for zero-order correlations, see Table S5). Model 1 showed that disgust ratings ($b^* = .12$, $t = 3.73$, $p < .001$) and perceived risk ($b^* = .55$, $t = 18.04$, $p < .001$) predicted support for restrictions but that perceived benefits and trust did not (ps > .40 and > .70, respectively). Model 2 showed that disgust sensitivity ($b^* = .06$, $t = 2.11$, $p = .035$) and perceived risk ($b^* = .58$, $t = 20.27$, $p < .001$) predicted support for restrictions but that perceived benefits and trust did not (ps > .19 and > .40, respectively). We then refit each model to also include controls for demographic variables and other individual differences (political orientation, religiosity, connectedness to nature, and inclusion of nature in self). These models are shown in Table 1. The only significant demographic predictor was age, as older individuals preferred stricter regulations. Disgust and disgust sensitivity continued to significantly predict support for restrictions.

These regression models are conservative in that they assume assessments of GM risks are not affected by disgust or disgust sensitivity. This assumption is very likely to be wrong, as people are known to rely on their general affective reactions toward a stimulus when making judgments about risks (e.g., the "affect heuristic," Costa-Font & Mossialos, 2007; Finucane et al., 2000). People are especially likely to rely on affect when knowledge is low (Ganzach, 2000)—which is, of course, often the case with GM. We therefore also tested a path model with disgust sensitivity, disgust at genetically modified food consumption, perceived risk, and support for GM restrictions. We allowed (a) disgust to affect support for restrictions both directly and indirectly via risk judgments and (b) disgust sensitivity to affect support for restrictions indirectly via disgust and risk judgments. This model revealed a significant total (i.e., direct plus indirect) effect of disgust on support for restrictions (standardized total effect = .34), as well as a significant indirect effect of disgust sensitivity on support for restrictions (standardized total effect = .18). For comparison, the direct effect of risk judgments on support for restrictions in this model was .55. Full details of the model specification, estimation, and fit statistics are available in the Supplemental Material.

Discussion

We draw three main conclusions from the current research. First, we find that a majority of the 64% of American participants who oppose GM can be described as moral absolutists. These individuals indicate that they would maintain their opposition for any balance of risks and benefits; that is, they profess to be evidence insensitive. Second, GM opponents, especially absolutist opponents, tend to feel heightened disgust, both generally and regarding the consumption of genetically modified foods specifically. Finally, disgust and disgust sensitivity predict support for legal restrictions of GM above and beyond explicit risk-benefit assessments.

These results underscore the power of affect to shape beliefs about the acceptability of new technologies. Not only are perceptions of risks and benefits often affectively based (Finucane et al., 2000), but at least in some cases, affectively-backed moral values are associated with willingness to disregard risks and benefits entirely. This may account for the ineffectiveness of persuasion attempts emphasizing benefits and casting doubt on risks of GM (Scholderer & Frewer, 2003). In this respect, GM attitudes are similar to those for other novel food technologies—including insect consumption (Ruby, Rozin, & Chan, in press) and recycled water (Rozin, Haddad, Nemeroff, & Slovic, 2015)—in which there are convincible opponents and evidence-insensitive, absolutist opponents. As in the present case, opponents of recycled water are also more disgust sensitive (Rozin et al., 2015).

A good deal of research has linked disgust to moral violations (e.g., Haidt et al., 1993; Horberg et al., 2009; Rozin et al., 1999). However, critics of the theoretical link between disgust and moral judgment have recently argued that anger, not disgust, is the predominant emotion motivating moral condemnation (Royzman, Atanasov, Landy, Parks, & Gepty, 2014). This does not seem to be the case here. We find that disgust, not anger, predicts absolute moral opposition, supporting the notion that, at least in some cases, moral disgust has downstream consequences on attitudes above and beyond anger. Critics of disgust as a moral emotion (e.g., Royzman et al., 2014) also note that many prominent examples of "moral disgust" involve some potential pathogen risk and/or involvement of body fluids, and they argue that putative moral disgust may simply be nonmoral "basic" or "core" disgust that is evoked by pathogen vectors such as feces, bodily fluids, and spoiled meat. This argument has less force when applied to the current study. Although eating is of course a core biological function, it seems unlikely that disgust at someone eating a genetically modified apple is simply core disgust of the kind elicited by pathogen threats.

Taken literally, moral absolutism poses severe problems for governmental and institutional policymaking.

Table 1. Least-Squares Regression Models Estimating the Relationship Between Disgust and Support for GM Restrictions.

	State disgust model				Trait disgust model			
Independent variable	*b*	*b**	*t*	*p*	*b*	*b**	*t*	*p*
Disgust	−.106	.139	3.958	<.001				
Disgust sensitivity					.167	.066	1.963	.05
Perceived risk	.487	.533	15.117	<.001	.526	.576	17.333	<.001
Perceived benefit	−.022	−.026	−0.836	.403	−.039	−.046	−1.486	.138
Trust	−.031	−.033	−1.056	.291	−.047	−.05	−1.575	.116
Connectedness to nature	.388	.121	3.418	.001	.421	.131	3.657	<.001
Inclusion of nature in self	−.08	−.085	−2.539	.011	−.067	−.072	−2.124	.034
Date of birth	−.012	−.106	−3.427	.001	−.011	−.099	−3.18	.002
Education	.004	.004	0.122	.903	−.01	−.009	−0.283	.778
Political orientation (7 = most conservative)	−.046	−.046	−1.41	.159	−.043	−.043	−1.305	.192
Income	−.041	−.034	−1.061	.289	−.031	−.025	−0.779	.436
Religiosity	.046	.03	0.971	.332	.049	.032	1.039	.299
Gender (1 = female, 0 = male)	.025	.007	0.228	.82	−.014	−.004	−0.119	.905
Ethnicity, White	−.095	−.017	−0.282	.778	−.103	−.019	−0.305	.76
Ethnicity, Black	−.099	−.013	−0.265	.791	−.03	−.004	−0.079	.937
Ethnicity, Hispanic	.77	.038	1.253	.211	.789	.039	1.271	.204
Ethnicity, East Asian	.247	.031	0.667	.505	.25	.031	0.669	.504
Ethnicity, Native American	.203	.014	0.465	.642	.254	.017	0.576	.565
Ethnicity, Southeast Asian	−.385	−.025	−0.766	.444	−.293	−.019	−0.577	.564

Note. Two ordinary least squares regression models—one with state disgust in response to genetically modified food consumption scenarios ("State disgust model") and one with trait disgust sensitivity ("Trait disgust model")—predicting support for regulations restricting the production and distribution of genetically modified food for 680 participants. Participants who selected a political orientation outside of liberal–conservative spectrum (e.g., "don't know") or who indicated an age outside the range of 18 to 100 years old were excluded.

Moral absolutists by definition have infinite utility for certain values; a committed moral absolutist would see the cost–benefit trade-offs that policymakers must routinely consider as irrelevant or even offensive (Tetlock et al., 2000). But how strongly are absolutist GM opponents committed to their position? The literature on protected values, from which we drew the questions we used to assess moral absolutism, can help answer this question. This research has found that people who hold a protected value do seem to treat that value differently from others. Protected values are universalized, elicit more emotion, and lead to more judgment errors, such as the omission bias (Baron & Ritov, 2009; Baron & Spranca, 1997; Ritov & Baron, 1999). So there is good reason to think that moral absolutists think about GM very differently from other people—a contention that is supported by our data.

However, the research on protected values also shows that people are not always as committed to their values as they claim to be (Baron & Leshner, 2000). In the case of GM, genetically modified corn and soybeans are present in many packaged and prepared foods in the United States, so it is likely that many GM opponents are routinely consuming genetically modified food (although they may not be doing so knowingly; Hallman et al., 2013). In this respect, GM attitudes may be like many other protected values that people claim to hold as absolute but routinely violate in practice (Baron & Leshner, 2000). This reasoning suggests that GM absolutism should be flexible at least to some degree. In a pilot study (which is described more fully in the Supplemental Material), we investigated whether absolute GM opposition is reduced by exposure to arguments in favor of genetically modified food. We recruited 355 Mechanical Turk workers and asked them the same four moral absolutism questions described earlier. However, some participants were randomly assigned to rate the persuasiveness of 10 arguments in favor of GM before they answered these questions; the remainder answered the moral absolutism questions first and rated the arguments afterwards. These arguments concerned different risks and benefits of GM; most importantly for the current results, two described large possible benefits for the global poor (preventing blindness by preventing Vitamin A deficiency and helping stop world hunger).

Surprisingly, we found that the prevalence of absolute moral opposition was not reliably affected by whether participants answered the moral absolutism questions before rating the pro-GM arguments (35% morally opposed) or afterward (29% morally opposed), $\chi^2(1, N = 337) = 1.09$, $p = .30$. (The somewhat lower prevalence of absolute opposition overall, as compared to our representative sample, is most likely due to the demographics of Mechanical Turk; for example, respondents were on average 11 years younger than our representative sample.) Across all respondents, benefits for the global poor and the environment were rated as the most persuasive arguments, but moral opponents rated even these below the scale midpoint of 4. It therefore seems that absolutist GM opponents reject even strong arguments in favor of genetically modified food and that presenting these arguments does not reliably shift opposition. Although this finding is consistent with prior research showing the ineffectiveness of persuasive messages in shifting GM attitudes (Scholderer & Frewer, 2003), to some extent it conflicts with research showing that people are willing to set aside protected values given a strong enough argument (Baron & Leshner, 2000). This apparent contradiction warrants further research.

Why genetically modified food inspires such high levels of moral absolutism is likewise an important topic for future research. We expect a number of reasons factor into absolute opposition to GM. Some may believe agricultural biotechnology companies such as Monsanto create and exacerbate economic inequality, which can itself violate a sacred value. However, people oppose genetically modified foods even when they directly benefit people in developing countries and are developed by nonprofits (Harmon, 2013), so anticorporatism cannot be the whole story. Nor is it likely that GM absolutism is the direct result of any other broader political ideology. Unlike other disgust-backed social attitudes (e.g., attitudes toward gay marriage; Inbar, Pizarro, & Bloom, 2009), attitudes toward GM are not strongly associated with political ideology, neither in our data (see Tables 1, S2, S3, and S5), nor in other nationally representative surveys (Kahan, 2015; Khan, 2013). This may seem surprising given the relationship between disgust and socially conservative beliefs (Inbar et al., 2009). However, for social conservatives, disgust-based moral intuitions often result from perceived violations of sexual purity, a value that is more important to social conservatives than to social liberals (Haidt & Hersh, 2001). In the case of GM, we believe that disgust-based moral intuitions are grounded in intuitions about contamination and perceived violations of "naturalness" (see Rozin, 2005). The current data suggest that valuing naturalness is not the exclusive province of the political left or right. However, these data and other pilot studies from our lab suggest that left- and right-wing people value it for different reasons. We believe those on the left feel more connected to nature, whereas those on the right feel stewardship over the natural world because nature is part of God's creation. If so, liberals may value nature because it is intrinsically part of a moral circle and object to any harm to wild animals or habitats. Conservatives may value nature on theological grounds and object to scientists "playing God" (Kass, 2001) by disregarding the prescribed relationship between man and the natural world.

Whatever its ultimate origin, the prevalence of moral absolutism bodes poorly for public discourse on genetically modified food. Even a rhetorical commitment to absolute moral values makes finding common ground much more difficult. For GM, as for other contentious social issues, mitigating moral absolutism may be a first step toward resolving long-standing conflicts.

Author Contributions

All authors designed the study and wrote the manuscript. S. E. Scott and Y. Inbar analyzed the data.

Acknowledgments

We thank Wes Hutchinson, Rom Schrift, and the members of the University of Toronto Morality Lab Group for their thoughtful feedback.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

Supplemental Materials

Additional supporting information may be found at http://pps.sagepub.com/content/by/supplemental-data

Note

1. Participants were excluded if they disagreed with the statement "I would rather eat a piece of fruit than a piece of paper" or if they rated the scenario "You see a person eating an apple with a knife and fork" as moderately, very, or extremely disgusting. Both these questions are included in the Disgust Scale–Revised (Haidt et al., 1994, modified by Olatunji et al., 2007) to detect inattentive responding.

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