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The Nature Of Natural

Abstract
In the modern Western world, consumers prefer natural foods, medicines, and personal care products and have a desire to connect with the natural world. Despite evident consumer demand for natural products, little research has been devoted to the psychological underpinnings of the natural preference. The present dissertation will examine the psychology of the natural preference and its implications in three chapters. Chapter 1 will expand the scope of explanations of opposition to genetically modified food by applying established theories about naturalness, sacred values and the law of contagion. Chapter 2 will examine how inferences about safety and efficacy of natural products cause natural to be more strongly preferred when preventing as opposed to curing an ailment. Chapter 3 will explore how naturalness operates as a trustworthiness cue and is more strongly preferred in the absence of other trustworthiness cues (e.g., brand familiarity).

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THE NATURE OF NATURAL

Sydney E. Scott

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in

Psychology & Marketing

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THE NATURE OF NATURAL

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I dedicate this dissertation to my family—Bill, Laura, and Drew.

Thank you all, for everything.

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Mom, Dad and Drew, thank you for your unconditional love and encouragement.

ABSTRACT

THE NATURE OF NATURAL

Sydney E. Scott

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Deborah A. Small

In the modern Western world, consumers prefer natural foods, medicines, and personal care products and have a desire to connect with the natural world. Despite evident consumer demand for natural products, little research has been devoted to the psychological underpinnings of the natural preference. The present dissertation will examine the psychology of the natural preference and its implications in three chapters. Chapter 1 will expand the scope of explanations of opposition to genetically modified food by applying established theories about naturalness, sacred values and the law of contagion. Chapter 2 will examine how inferences about safety and efficacy of natural products cause natural to be more strongly preferred when preventing as opposed to curing an ailment. Chapter 3 will explore how naturalness operates as a trustworthiness cue and is more strongly preferred in the absence of other trustworthiness cues (e.g., brand familiarity).

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PREFACE

The research of this dissertation has been conducted in collaboration with Dr. Paul Rozin, Dr. Deborah Small and Dr. Yoel Inbar. Chapter 1 of this thesis has been published as Scott, S.E., Inbar, Y., & Rozin, P. (2016). Evidence for absolute moral opposition to genetically modified food in the United States. *Perspectives on Psychological Science, 11*(3), 315-324. I was responsible study design, data collection, data analysis, and manuscript composition. Yoel Inbar assisted with study design, data analysis, and manuscript composition. Paul Rozin assisted with study design and manuscript composition. Chapter 2 of this thesis was conducted in collaboration with Deborah Small and Paul Rozin. I was responsible study design, data collection, data analysis, and manuscript composition. Deborah Small assisted with study design, data analysis, and manuscript composition. Paul Rozin assisted with study design and manuscript composition. Chapter 3 of this thesis was conducted in collaboration with Deborah Small. I was responsible study design, data collection, data analysis, and manuscript composition. Deborah Small assisted with study design, data analysis, and manuscript composition.

OVERVIEW

The present dissertation uses a multi-method approach to examine the preference for natural and its implications. The preference for natural is prevalent in the Western world and influences many everyday consumer judgments and decisions (for further discussion, see p. 27 in Chapter 2). The natural preference varies both across individuals and across situations. In Chapter 1, I examine individual differences in moral intuitions and intuitions about naturalness in the context of attitudes to genetically modified food. In Chapters 2 and 3, I examine consumers' inferences about natural products and how these inferences cause systematic variation in the natural preference across contexts.

What Does Natural Mean to the Lay Consumer?

In order to understand the natural preference, we first must understand what natural means to consumers[1]. Consumers believe naturalness comprises two key attributes: lack of extensive human intervention and processing, and lack of additives. In free responses, consumers define naturalness as that which lacks human intervention and lacks additives (Rozin, Fischler, Shields-Argelès, 2012). In laboratory studies, manipulating history of human intervention (Rozin, 2005) and the presence of additives (Rozin, 2006) reliably alters perceptions of naturalness.

Individual Differences in the Natural Preference

Much of the research that has been devoted to the natural preference examines which consumers prefer natural products (e.g., Smith, Huang, & Lin, 2009) and why some consumers might always prefer natural products (e.g., Lee, Shimizu, Kniffin, & Wansink, 2013; Honkanen, Verplanken, & Olsen, 2006). One reason why some

[1] Although there is a clear lay definition of natural, "natural" is not a legally defined and regulated term (FDA 2016; Levinovitz 2016).

consumers might always prefer natural is that natural products are perceived to be morally or ethically superior (Honkanen et al., 2006; Sunstein, 2005).

One way to understand consumers' ethical views surrounding naturalness and individual differences in those views is to use the framework of "sacred" or "protected" values. Sacred values are defined by the unconditional proscription of certain actions (e.g., "Do not kill another human being") and are backed strong negative emotions (Hanselmann & Tanner, 2008; Baron & Ritov, 2009). One potential sacred value involves tampering with nature. Indeed, consumers tend to believe that humans should not "tamper with the natural world" (Sunstein, 2005) and many sacred value violations involve destroying the natural environment (Baron & Spranca, 1997).

In Chapter 1, I use the theoretical lens of sacred values to contribute to work on individual differences in the natural preference. I examine the psychology of moral intuitions and intuitions about naturalness with respect to an important policy issue—attitudes to genetically modified food. If nature is a sacred value for some consumers, then the sacred value theoretical framework could provide a new perspective on attitudes towards GM food, which are often seen as "unnatural." Prior research on GM food attitudes generally focuses on rational or quasi-rational factors, such as beliefs about GM food's risks and benefits, trust in GM food-related institutions, and scientific literacy (e.g., Frewer, Scholderer, & Bredahl, 2003; Siegrist, 2000). This approach (which implicitly assumes that consumers usually reason about costs and benefits to arrive at their attitudes) remains the dominant paradigm in the study of attitudes towards GM food. Chapter 1 expands the scope of explanations of opposition to GM by applying established theories about sacred values and the natural preference. I investigate whether opposition to GM food is based in sacred values and emotional intuitions, and whether attitudes to the natural world predict anti-GM food attitudes above and beyond cost-benefit analyses.

Variation in the Natural Preference Across Contexts

While a great deal of research has been devoted to who might always prefer natural products and why, scant research has examined why consumers prefer natural in some contexts but not others. Consumers sometimes choose conventional products because of pricing (Hughner, McDonagh, Prothero, Shultz, & Stanton, 2007) or because the natural preference is weaker in certain product domains (Rozin et al., 2004). However, I expect that additional psychological factors drive variation in the natural preference across contexts. Chapters 2 and 3 examine inferences people make about naturalness and how that causes systematic variation in the natural preference across contexts.

Some prior work has examined the inferences consumers make about natural products. This research is often based on theories about halo effects and the affect heuristic (Nisbett & Wilson, 1977; Slovic, Finucane, Peters, & MacGregor, 2007). According to these theories, one positive attribute (naturalness) begets other positive evaluations. For example, natural hazards are viewed as having better risks and benefits (Siegrist & Sütterlin, 2014); organic cookies are believed to have lower calorie content (Lee et al., 2013); and natural perfumes are perceived to smell better (Apaolaza, Hartman, López, Barrutia, & Echebarria, 2014).

The present work expands on this research by taking a different approach. I am exploring the nuanced inferences that cause a preference for, or against natural products. Sometimes consumers have very robust, positive beliefs (e.g., that natural products are usually safer) and other times consumers have *negative* beliefs (e.g., that natural products are usually less potent). Understanding how inferences vary across attributes allows us to predict the contexts in which natural products are most appealing.

Chapter 2 examines how inferences about safety and potency make natural products more appealing in some contexts and less appealing in others. Specifically, I investigate whether consumers view natural products as safer, but less potent. I expect if consumers view natural products as safer, but less potent, they will prefer natural products more when preventing than curing ailments. When preventing an ailment, I predict consumers place more importance on safety and therefore strongly prefer natural alternatives; When curing an ailment, consumers place more importance on potency and therefore less strongly prefer natural alternatives.

Chapter 3 examines naturalness as a trustworthiness signal that is most appealing when no other trustworthiness signals are available. Trustworthiness entails beliefs about reliability, safety, and honesty (Chaudhuri & Holbrook, 2001). To the extent that both naturalness and trustworthiness are related to safety and morality (e.g., honesty), prior research suggests that natural products will be viewed as more trustworthy (Li & Chapman, 2012; Sunstein, 2005). I propose that consumer beliefs about trustworthiness systematically affect when natural products are most appealing. Specifically, if natural products are trustworthy, then they should be most appealing when other trustworthiness cues are unavailable. When other cues indicate that a product is trustworthy, naturalness as a trustworthiness cue is relatively superfluous. However, in the absence of other trustworthiness cues, natural products should be more strongly preferred because their trustworthiness is highly informative.

EVIDENCE FOR ABSOLUTE MORAL OPPOSITION TO GENETICALLY MODIFIED FOOD IN THE UNITED STATES

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 beta-carotene (Harmon, 2013). In the European Union, the use of genetically modified organisms in agriculture is subject to extensive restrictions, and six European nations have used the so-called "safeguard clause" to bar the cultivation of specific crops (European Commission's Directorate General for Health and Consumers, 2009). 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, most experts believe that genetically modified crops are no more dangerous than conventionally-bred crops. 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 human health or the natural environment above and beyond those of conventional (i.e., non-GM) agriculture (Nicolia, Manzo, Veronesi, & Rosellini, 2014; Sanvido, Romeis, & Bigler, 2007).

The American public, however, does not share this sanguine attitude. Although American consumers may be more accepting of GM than Europeans (Gaskell, Bauer, Durant, & Allum, 1999; Rozin et al., 2012), opposition in the US is widespread and has remained so over time (Hallman, Cuite, & Morin, 2013; Hallman, Hebden, Aquino, Cuite, & Lang, 2003). A recent survey of American 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). The fifty-one-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 pre-existing 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 Americans 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 correct score was 6.8%, i.e. about 10 points better than chance (Gaskell et al., 1999). And people seem to realize how little they know: Fifty-four percent of Americans in a 2013 survey 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?

I 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 non-moral (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 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, I examine the roles of disgust and moral absolutism in Americans' attitudes towards genetically modified food. I use measures from the literature on "protected values" (Baron & Spranca, 1997; Baron & Leshner, 2000; Ritov & Baron, 1999; Baron & Ritov, 2009) to answer three main questions: *First*, how widespread is American opposition to GM, and how much of that opposition is absolute moral opposition? *Second*, what role does disgust play—as a cause and/or consequence—in moral opposition to GM? *Third*, what are the consequences of disgust for people's support for GM-related public policies? The most important findings of the survey are described below. However, many details of the measures, participants, statistical analyses, and extended robustness checks can be found in Appendix A.

Methods and Results

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 Appendix A). I specified a minimum sample size of 1,000 participants based on effect sizes from a pilot study, and I ceased data collection when the minimum sample size was reached. I decided *a priori* to exclude individuals who did not pass two attention-check questions[2]. The final sample was 859 participants (51.7% female; $M_{\text{age}} = 46.9$, $SD = 16.5$).

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 & Spranca, 1997; Ritov & Baron, 1999; Baron & Ritov, 2009). To assess absolute moral opposition to GM, I asked participants four agree/disagree questions (adapted from Baron & Spranca, 1997) about "genetically engineering plants and animals." These were 1) "I do not oppose this"; 2) "This should be prohibited no matter how great the benefits and minor the risks from allowing it"; 3) "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 4) "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. My primary classification of participants as non-absolutist vs. absolutist opponents was based on responses to question 2, as agreement with this question is a face-valid statement of absolutism. However, my results were not sensitive to this

[2] 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, McCauley, & Rozin, 1994, modified by Olatunji, Williams, Tolin, & Abramowitz, 2007) to detect inattentive responding.

specification. Answers to questions 2, 3, and 4 were the same for 80% of participants, and using alternate classifications (e.g., based on questions 3 and 4) also yielded very similar results to those reported below (full details are available in Appendix A).

In my primary analyses, participants were classified as supporters if they answered "yes" to Q1 and "no" to Q2, as non-absolutist opponents if they answered "no" to both questions, and as absolutist opponents if they answered "no" to Q1 and "yes" to Q2. (Data from fifty-six 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

I presented participants with four scenarios describing consumption of genetically modified foods (tomatoes, apples, tuna, and milk) to assess their affective reactions (see Appendix A for the full scenarios). Each scenario had two versions: one where the individual intentionally consumed the food, and another where 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 how disgusted and how angered they were when imagining the scenario (1 = Not at all angry/disgusted, 9 = Extremely angry/disgusted).

My first set of analyses concerned these disgust and anger ratings. I averaged disgust ratings ($\alpha = .91$) 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 1.1 shows composite disgust reactions averaged across the four scenarios. Absolutists were more disgusted ($M = 5.48$, $SD = 2.03$) than non-absolutist 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. I averaged anger ratings across the four scenarios to create anger composite scores ($\alpha = .90$). I then conducted a multinomial logistic regression where 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 non-absolute opposition (anger $b^* = .266$, Wald $\chi^2 = 1.25$, $p > .10$).

This association was robust to controlling for demographics and individual differences. In a multinomial regression with absolute moral opposition as the reference category, I entered 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 (see Table A.2 in the Appendix A). Disgust was the best predictor distinguishing non-absolute opposition and support from absolute moral opposition.

To check robustness to an alternative emotion measure, I examined whether participants were more likely to choose disgusted 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 my 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 binomial sign tests two-tailed). 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 Appendix A for the full results). It is therefore unlikely that the current results are an artifact of the use of the word "disgust" in English.

I also compared scenarios that involved intentional versus unintentional consumption (i.e., where consumers ate food knowing versus not knowing it was genetically modified). For three of four scenarios disgust was significantly higher for unintentional consumption. Although I did not anticipate this result *a priori*, in retrospect I suspect 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 where 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 Appendix A.

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 of my results, I 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%), non-absolutist opponents (165/789; 2.9%), and absolutist opponents (568/789; 72.0%) of this practice. (Seventy people were excluded 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; $t(513)$ = 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 χ^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 $\chi^2 = 11.89$, $p = .001$) distinguished absolutist from non-absolutist opponents (disgust, $b^* = -.177$, Wald $\chi^2 = 1.827$, $p > .10$). 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, I 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 non-absolutist GM opponents. If absolute GM opposition results in part from disgust, then the disgust-sensitive—those individuals who are especially likely to attend to disgust cues and react with disgust to ambiguous cues—should be more inclined to absolute opposition.

I measured trait disgust sensitivity with the widely used 25-item Disgust Scale-Revised (Haidt, McCauley, & Rozin, 1994, modified by Olatunji et al., 2007). As the right panel of Figure 1.1 shows, absolutist GM opponents were more disgust sensitive ($M = 2.33$, $SD = .65$) than were non-absolutist GM opponents ($M = 2.11$, $SD = .68$, $t(513) = 3.41$, $p = .001$, $d = .33$) 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 A.3 in Appendix A).

Disgust predicts support for genetically modified food restrictions

To measure support for GM restrictions, I 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 ($\alpha = .85$) and I therefore averaged them to form a single composite, where 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 policy preferences over and above explicit beliefs about risks and benefits, I 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 A.4 in Appendix A). I therefore created separate composites for perceived risks (4 items, $\alpha = .91$), perceived benefits (4 items, $\alpha = .92$), and trust in GM-related institutions (5 items, $\alpha = .87$).

I 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 VIFs < 1.3, for zero-order correlations, see Table A.5). 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 perceived benefits and trust did not (*p*s > .40 and > .70, respectively). Model 2 showed that disgust sensitivity ($b^* = .06$, $t = 2.11$, $p = .035$) and perceived risk ($b^* = .58$, $t = 2.27$, $p < .001$) predicted support for restrictions, but perceived benefits and trust did not (*p*s > .19 and > .40, respectively). I then re-fit 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 1.1. The only significant demographic predictor was age, where 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 towards a stimulus when making judgments about risks (e.g., the “affect heuristic,” Costa-Font & Mossialos, 2007; Finucane, Alhakami, 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. I therefore also tested a path model with disgust sensitivity, disgust at genetically modified food consumption, perceived risk, and support for GM restrictions. I allowed a) disgust to affect support for restrictions both directly and indirectly via risk judgments; 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 Appendix A.

Discussion

I draw three main conclusions from the current research. First, I 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, Alhakami, 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, 2015) and recycled water (Rozin, Haddad, Nemeroff, & Slovic, 2015)—where 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, Lowery, 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. I 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 that putative moral disgust may simply be non-moral "basic" or "core" disgust, which 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 policy-making. Moral absolutists by definition have infinite utility for certain values; a committed moral absolutist would see the cost-benefit trade-offs that policy-makers 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 I drew the questions I 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 & Spranca, 1997; Ritov & Baron, 1999; Baron & Ritov, 2009). So there is good reason to think that moral absolutists think about GM very differently from other people—a contention that is supported by my data.

However, the research on protected values also shows that people are not always as committed to their absolute 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 Appendix A), I investigated whether absolute GM opposition is reduced by exposure to arguments in favor of genetically modified food. I 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 ten 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, I found that the prevalence of absolute moral opposition was not reliably affected by whether participants answered the moral absolutism questions before rating the arguments (35% morally opposed) or afterwards (29% morally opposed, in Yates' chi-square test $\chi^2(1, N = 337) = 1.09, p = .30$). (The somewhat lower prevalence of absolute opposition overall, as compared to my representative sample, is most likely due to the demographics of Mechanical Turk; for example, respondents were on average 11 years younger than my 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. I 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 in itself violate a sacred value. However, people oppose genetically modified foods even when they directly benefit people in developing countries and are developed by non-profits (Harmon, 2013), so anti-corporatism 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 towards gay marriage; Inbar, Pizarro, & Bloom, 2009) attitudes toward GM are not strongly associated with political ideology, neither in my data (see Tables 1.1, A.2, A.3, and A.5), 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 seem to 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, I believe that disgust-based moral intuitions are grounded in intuitions about contamination that result from 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 my lab suggest that left- and right-wing people value it for different reasons. I 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 of 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 towards resolving long-standing conflicts.

Table 1.1. Least-squares regression models estimating the relationship between disgust and support for GM restrictions.

Independent Variable	State Disgust Model				Trait Disgust Model			
	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	-.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	.122	.903	-.01	-.009	-.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	-.779	.436
Religiosity	.046	.03	.971	.332	.049	.032	1.039	.299
Gender (1 = female)	.025	.007	.228	.82	-.014	-.004	-.119	.905
Ethnicity, White	-.095	-.017	-.282	.778	-.103	-.019	-.305	.76
Ethnicity, Black	-.099	-.013	-.265	.791	-.03	-.004	-.079	.937
Ethnicity, Hispanic	.77	.038	1.253	.211	.789	.039	1.271	.204
Ethnicity, East Asian	.247	.031	.667	.505	.25	.031	.669	.504
Ethnicity, Native American	.203	.014	.465	.642	.254	.017	.576	.565
Ethnicity, Southeast Asian	-.385	-.025	-.766	.444	-.293	-.019	-.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 N = 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 are excluded.

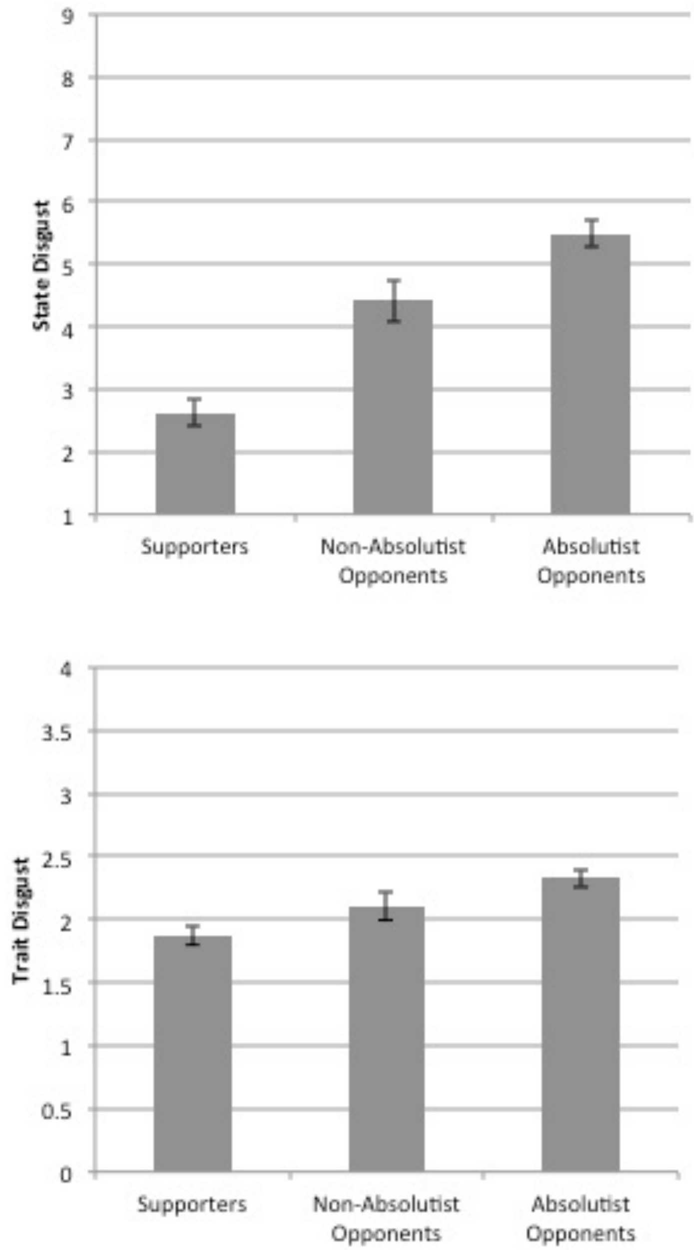


Figure 1.1. Disgust to genetically modified food scenarios and trait disgust for supporters, non-absolutists, and absolutists. Reactions to genetically modified food consumption scenarios (averaged across four scenarios; left panel) and trait disgust sensitivity (DS-R; right panel) for GM supporters, non-absolutist opponents, and absolutist opponents are displayed. Error bars are 95% confidence intervals.

CONSUMERS PREFER "NATURAL" MORE FOR PREVENTATIVES THAN FOR CURATIVES

Consumers often prefer natural versions of many things, including foods, medicines, personal care products and home products. Though "natural" is not a legally defined and regulated term (FDA, 2016; Levinovitz, 2016), consumers tend to consider natural products to be those that don't have extensive human intervention and processing or additives (Rozin et al., 2012). Consumers also widely agree that naturalness is preferable. This preference lies at the heart of many consumer trends and public policy initiatives. "Natural" was the second-most common claim (after "premium") made by new food and beverage products between 2003 and 2010 (USDA, 2011). Moreover, consumers avoid products considered unnatural, such as GMO foods, because of the human intervention involved (see Chapter 1; Tenbült et al., 2005). As a result, many companies offer GMO-free alternatives (e.g., Chipotle) and some states have passed mandatory GMO food labeling laws (e.g., Vermont; Hopkinson, 2016). In the medical domain, a growing segment of consumers avoid synthetic medical interventions (preferring "nature to take its course"). This trend is evident in the anti-vaccination movement, which has led to record-breaking measles and whooping cough outbreaks (CDC, 2016; Salzberg 2012, 2015). Finally, there is also a burgeoning natural childbirth movement, with many women using midwifes for childbirth and avoiding medical interventions like early labor induction, IV antibiotics during labor, and caesarian birth (Hamilton, Martin, Osterman, Curtin, & Mathews, 2015; Cruz, 2015).

Yet even many people devoted to naturalness abandon this preference in certain circumstances. For example, most insulin today is genetically engineered, and consumers widely approve of it (Hallman et al., 2002). Similarly, antibiotic treatments are highly unnatural. Nonetheless, even for relatively mild ailments like a minor skin infection, most consumers accept a synthetic antibiotic treatment.

Thus, anecdotally, the preference for natural products is not universally pervasive. One factor that unites the examples above for which the natural preference looms large (e.g., food, vaccination, childbirth) is that they all occur in the absence of illness so the health impacts are primarily preventative. These examples highlight a critical variable that determines when the natural preference is particularly strong: when a treatment is used as a preventative rather than a curative. I provide evidence that the distinction between preventing and curing explains variation in the preference for natural across broad product categories (e.g., food vs. medicine), within product categories (e.g., within medicine: for supplements vs. cold & flu remedies), and for the same product depending on how it is used (to prevent or to cure ailments). Furthermore, I provide evidence for the mechanism and boundary conditions based on consumers' inferences about and preferences for safety and potency in their products.

Inferences about Safety and Potency of Natural Products

One way to understand why consumers prefer natural in some situations but not others is to consider the inferences they make about natural products, and in particular about safety and potency. Past research suggests that people generally associate naturalness with safety (Slovic et al., 2007; Lee et al., 2013; Li & Chapman, 2012). Natural things are more familiar and therefore may be lower on the "unknown" dimension of risk perception (Sjöberg, 2000; Slovic, 1987). Consumers believe risks that are caused by nature (as opposed to man) are less dangerous and they are willing to pay less to reduce nature-caused risks (Kahneman, Ritov, Jacowitz, & Grant, 1993; Rudski, Osei, Jacobson, & Lynch, 2011). Indeed, natural products are thought to be safer than conventional counterparts even when there is little evidence that this is objectively the case (Hughner et al., 2007; Li & Chapman, 2012; Smith-Spangler et al., 2012).

Prior research on consumer perceptions' of potency is less straightforward. A number of theories—such as halo effects (Asch, 1946; Nisbett & Wilson, 1977; Thorndike, 1920) and the affect heuristic (Slovic et al., 2007)—emphasize that a liked object is inferred to be better on unknown attributes. Consistent with these theoretical accounts, objectively equivalent outcomes of natural (vs. human-caused) hazards are evaluated more positively (Siegrist & Sütterlin, 2014), organic products are viewed as superior on many dimensions due to the halo effect (Lee et al., 2013; Schuldt & Schwarz, 2010), and alternative medicines are sometimes viewed as better at "treating the cause, not just the symptoms" (CDC/NCHS, 2012a; Wang, Keh, & Bolton, 2010). Importantly, if this account is correct, natural products should be uniformly judged positively with little variation in preferences for the natural alternative across prevent and cure contexts.

On the other hand, natural products are sometimes marketed as "gentler" alternatives (e.g., Johnson & Johnson's Natural baby products are advertised as "Natural Made Gentle", n.d.). While there is little prior research that directly demonstrates a "natural is gentle" inference, there is evidence that ethical and green products are perceived to be gentler and less powerful (Luchs, Naylor, Irwin, & Raghunathan, 2010; Newman, Gorlin, & Dhar, 2014). Thus it seems plausible that a similar association will hold for "natural". If so, then natural products might be viewed as safer, but *less* potent. Consistent with this possibility, natural drugs for treating hypertension are perceived to be less effective than their synthetic counterparts (Meier & Lappas, 2016). Together, these findings suggest that halo effects around naturalness may not apply when it comes to judgments of potency.

I propose that, although natural products may be viewed as superior on certain dimensions, particularly safety, they are viewed as inferior on potency. These nuanced beliefs about natural products have important downstream implications. Because consumers perceive tradeoffs between safety and potency, they find natural products to be more appealing in some contexts than in others.

Importance of Safety and Potency when Preventing versus Curing

If consumers infer that natural alternatives are safer but less potent, then they should prefer natural alternatives to a greater extent in contexts where safety is more important and potency is less important. I suggest that the importance of safety and potency depends on whether consumers are preventing or curing an ailment. Specifically, I propose that consumers care more about safety when preventing ailments, but once an ailment exists they then prefer a more potent remedy even at the expense of safety.

While these predictions have not explicitly been tested to my knowledge, they are consistent with prospect theory, in which risk seeking occurs in the domain of losses (Kahneman & Tversky, 1979). Specifically, when a consumer is already afflicted (i.e., below the reference point and in the loss domain for health), safety becomes less important. For example, a consumer afflicted with cancer would become risk seeking and thus would prefer a stronger, even if less safe, remedy to try to cure it. However, a consumer trying to prevent cancer would be at or above the reference point and thus would prefer a safer, albeit less potent remedy. Consistent with this conceptualization, the prospect theory value function has been used to explain why terminally ill patients'—who are in the loss domain for health—exhibit risk seeking treatment preferences (Rasiel, Weinfurt, & Schulman, 2005).

The Present Research

I propose that a) natural products are inferred to be safer and less potent, and b) consumers will prefer safer, less potent alternatives more when preventing versus curing an ailment. Putting these two predictions together, consumers should prefer natural more for preventatives than for curatives. Furthermore, the increased preference for natural when preventing should be contingent on inferences about risk and potency. If the inferences about a natural product's risks and potency reverse, I predict a reversal of the effect. Specifically, when the natural option is the *more* risky and *more* potent one (the reverse of the usual inference), it will be preferred more for curing than for preventing an ailment.

Beyond anecdotal evidence, the hypothesis that natural is more preferred for preventing than for curing is supported by an analysis I performed on a nationally representative survey conducted by the Centers for Disease Control/National Center for Health Statistics (CDC/NCHS, 2012a; see study B.1 in Appendix B for detailed analysis). In this survey, respondents emphasize the importance of naturalness more when trying to prevent illness. However, because alternate accounts might exist to explain this association in observational data, I focus my analysis on experiments that manipulate treatment purpose (prevent vs. cure) to isolate the effect and its mechanism holding all else constant.

I present a series of studies examining the preference for natural products as a function of whether the product is used to prevent or cure an ailment. In a pilot study, I examine preferences for natural products across a number of drug/convenience store product categories (e.g., vitamins, hair care) and find that the preference for natural is predicted by whether the product category is primarily used to prevent or to cure problems. Study 2.1 demonstrates the central hypothesis in a controlled test for both medicines and household products: natural products are more strongly preferred for preventing than for curing an ailment or problem. Studies 2.2-2.4 examine the mechanism in different ways. Study 2.2A tests inferences about natural medicines and finds that natural medicines are viewed as safer but less potent than synthetic ones. Study 2.2B tests the effect of treatment purpose on safety and potency preferences and finds that consumers prefer safer, less potent medicines when preventing as compared to curing ailments. Study 2.3 presents a mediation model of the proposed psychological process: the increased preference for natural when preventing versus curing is mediated by increased importance of safety relative to potency. Finally, study 2.4 experimentally manipulates information about safety and potency of different treatment options and finds that this information moderates the key effect. Specifically, when the natural alternative is described as the *more* potent and *more* risky alternative (the opposite of the intuitive inference), then the effect of treatment purpose reverses: Natural becomes more preferred when curing as compared to preventing. Together, these studies provide an organizing principle for understanding when the natural preference is strong and when it is not and offers a mechanism for this principle.

Pilot Study

First, I investigate a wide range of common drug and convenience store product categories (e.g., hair care, supplements) that contain both natural and synthetic alternatives. I examine whether a category's primary purpose (prevent vs. cure) predicts preference for natural alternatives in that product category.

Methods

One hundred twenty-four product categories are listed on Walgreens.com. A research assistant blind to the hypotheses reviewed all categories and selected the subset of categories that (1) had both natural and synthetic alternatives and (2) were not promotional categories. (An example of a promotional category would be "sale on vitamins" which was listed separately from "vitamins" category). For the remaining forty categories, the RA generated three examples of items in each category (e.g., hair care: shampoo, conditioner, and hair spray). Six categories were excluded because they were gender-specific (e.g., feminine care), which left thirty-four product categories.

Next, two hundred participants on Amazon's Mechanical Turk (M_{age} = 36.4, SD = 11.6, 51.5% female) rated the thirty-four categories on two dimensions in a block design. In the *purpose* block, participants rated all thirty-four products, in a random order, in terms of category purpose (prevent vs. cure). In the *natural preference* block, participants rated all thirty-four products, in a random order, in terms of their preference for natural in each product category. The order of these two blocks was randomized. For the purpose rating, participants rated how the product categories were used from 1 = almost always for curing to 5 = almost always for preventing. Through random assignment, half of participants saw the reverse response scale order (i.e., 1 = almost always for preventing, 5

= almost always for curing). For the natural preference rating, participants rated their preference for the natural or synthetic versions of products in that category on a scale from 1 = strongly prefer synthetic to 7 = strongly prefer natural, with a midpoint of 4 = indifferent. When each category was presented, the three examples of items in that category (e.g., shampoo, conditioner, hair spray) were displayed with the category (e.g., hair care).

After rating the product categories, all participants completed demographic measures (gender, age, income, political orientation, ethnicity, whether they grew up in a rural, suburban, or urban neighborhood, religion, and religiosity) and were debriefed.

Results

First, I examined whether a category's primary purpose (prevent vs. cure) predicts preference for natural alternatives. The blocked design allows a between-subjects and within-subjects analysis. In both analyses, a mean *purpose* rating (curative to preventative) and a mean *natural preference* rating (prefer synthetic to prefer natural) were calculated for each product category. In the between-subjects analysis, ratings were calculated using only data from the first block the participants completed (e.g., the *purpose* rating was calculated only using data from participants who completed the *purpose* block first). In the within-subjects analysis, all ratings were used. In both the between-subjects and within-subjects analysis, preventative category purpose positively correlated with preference for natural alternatives (between: $\rho = .42$, $p = .013$; within $\rho = .30$, $p = .084$; see Figure 2.1).

Discussion

The pilot study demonstrates that the stated purpose (prevent vs. cure) predicts variation in preferences for natural across a wide range of everyday product categories. For example, food categories, which were considered more preventative, overall elicited a stronger natural preference than medicine categories (see Figure 2.1). Even within particular domains (e.g., medicines), categories that were more preventative elicited higher natural preferences (e.g., vitamins, which are largely preventative, had a higher natural preference than medicines to treat skin ailments). However, because this study is correlational and many factors may covary with preventative purpose, in the remaining studies I examine the effect of prevent versus cure purpose on natural preference in a controlled design.

Study 2.1

Study 2.1 investigates the central hypothesis, that there will be a stronger preference for natural products when preventing than when curing—holding constant other aspects of the ailment and product.

Methods

One thousand four U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation (M_{age} = 36.4, SD = 12.1, 48.5% female).

Through random assignment, half of participants viewed scenarios about preventing problems and half viewed scenarios about curing problems. All participants viewed a total of nine scenarios. Three scenarios were about medicines (vitamin B12 for vitamin B12 deficiency, vitamin C for vitamin C deficiency/scurvy, and allicin for the common cold) and six scenarios were about household products (anti-mold solution for mold, caulk for pipe leaks, mouthwash for mouth bacteria, anti-stain solution for wood stains, anti-stain solution for metal stains, anti-stain solution for clothing stains). I selected these problems and products because, for each problem, the same product is used to prevent and to cure that problem.

Scenario presentation order was manipulated through random assignment. To simplify the task for participants, I separated the medicines and household products in two blocks with instructions for each (e.g. before the medicines block in the preventing condition, "*We are going to ask you to imagine three possible scenarios. In each scenario, you are completely healthy and have no symptoms of illness. You are choosing a treatment to <u>prevent</u> an illness*" and before the household products block in the preventing condition, "*We are going to ask you to imagine three possible scenarios. In each scenario, you are evaluating products used to <u>prevent</u> problems*.") Half of participants viewed the three medicine scenarios first (in randomized order) followed by the six household product scenarios (in randomized order). The other half of participants viewed the six household product scenarios first (in randomized order) followed by the three medicine scenarios (in randomized order).

As an example of a scenario, preventing vitamin B deficiency read as follows (with curing version in brackets):

Imagine the following:

You are currently healthy [ill with hypocobalaminemia, a vitamin B12 deficiency].

You have absolutely <u>*none*</u> *of the symptoms of hypocobalaminemia, a vitamin B12 deficiency (such as fatigue and numbness) [have symptoms of hypocobalaminemia (such as fatigue and numbness).]*

You decide to take a treatment, vitamin B12, to prevent [cure] hypocobalaminemia. Suppose there are synthetic forms of vitamin B12 (generated in a lab) and natural forms of vitamin B12 (extracted from soybean plants). Assume the synthetic and natural forms are the same price and you plan to take vitamin B12 once a day for a month.

As in the pilot study, participants indicated preference for natural alternatives on a seven-point likert scale for each scenario. After responding to questions about all scenarios, participants indicated what the previous scenarios were about (preventing illnesses and other problems, curing illnesses and fixing other problems, or don't know/unsure) in a multiple choice manipulation check. For exploratory purposes, participants completed the demographic measures from the pilot study and fifteen items about general tendencies to prefer natural products (based on Rozin et al., 2004; Schultz, 2001; for full list of items see Appendix B, study B.4). None of these variables reliably moderated the key experimental manipulation, so I do not report analyses including them.

Results

The majority of participants (95.3%) passed the manipulation check. Patterns and statistical significance of results are the same when participants who failed the manipulation check are excluded. Additionally, order did not interact with treatment purpose (prevent versus cure). Therefore, I collapse across order.

In a 2 (Treatment Purpose: Prevent, Cure) X 9 (Target Problem: Vitamin B Deficiency, Scurvy, Common Cold, House Mold, Mouth Bacteria, Metal Stains, Wood Stains, Clothing Stains, Pipe Leaks) mixed ANOVA[3], natural options were more strongly preferred for preventing than for curing ($F(1, 1000) = 35.20$, $p < .001$, $\eta_p^2 = .04$). In addition, natural options were more strongly preferred for certain target problems ($F(8, 995) = 72.52$, $p < .001$, $\eta_p^2 = .37$) and there was no interaction between treatment purpose and target problem ($F(8, 995) = 1.65$, $p = .107$). In pairwise comparisons, the natural product was significantly more preferred for preventing than for curing in all nine scenarios (see Figure 2.2 and Table B.1; across scenarios, effect sizes ranged from d = .20 to d = .34; average d = .27). Preventing as compared to curing a problem significantly increased natural preference even when only the first scenario presented was examined (see Appendix B).

Discussion

Study 2.1 demonstrates that consumers prefer natural alternatives more when preventing than when curing. In real world contexts, preventing and curing may differ in a number of ways. For example, consumers may use curatives targeted toward very specific diseases but use preventative treatments for general wellness. Relatedly, prevention may involve a more abstract goal (cf. Trope & Liberman, 2003). In study 2.1, I control for these potential confounds by varying only whether the product was used to prevent or to cure the problem.

The increased natural preference for preventatives is robust across a number of different products and ailments. It is robust across medical and common household

[3] I also assessed these effects in two separate mixed ANOVAs—one on medicines and one on household products. The direction and significance of effects was the same as the overall ANOVA.

problems. In Appendix B, I report replications of these findings for the medicine scenarios (see study B.2A) and the household product scenarios (see study B.2B) using fully within-subjects designs.

Study 2.2

In study 2.2, I begin to examine why preventing versus curing alters the strength of natural preference. I hypothesize that natural alternatives are viewed as less risky and less potent than synthetic alternatives and that less risky, less potent alternatives will be more strongly preferred for preventing than for curing. I examine beliefs about natural and synthetic alternatives in study 2.2A, and I examine the importance of risk and potency in study 2.2B.

Study 2.2A Methods

Two hundred two U.S. participants from Amazon's mechanical Turk completed an online survey in exchange for monetary compensation (M_{age} = 32.9, *SD* = 1.4, 33.7% female).

I predict that natural products will be perceived as safer, but less potent than synthetic products. This pattern should be independent of treatment purpose. Nonetheless, I examine beliefs across both preventing and curing contexts as an exploratory variable. Based on random assignment, half of participants were told "We are interested in your views about prevention of illnesses" and the other half were told "We are interested in your views about treatment of illnesses." Participants rated whether natural medicines a) are stronger, b) are more potent, c) are more powerful, d) are riskier, e) are more dangerous, and f) have more severe side effects than synthetic medicines. The six items were presented in randomized order. Through random assignment, half of participants saw comparisons in one scale order (e.g., “Generally, how strong are natural versus synthetic medicines? 1 = natural medicines are much stronger, 4 = natural and synthetic medicines are equally strong, 7 = synthetic medicines are much stronger) and half of participants saw comparisons in the reverse response scale order (e.g., “Generally, how strong are synthetic versus natural medicines? 1 = synthetic medicines are much stronger, 4 = synthetic and natural medicines are equally strong, 7 = natural medicines are much stronger). Then, participants answered a manipulation check: “Which of the following was this study about? (a) Prevention of illnesses, (b) Treatment of illnesses”. Finally, participants completed demographic measures (same as pilot study).

Results

The majority of participants (83.2%) passed the manipulation check. Patterns and statistical significance of results are the same when participants who failed the manipulation check are excluded. I reverse scored one response scale order, so that ratings above the midpoint always indicate synthetic medicines are more risky/potent. Response scale order did not reliably affect ratings on the six comparison items[4] and so I collapse across order. Additionally, as expected, thinking about medicines in the context of preventing versus curing diseases had no effect on the six comparison items, so I collapse across the treatment purpose experimental manipulation.

A principal components analysis with a varimax rotation on the six comparison ratings yielded a two-factor solution. Accordingly, I averaged a) stronger, b) more potent, and c) more powerful into a composite potency score (Cronbach's $\alpha = .89$), and I averaged a) riskier, b) more dangerous, and c) having more severe side effects into a

[4] Those who saw the risk item in the reverse response scale order rated natural medicines as riskier overall ($t(200) = 2.19$, $p = .030$). However, since this pattern of results was neither predicted nor found for danger and side effects items, I collapse across order.

composite risky score (Cronbach's α = .84). Both composite scores significantly differed from the midpoint of four, such that synthetic medicines were perceived as more potent and riskier ($M_{potency}$ = 5.07, *SD* = 1.24, $t(201)$ = 12.22, $P < .001$, d = .86; M_{risky} = 4.82, *SD* = 1.25, $t(201)$ = 9.37, $P < .001$, d = .66).

Study 2.2B Methods

Two hundred two U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation (M_{age} = 34.9, *SD* = 1.7, 45.0% female). For this study, in addition to manipulating treatment purpose, I manipulated severity to explore whether severity interacts with treatment purpose. For example, consumers might always prefer extremely safe medicines for preventing and curing very mild ailments, such as a slight cough; In contrast, they might always prefer extremely potent medicines for preventing and curing very severe ailments, such as cancer. Participants were instructed to imagine scenarios either involving preventing or curing diseases that were a) not severe, b) moderately severe, or c) extremely severe. Thus, the study consisted of a 2 (Treatment Purpose: Prevent, Cure) by 3 (Disease Severity: Low, Medium, High) fully within-subjects design. Using a within-subjects manipulation increased statistical power to detect any main effects or interactions, though a between-subjects analysis using only the first scenario yields statistically significant effects in the same direction (see Appendix B). Scenarios followed the format (emphasis in original): "Your doctor informs you that you [are at risk for/already have] a disease that is [**not severe/moderately severe/extremely severe].**"

For each scenario, participants responded to four questions on scales ranging from 1 = not at all, to 7 = extremely. The questions read as follows (emphasis in original).

1) To [**prevent/cure]** this disease, how powerful would you prefer your medicine to be?

2) To [**prevent/cure]** this disease, how strong would you prefer your medicine to be?

3) To [**prevent/cure]** this disease, how willing would you be to tolerate risks to your health as a result of the medicine?

4) To [**prevent/cure]** this disease, how willing would you be to tolerate uncomfortable side effects of the medicine?

All scenarios were presented in randomized order, and the four questions were randomized for each scenario. Finally, participants completed the same demographic measures as in the pilot study.

Results

For each scenario, I first created a composite potency preference measure by averaging ratings about preferred strength and power (average $r = .87$) and a composite risk tolerance measure by averaging ratings about risk tolerance and side effects tolerance (average $r = .76$). Then, I conducted a 2 (Treatment Purpose: Prevent, Cure) by 3 (Disease Severity: Low, Medium, High) repeated measures ANOVA on potency preference. There were two main effects, such that people preferred more potent medicines when curing diseases ($F(1, 201) = 35.88$, $p < .001$, $\eta_p^2 =.15$) and when diseases were more severe ($F(2, 200) = 309.16$, $p < .001$, $\eta_p^2 =.76$). The interaction between treatment purpose and disease severity was not significant ($F(2, 200) = .09$, $p > .25$). Similarly, in a 2 x 3 repeated measures ANOVA on risk tolerance, people tolerated more risk/side effects when curing diseases ($F(1, 201) = 44.45$, $p < .001$, $\eta_p^2 = .18$) and when diseases were more severe ($F(2, 200) = 361.93$, $p < .001$, $\eta_p^2 =.78$). There was no interaction between treatment purpose and disease severity ($F(2, 200) = 1.73$, $p = .18$). At every level of disease severity, preventing (versus curing) diseases reduced the preference for potency (in paired t-tests, *P*s < .001, effect sizes between *d* = .26 and *d* = .34; see table B.2A in Appendix B) and tolerance of risks (in paired t-tests, all *P*s < .01, effect sizes between *d* = .21 and *d* = .39; see table B.2B in Appendix B).

Discussion

Study 2.2 finds that consumers believe natural medicines are less risky and less potent (study 2.2A). Moreover, no matter the severity of the ailment, they prefer less risky and less potent medicines when preventing versus when curing illnesses (study 2.2B). These results imply that one reason why people prefer natural when preventing is that the relative importance of potency and safety changes across contexts. Therefore, the next study directly examines whether changes in the relative importance of safety and potency mediate the effect of treatment purpose on the preference for natural.

Study 2.3

Methods

Two hundred five U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation (M_{age} = 34.9, *SD* = 11.7, 41.5% female).

Through random assignment, each participant viewed one scenario that described vitamin B deficiency, the common cold, or scurvy. The scenario instructed participants consider two cases—one case where they were preventing the ailment and another case where they were curing the same ailment. I chose this within-subjects manipulation of prevent vs. cure because a within-subjects manipulation provides more power to estimate the size of the indirect vs. total effect in a mediation analysis. The scenarios were therefore adapted from study 2.1 for a within-subjects design. (See study B.2A in Appendix B for the scenario text.)

Additionally, all participants indicated the importance of both safety and potency when preventing and curing the ailment. Specifically, participants filled out two importance measures—one for preventing and one for curing. For each, participants specified how important they considered safety and potency of the medicine on a 0 to 100 constant sum scale. For example, below is the text presented for evaluating the importance of potency and safety when preventing the common cold:

Two features of treatments that consumers often care about are potency and safety. We are interested in how important these features are to you when you are <u>preventing the common cold</u>.

Potency refers to how strong and powerful the treatment is.

Safety refers to the degree of risk and the extent of side effects that the treatment might entail.

Please tell us how important each of these are to you personally by allocating 100 points between them. For example, if you thought potency and safety were equally important, you should allocate 50 points to each. If you thought potency was the only important feature and safety was not important at all, you should allocate all 100 points to potency and no points to safety.

In case A, where you are preventing the common cold, how important are safety and potency of the treatment?

The survey software required importance of safety and potency to add to 100 before the participant could move forward. Through random assignment, half of participants completed importance questions before preference questions and half completed them after preference questions. Furthermore, through random assignment, half of participants considered curing before preventing and half considered preventing before curing. In addition, participants completed the same trait natural preference measures and demographic measures from study 2.1.

Results

There were no main effects or interactions with order of questions (all *p*s > .10) so I collapse across order. Additionally, there were no main effects or interactions with the type of ailment participants considered, except one main effect where the overall preference for a natural medicine (both when preventing and curing) was higher for scurvy. Therefore, I collapse across ailments.

Replicating study 2.1, participants preferred natural medicines more when they were preventing an ailment than curing it ($M_{\text{Prevent}} = 5.52$, $SD = 1.43$, $M_{\text{Cure}} = 5.15$, $SD = 1.68$, $t(204) = 4.09$, $p < .001$, $d = .29$; See Figure 2.3A). Participants also indicated higher importance for safety of the treatment when preventing ailments ($M_{\text{Prevent}} = 62.6$, $SD = 16.8$, $M_{\text{Cure}} = 51.0$, $SD = 19.2$, $t(204) = 1.66$, $p < .001$, $d = .75$; See Figure 2.3B). Viewed another way, participants indicated lower importance for potency when preventing; statistical tests are identical because safety and potency's importance ratings were required to sum to 10. Tables B.3A and B.3B in Appendix B present descriptive statistics and t-tests for each scenario independently.

In a (within-subjects) mediation analysis, I assessed the indirect effect of treatment purpose on preference for natural medicine through relative importance of safety versus potency. Because my experimental design was within-subjects, I used *MEMORE* in SPSS (Montoya & Hayes, 2017). *MEMORE* uses a path-analytic framework to estimate indirect and direct effects with bootstrap confidence intervals. This analysis revealed a significant indirect effect of the relative importance of safety versus potency (indirect effect = .32, 95% CI [.18, .47]). Preventing (versus curing) an ailment increased the importance of safety relative to potency ($a = 11.63$), and increasing the importance of safety relative to potency increased the natural preference ($b = .03$[5]). After including relative importance in the model, the effect of treatment purpose became non-significant ($c = .37$, $p < .001$; $c' = .05$, $p = .63$). Thus, there is evidence for complete mediation; the change in preferences for natural when preventing (as opposed to curing) is mediated by changes in relative importance of safety versus potency.

Discussion

Study 2.3 finds that when preventing (as opposed to curing) consumers place relatively more importance on safety and less on potency. This change in relative importance mediates the effect of prevention purpose on preference for natural products.

Though the constant sum measure of attribute importance has the advantage of forcing participants to consider tradeoffs between safety and potency, it does not allow us to determine whether relative importance shifts because the importance of safety increases when preventing, the importance of potency decreases when preventing, or some combination of these two effects. Therefore, I conducted a replication of this

[5] Note that the estimate for the *a* path is much larger than the estimate for the *b* path because in *a* the outcome variable is on a 0 to 100 scale, and in *b*, the predictor variable is a 0 to 100 scale and the outcome variable is a 1 to 7 scale.

experiment using absolute measures of safety and potency's importance (a 7 point likert scale for safety's importance and a 7 point likert scale for potency's importance). Furthermore, I included all scenarios from study 2.1 (including household products) to further examine the same mechanism across both medicines and household products. I find consistent evidence that the effect of treatment purpose on the natural preference is mediated both by an increase in absolute importance of safety and a decrease of absolute importance of potency. The details of this additional study are reported in study B.3 in Appendix B.

Study 2.4

Studies 2.2 and 2.3 provide evidence consistent with the prediction that natural medicines are more strongly preferred when preventing because they are judged to be less risky and less potent than synthetic medicines. In study 2.4, I test whether providing information that reverses these judgments of risk and potency will reverse when natural is more strongly preferred. In other words, when natural medicines are viewed as *more* risky and *more* potent, then natural medicines should be more preferred in curing contexts than in preventing contexts.

Methods

One thousand five hundred five U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation (M_{age} = 34.8, *SD* = 11.6, 5.4% female).

Participants were randomly assigned to one of six conditions in a 2 (Treatment Purpose: Prevent, Cure) X 3 (Attribute Information: Natural More Potent/Risky, Unspecified, Natural Less Potent/Risky) between-subjects design. All participants viewed one scenario about an infectious disease with symptoms of fever, fatigue, and diarrhea. Half of participants were randomly assigned to consider preventing this disease, and half considered curing it.

In the Unspecified condition, the scenario followed the same format as study 2.1 where the risk and potency of the medicines were left unspecified. In the Natural More Potent/Risky scenarios, the following table of relative risk/potency information was appended to each scenario.

Here is some information on your choices:

Natural Drug	*Synthetic Drug*
Stronger	*Less Strong*
More side effects/more risk *(e.g., more chance of nausea and allergic reactions)*	*Fewer side effects/less risk* *(e.g., less chance of nausea and allergic reactions)*

In the Natural Less Potent/Risky scenario, participants saw the same table but the information was reversed for the two drugs: the natural drug was described as less strong and with fewer side effects/less risk and the synthetic drug was described as stronger and with more side effects/more risk. After reading the scenario, participants indicated whether they preferred the natural or synthetic drug on the 7-point likert scale adapted from study 2.1.

After indicating their preference for the natural versus synthetic drug, participants completed three manipulation checks. As a multiple choice manipulation check of treatment purpose, participants indicated if the scenario was about preventing a disease, curing a disease, or they didn't know/were unsure. Then, as a manipulation checks on attribute information, participants indicated on two 7-point likert scales the relative strength and the relative risk of the natural (versus synthetic) drugs. These scales followed the same format as in study 2.2A, where the midpoint of 4 indicated that natural and synthetic drugs were equally strong/risky, and higher scores indicated natural drugs were stronger/riskier. Finally, participants completed the same trait natural preference measures and demographic measures from study 2.1.

Results

The majority of participants (96.1%) passed the manipulation check about treatment purpose. I examined the manipulation checks of attribute information by using one sample t-tests that compare mean ratings of risk and of potency to the midpoint of four (which indicated natural and synthetic equally risky/potent). In the Natural More Potent/Risky condition, natural medicines were rated as more potent ($M = 5.86$, *S.D.* = 1.53, $t(501) = 27.23$, $p < .001$, $d = 1.22$) and riskier ($M = 5.86$, *S.D.* = 1.49, $t(501) = 28.03$, $p < .001$, $d = 1.26$). In the Unspecified condition, natural medicines were rated as equally potent as synthetic medicines ($M = 4.00$, *S.D.* = .59, $t(496) = .15$, $p > .25$) and safer ($M = 3.88$, *S.D.* = .66, $t(496) = 4.03$, $p < .001$, $d = .18$). In the Natural Less Potent/Risky condition, natural medicines were rated as less potent ($M = 1.99$, *S.D.* = 1.34, $t(505) = -33.32$, $p < .001$, $d = 1.48$) and less risky ($M = 1.99$, *S.D.* = 1.15, $t(505) = -39.28$, $p < .001$, $d = 1.75$).

In a 2 (Treatment Purpose: Prevent, Cure) X 3 (Attribute Information: Natural More Potent/Risky, Unspecified, Natural Less Potent/Risky) ANOVA on the preference for the natural drug, there was a main effect of treatment purpose such that consumers preferred natural more, on average, when preventing than when curing ($F(1, 1499) = 12.98$, $p < .001$, $\eta_p^2 = .01$). There was also a main effect of attribute information, such that whichever medicine option was described as less potent/less risky was more preferred ($F(2, 1499) = 10.96$, $p < .001$, $\eta_p^2 = .12$). As predicted, the main effect of treatment purpose was qualified by an interaction between treatment purpose and attribute information ($F(2, 1499) = 22.20$, $p < .001$, $\eta_p^2 = .03$).

Independent sample t-tests comparing prevent and cure conditions at each level of attribute information revealed the nature of this interaction (see Figure 2.4). In the Unspecified condition, I replicate the effects in study 2.1: the natural alternative is more preferred for preventing than for curing ($M_{prevent} = 5.25$, *S.D.* = 1.66, $M_{cure} = 4.89$, *S.D.* = 1.88, $t(495) = 2.32$, $p = .021$, $d = .20$). Similarly, in the Natural Less Potent/Risky condition, natural is more preferred for preventing than for curing ($M_{prevent} = 5.58$, *S.D.* = 1.66, $M_{cure} = 4.48$, *S.D.* = 1.95, $t(504) = 6.80$, $p < .001$, $d = .61$). However, when natural is specified as more risky and more potent, the effect of treatment purpose reverses: natural medicines are more preferred for curing than for preventing ($M_{prevent} = 3.40$, *S.D.* = 1.90, $M_{cure} = 3.85$, *S.D.* = 1.92, $t(500) = 2.60$, $p = .010$, $d = -.24$).

The condition for which natural is specified as more risky and more potent demonstrates the rare case where the synthetic product is preferred to the natural product. When natural products are made to look like synthetic products in terms of their risks and potency (in the Natural More Potent/Risky condition), natural products are no longer preferred overall (in one-sample t-tests comparing means to midpoint of 4/indifference, $M_{prevent} = 3.40$, *S.D.* = 1.90, $t(255) = -5.04$, $p < .001$, $d = .32$; $M_{cure} = 3.85$, $SD = 1.92$, $t(245) = -1.26$, $p = .21$).

Discussion

In study 2.4, I reverse the key effect when I reverse consumers' intuitive inferences about natural products (making natural more potent and more risky), thereby providing further experimental evidence for my proposed psychological mechanism. It is worth noting that across my studies, consumers generally prefer the natural alternative (albeit less strongly when curing), but in study 2.4 I demonstrate a case for which natural products are less preferred. When natural products are specified to be *more* risky and *more* potent than the synthetic products, consumers tended to prefer synthetic alternatives. This could be because safety is generally highest priority—even more so than potency—which causes natural to generally be preferred. It could also be that the ailments I examined are relatively mundane and that potency would be prioritized over safety and thus synthetic medicines would be preferred for more severe ailments (e.g., cancer).

General Discussion

Consumers widely desire natural products, but not always to the same degree. In this article, I demonstrate that the preference for natural is particularly strong when consumers are preventing problems or illnesses compared to when they are curing the same problems or illnesses. In a pilot study using a variety of common drugstore product categories, I find that consumers tend to prefer natural more strongly for categories that are primarily used for preventative purposes than for those used for curative purposes. Study 2.1 shows that the exact same natural product is more strongly preferred when preventing an ailment than when curing it. This effect replicates across many products, both for medical and household needs. Study 2.2 shows natural is perceived to be less risky and less potent, and that less risky, less potent alternatives are preferred more for preventing. Study 2.3 finds that the increased preference for natural when preventing is mediated by increased importance of a treatment's safety relative to its potency. Study 2.4 finds that when natural products are described as riskier and more potent than their synthetic alternatives, the effect of treatment purpose reverses: natural is more preferred for curing than for preventing.

The natural preference is stronger in some contexts than others. The present research helps to explain this. First, it helps to explain variation in preferences for natural across broad categories of products, such as why the natural preference is stronger for food than for medicine (Gaskell et al., 1999; Rozin et al., 2004). Food is a form of preventative health/general wellness and medicines are usually used to cure existing ailments. Second, the preventative/curative distinction helps make sense of other puzzling preferences, such as variability within product categories. For example, although consumers are fairly accepting of most synthetic medicines, there is widespread concern about vaccination. Vaccination involves a synthetic treatment used in a preventative context, a context where the natural preference is strong (DiBonaventura & Chapman, 2008; Lombrozo, 2015). Finally, the preventative/curative distinction explains variability in preferences for the same product depending on whether it is used as a preventative or curative.

In the real world, preventing vs. curing may be confounded with other variables. Prevention often involves a more abstract goal (cf. Trope & Liberman, 2003), such as overall wellness as opposed to treating a specific illness. Preventatives are often used for longer periods of time or in smaller doses than curatives, and doctors might be less likely to prescribe preventatives. In my experiments these other factors are held constant, allowing me to more conclusively demonstrate that treatment purpose (i.e., preventing or curing) is what is driving the variation in natural preference.

The pattern of preferences for natural is generally consistent with a prospect theory framework (Kahneman & Tversky, 1979). When consumers have an existing ailment and are curing, they are in the loss domain and therefore risk seeking (lower priority on safety vs. potency); when consumers are healthy and preventing, they are at or above the reference point and therefore more risk averse (higher priority on safety vs. potency). Another theory with some commonalities is regulatory focus (Bullard & Manchanda, 2013; Crowe & Higgins, 1997; Higgins, 1998). Accordingly, a "prevention focus" which is "concerned with security, safety and responsibility" naturally maps on to preventing an ailment (p. 117, Crowe & Higgins, 1997). However, it is not obvious that a promotion focus, which is "concerned with advancement, growth, and accomplishment" would map onto curing an ailment (p. 117, Crowe and Higgins 1997). Moreover, if regulatory focus were the appropriate framework, then a prevention focus would be associated with a stronger preference for natural. I sought to test this empirically. Specifically, in study B.4, presented in Appendix B, I examined the relationship between natural preference and regulatory focus with 203 participants on Amazon's Mechanical Turk. The correlation between predominant regulatory focus (higher scores corresponding to a predominant promotion focus) and trait natural preference was not significant (r = .095, $t(201)$ = 1.35, p = .178). Thus, I don't find logical or empirical support for a regulatory focus account.

My findings also dovetail with Rothman and Salovey's (1997) review on the role of framing in medical communication. They argue that messages emphasizing gains (e.g., "If you take this medication, you will prevent disease 95% of the time") effectively motivate people to choose safe options whereas messages emphasizing losses (e.g., "If you take this medication, you will get the disease 5% of the time") motivate people to choose risky options. While they do not directly test the difference between preventative and curative (which they call "recuperative") needs, they argue that for both, gain-framed messages are most effective at inducing treatment (compared to no treatment) because treatment is considered a safer option.

Although Rothman and Salovey's article and the present research both involve risk preferences when preventing and curing, their context and conceptualization differs from mine in a few important ways. First, they examine which message frames are most effective at persuading treatment, whereas I examine what type of treatments are selected for preventing vs. curing needs. Second, they examine risk preferences as an outcome of message frames, whereas I argue and find that people hold different risk preferences (absent any message) when preventing vs. curing. Nonetheless, it is interesting that Rothman and Salovey treat preventative and curative needs as psychologically similar. My findings suggest that there might be more substantial differences.

Beyond these factors, preventing and curing intrinsically differ in both temporal distance and uncertainty. The effects of temporal distance and uncertainty are difficult to disentangle. Prevention is about the future, which is inherently uncertain. Indeed, Frederick, Loewenstein, and O'Donoghue argue that "it is unclear whether subjects do (or can) accept [the assumption that delayed rewards will be delivered with certainty], because delay is ordinarily—and perhaps unavoidably—associated with uncertainty" (p. 382, 2002). I expect that both temporal distance and uncertainty generate changes in the natural preference, and leave the relative importance of these variables as a question for future research.

Finally, I view the preference for natural products as similar to the preference for branded products, which are also heuristically believed to be better than generics (Becker & Murphy, 1993; Bronnenberg, Dubé, Gentzkow, & Shapiro, 2015). Heuristic thinking can distort good decision making if consumers' beliefs about the potency and risks associated with different treatment options are inaccurate. In fact, the inference that natural is safer might be grossly misguided in the current regulatory environment. In the U.S., natural products are often categorized as "dietary supplements" as opposed to "medicines." Unlike medicines, dietary supplements do not need to demonstrate safety and efficacy to the FDA to go to market, and thus may paradoxically be less safe (Bent, 2008). As a result, marketers might exploit these heuristics (Akerlof & Shiller, 2015) thus exacerbating sub-optimal consumer decision making. The degree to which these heuristics reduce consumer welfare is a promising direction for future research.

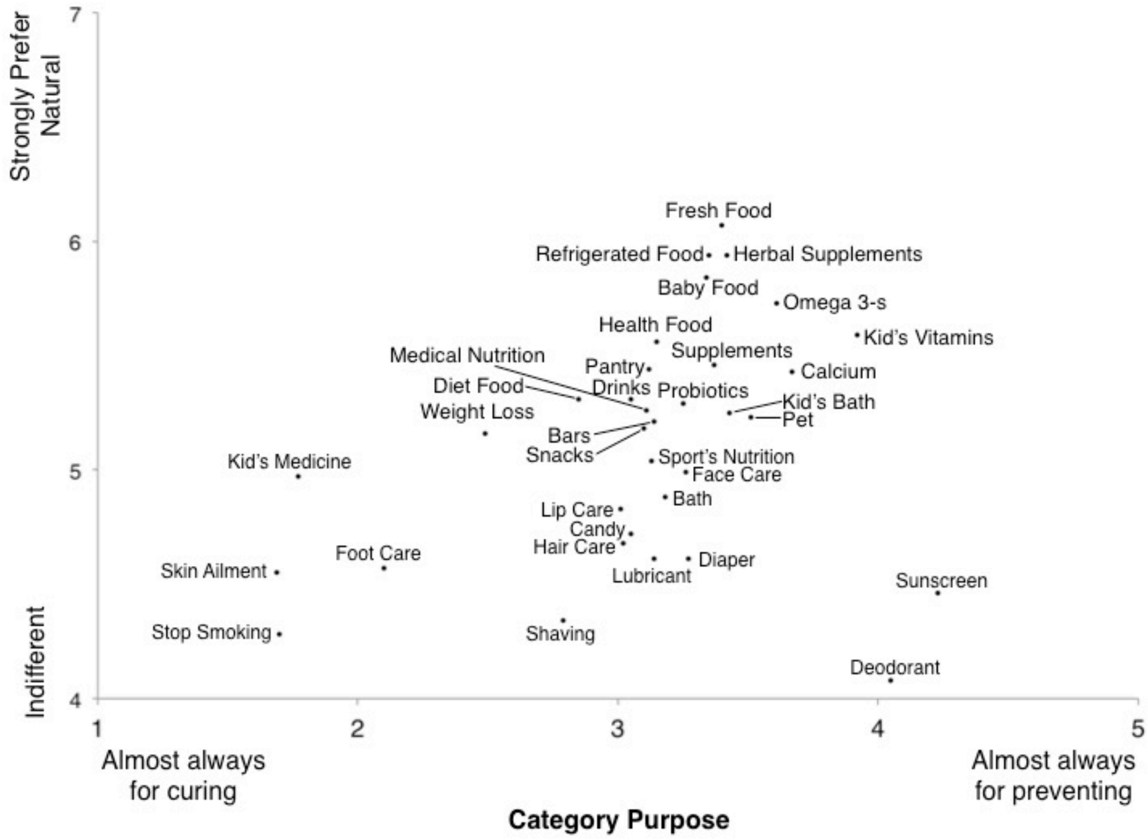


Figure 2.1. Association between preventative vs. curative category purpose and preference for natural in pilot study. Each data point represents a category whose position on the x-axis is the mean of participants' purpose ratings and position on y-axis is mean of participants' natural preference ratings (starting at 4 = indifferent so that product category labels are readable). Between-subjects version is displayed, such that only the first block of participants' ratings are used (e.g., purpose score only calculated using participants who rated category purpose first in the survey).

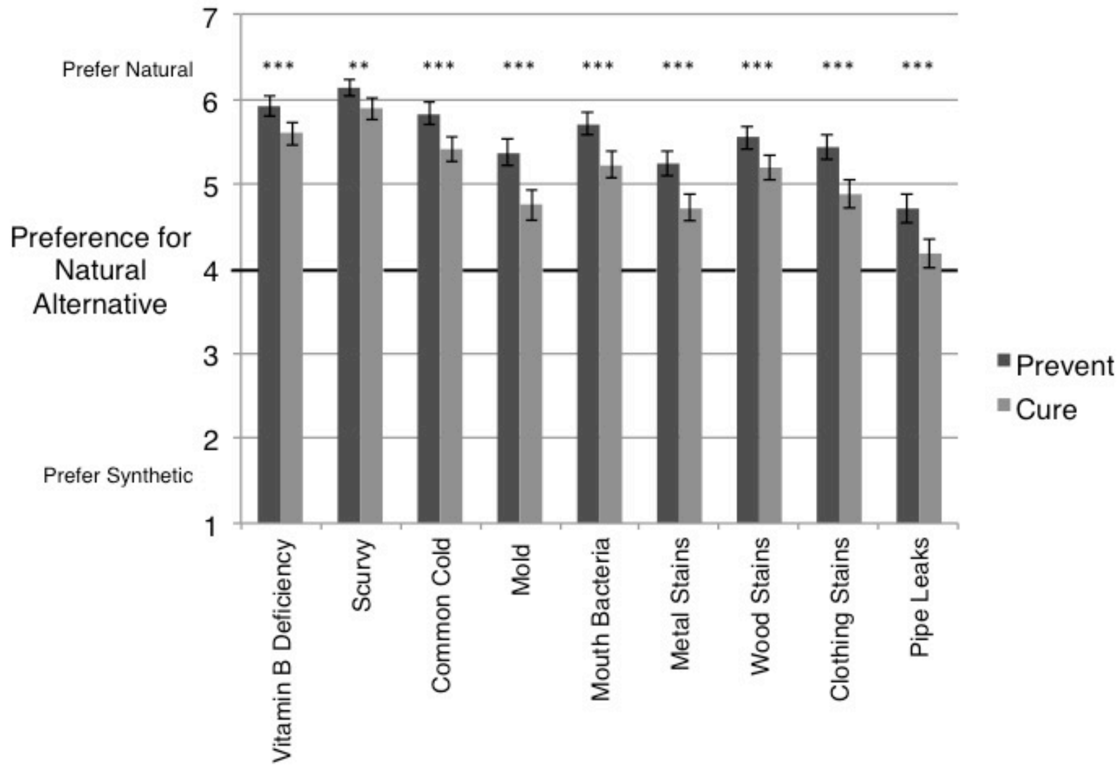


Figure 2.2. Preference for natural when preventing versus curing in study 2.1. The bolded line of four represents indifference between natural and synthetic alternatives. Error bars represent 95% confidence intervals of the mean.

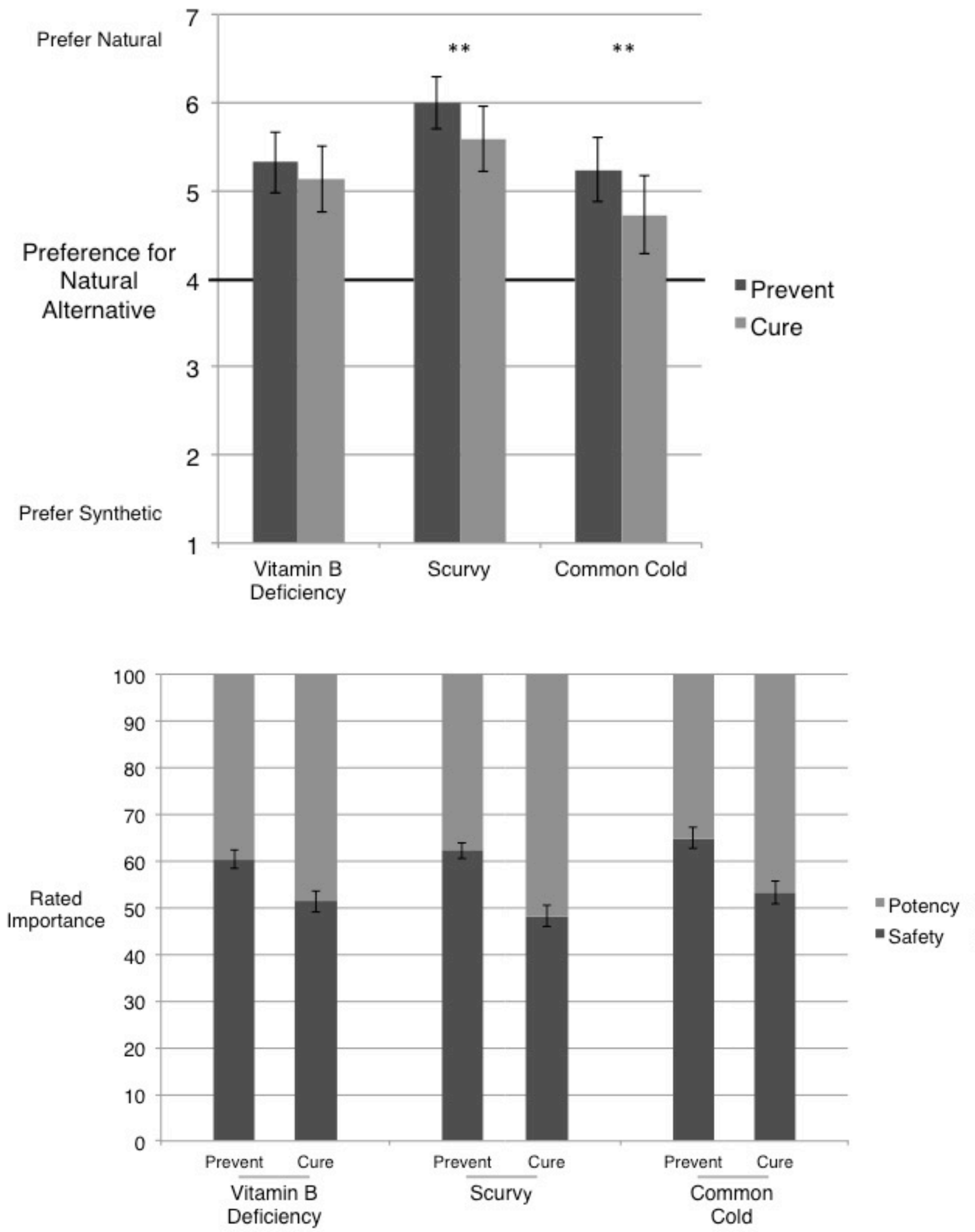


Figure 2.3. Preference for natural and importance of safety vs. potency when preventing vs. curing in study 2.3. The preference for natural increases (panel a) and the relative importance of a treatment's safety vs. potency increases (panel b) when consumers are preventing diseases as compared to curing them. Error bars represent 95% confidence intervals.

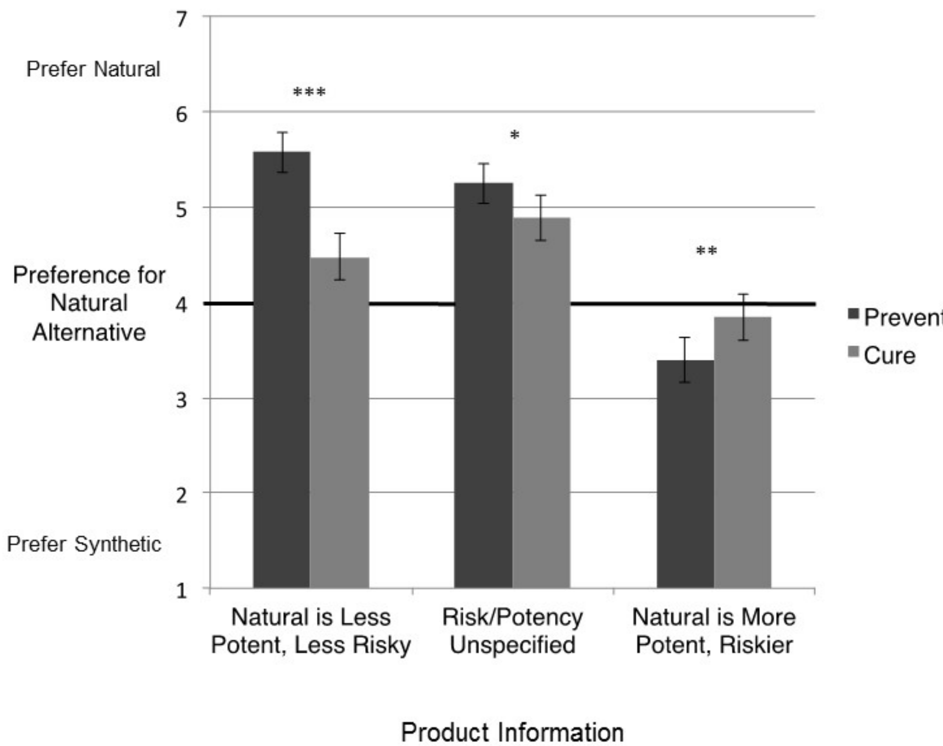


Figure 2.4. Preference for natural when preventing vs. curing, depending on information about risks and potency of natural treatment in study 2.4. In study 2.4, preference for natural as a function of a) preventing/curing and b) information about risk and potency is displayed. The bolded line of four represents indifference between natural and synthetic alternatives. Error bars represent 95% confidence intervals of the mean.

IN NATURE WE TRUST

Consumers clearly desire and demand natural products. As described in Chapter 2 (see p. 27), consumers frequently prefer natural foods and medicines. Yet, despite the evident consumer demand for natural products, we know relatively little about the psychological underpinnings of the natural preference. Understanding the psychology of the natural preference should allow us to build richer theories about these consumer preferences and generate predictions about when the natural preference is strong and when it is weak. In this chapter, I argue that naturalness is interpreted as a signal of trustworthiness. Therefore, natural products are most appealing when consumers do not have other trustworthiness cues to rely on (e.g., when the brands are novel or unfamiliar). When other trustworthiness cues are absent, naturalness is impactful because it is a particularly informative signal of trustworthiness.

Trust

Trust is a multifaceted construct comprised of beliefs about reliability, safety, and honesty (Chaudhuri & Holbrook, 2001; Moorman, Zaltman, & Deshpande, 1992; Morgan & Hunt, 1994). Prior work has examined trust in the contexts of exchange relationships and branding. These two streams of research have arrived at similar definitions of trust and its components. In research on exchange relationships, trust is typically defined as "a willingness to rely on an exchange partner in whom one has confidence." (p. 315, Moorman et al., 1992). Trust perceptions entail two key dimensions: credibility/reliability and honesty/benevolence (Doney & Cannon, 1997; Ganesan, 1994; Kumar, Scheer, & Steemkamp, 1995). These two dimensions emerge in factor analyses of survey items about trust in buyer-seller relationships (Ganesan, 1994) and researcher-marketer relationships (Kumar et al., 1995). Similarly in brand relationships, trust has been defined as “willingness of the average consumer to rely on the ability of the brand to perform its stated function” which involves “beliefs about reliability, safety, and honesty” (p. 82, Chaudhuri & Holbrook 2001).

Trustworthiness is not simply general positivity or quality. For example, brand trust is distinct from brand affect (tendency to elicit a positive emotional response) in factor analyses of consumer ratings of brands (Chaudhuri & Holbrook, 2001). Similarly, trustworthiness of an endorser differs from attractiveness and expertise in factor analyses (Ohanian, 1990). Trusthworthiness confers important advantages, including purchase and attitudinal loyalty (Chaudhuri & Holbrook, 2001; Garbarino & Johnson, 1999; Morgan & Hunt, 1994; Sirdeshmukh et al., 2002), favorable treatment from media and regulators (Keller, 2003), and successful exchange relationships, particularly in long-term or uncertain contexts (Ganesan, 1994; Morgan & Hunt, 1994).

Natural as Trustworthy

Prior research has not directly examined the relationship between the natural preference and trustworthiness. However, lay inferences about naturalness tend to correspond to the definitions of trustworthiness outlined above. In particular, natural is viewed as safe and moral, which maps to the dimensions of safety/reliability and honesty/benevolence.

First, natural things are inferred to be high on “safety”/“reliability”, one key dimension of trustworthiness. The inference that natural is safe has been found across many contexts (as also discussed in Chapter 2 on pp. 28-29 and demonstrated in study 2.2B). Technologies that involve less “tampering with the natural world” are viewed as safer (Sjöberg, 2000). Natural foods (Li & Chapman, 2012) and natural medicines (study 2.2B; Green, Horne, & Shephard, 2013) are viewed as safer than conventional counterparts. Genetically modified foods are viewed as unsafe in part because they are unnatural (Siegrist, Hartmann, & Sutterlin, 2016). In fact, the natural-is-safe inference is robust enough to persist in the face of evidence that natural and synthetic are equally safe. Even when the consequences of natural and man-made hazards are explicitly identical, natural hazards and their consequences are viewed as less dangerous and severe (Rudski et al., 2011; Siegrist & Sütterlin, 2014). Similarly, even when natural foods and vitamins are chemically identical to synthetic ones, consumers believe that the natural alternatives are safer (Li & Chapman, 2012).

Second, naturalness should evoke inferences of "honesty"/"benevolence," the other key dimension of trustworthiness. Naturalness is a morally laden concept (Sjöberg, 2000; Sunstein, 2005) and natural things are considered to be morally good and pure (Rozin et al., 2004). Two features of moral goodness are honesty and benevolence (Landy & Uhlmann, 2017). Therefore, it is likely that natural things are considered both honest and benevolent. Indeed, beliefs about safety/healthfulness of natural entities may be linked to or the result of more fundamental beliefs that nature is pure and benevolent whereas humans are malevolent (Rozin et al., 2004). Thus, naturalness should indicate trustworthiness on the honesty/benevolence dimension.

Substitution Effects

Inferences about trustworthiness should systematically affect when natural products are most appealing. Trustworthiness is unobservable, but it can be signaled by multiple cues. For example, brand familiarity, reputation, and charitable donation are viewed as trustworthiness signals (Herbst, Finkel, Allan, & Fitzsimmons, 2012; Elfenbein, Fisman, & McManus, 2012). I posit naturalness can also signal trustworthiness. Moreover, if natural products are trustworthy, then they should be most appealing when other trustworthiness cues are unavailable. When other cues indicate that a product is trustworthy, naturalness as a trustworthiness cue is relatively superfluous. However, in the absence of other trustworthiness cues, natural products should be more strongly preferred because their trustworthiness signal is highly informative.

Some prior work suggests that when consumers try to discern the latent quality of trustworthiness, one trustworthiness cue can be less important if other trustworthiness cues are already available. A company's trustworthiness ratings are considered less diagnostic if the product category has a low rate of failure (i.e., the product category is reliable/trustworthy; Gürhan-Canli & Batra, 2004). "Disclaimer speed" can also operate as a trust cue, where slow (vs. fast) disclaimers signal trustworthiness. Disclaimer speed does not impact consumer ratings when a brand is trusted, but does matter when the brand is novel or untrustworthy (Herbst et al., 2012). Finally, charitable donations may operate as a trust cue. eBay sellers who donate some proportion of profits to charity get increased sales and profits, possibly because they are considered more trustworthy sellers. Donating to charity matters least for sellers with a long reputation history and most for sellers with very little reputation history. In other words, the trustworthiness cue of charitable giving matters less if another trustworthiness cue (reputation history) is available (Elfenbein et al., 2012).

Present Research

I propose that consumer inferences about trustworthiness will systematically affect when natural products are most appealing. Specifically, if natural products are trustworthy, then they should be most appealing when other trustworthiness cues are unavailable. When other cues indicate that a product is trustworthy, naturalness as a trustworthiness cue is relatively superfluous. However, in the absence of other trustworthiness cues, natural products should be more strongly preferred because their trustworthiness is highly informative. I begin to examine this account by investigating preference for natural in the presence of a particular trustworthiness cue: brand familiarity. I present one study in depth demonstrating that naturalness is most appealing when brands are novel. Then I estimate the effect size of brand familiarity on natural preference in a meta-analysis of across $k = 7$ studies and 3,217 participants.

Study 3.1

First, I investigate whether that natural preference is stronger for novel brands. I expect that for novel brands, participants rely heavily on naturalness as a trustworthiness signal because they do not have other trustworthiness signals (e.g., brand familiarity) to rely on. Therefore there should be a stronger natural preference for novel brands.

Methods

Four hundred one participants from Amazon's mechanical Turk completed an online survey in exchange for monetary compensation (51.4% female, $M_{age} = 37.2$, $SD = 12.4$). Through random assignment, half of participants evaluated products from familiar brands and half evaluated products from novel brands. All participants evaluated nine pairs of products, where one product was natural and one was synthetic. Figure 3.1 displays an example of a product pair a participant might evaluate.

In the familiar brand condition, participants evaluated nine pairs of products from nine well-known brands. Specifically, the pairs were: Comet Pure Home Cleaning Powder and Comet Original Cleaning Powder; Pledge's 99% Natural Multi-Surface Cleaning Spray and Pledge's Multi-Surface Cleaning Spray; Dawn's Pure Essentials Dish Soap and Dawn's Platinum Dish Soap; Febreze's Free Nature Air Spray and Febreze's Heavy Duty Air Spray; Tide's Free & Gentle Laundry Detergent and Tide's Original Laundry Detergent; Sierra Mist Natural and Sierra Mist; Pepperidge Farm Baked Naturals Crackers and Pepperidge Farm Harvest Wheat Crackers; Lay's Simply Natural Chips and Lay's Classic Chips; and Smucker's Natural Red Raspberry Jam and Smucker's Red Raspberry Jam. I selected these products because they represented pairs of products from the same (well-known) brand that were roughly equivalent except insofar as one was natural. In the novel brand condition, these same pairs were modified so that the brand name and logo were altered (e.g., Sierra Mist became Fresh Pop!). A research assistant blind to the study's hypotheses altered the images using Adobe Photoshop to insert the novel brand names and logos. The order of product pairs was randomized. Response scale order was counterbalanced, such that half of participants saw natural products on the right side of the screen and a response scale where 1 = strongly prefer [synthetic product picture] and 9 = strongly prefer [natural product picture] and half of participants saw natural products on the left side of the screen and the reverse scale order.

After evaluating all nine product pairs, participants completed twelve items about their trait natural preference (i.e., their general tendencies to prefer natural products; based on Rozin et al. 2004, closely adapted from Chapter 2's trait natural preference scale described in study B.4 in Appendix B). Finally, participants completed demographic measures (gender, age, political orientation) and were debriefed.

Results

Response scale order had no main or interactive effects (all *p*s > .45). Therefore, I coded responses so that in all cases higher numbers mean stronger preferences for natural and collapse across scale order.

First, I examined whether consumers preferred natural products more strongly for novel brands. I conducted a 2 (Brand: Familiar, Novel) X 9 (Product Pairs) mixed ANOVA on ratings of preferences for the natural alternative. There was a marginal effect such that participants preferred natural products for novel vs. familiar brands ($F(1, 399) = 2.70$, $p = .102$, $\eta_p^2 = .01$). Additionally, some product pairs elicited stronger preferences for natural than others ($F(8, 392) = 13.94$, $p < .001$, $\eta_p^2 = .22$), and there was a significant interaction such that novel brands increased the natural preference more for some product pairs than for others ($F(8, 392) = 2.14$, $p = .031$, $\eta_p^2 = .04$). Figure 3.2 displays the effect of novel vs. familiar brand on the natural preference for each product pair. In eight of nine pairs, the natural alternative was preferred more strongly for novel brands than for familiar brands.

Some individuals prefer natural products more across situations. To control for this variability and increase power to detect the effect of brand familiarity, I conducted the same analysis of variance including the covariate of trait natural preference ($\alpha = .87$).

In this 2 (Brand: Familiar, Novel) X 9 (Product Pairs) mixed ANCOVA on the natural preference, with trait natural preference as a covariate, there was a significantly stronger preference for natural for novel vs. familiar brand pairings ($F(1, 398) = 7.44$, $p = .007$, $\eta_p^2 = .02$). Additionally, some product pairings elicited stronger preferences for natural than others ($F(8, 391) = 13.94$, $p < .001$, $\eta_p^2 = .22$). Participants with high trait natural preference more strongly preferred natural alternatives ($F(1, 398) = 209.15$, $p < .001$, $\eta_p^2 = .34$). There was a significant trait natural preference by product pairing interaction ($F(8, 391) = 2.95$, $p = .003$, $\eta_p^2 = .06$) and a significant brand familiarity by product pairing interaction ($F(8, 392) = 2.14$, $p = .031$, $\eta_p^2 = .04$).

Next, I examined whether the effect of novel vs. familiar brand on natural preference differed depending how devoted a consumer was generally to consuming natural products. Specifically, I examined whether the trait natural preference moderated the effect of our key experimental manipulation. I created a composite score of natural preference by averaging across the nine product pairings ($\alpha = .82$). Then, I conducted an ordinary least squares regression with composite natural preference as the outcome variable and brand novelty (familiar = 0, novel = 1), trait natural preference, and their interaction as simultaneous predictors. There was a stronger preference for natural if brands were novel ($b^* = .11$, $p = .007$) or if individuals were high on trait natural preference ($b^* = .56$, $p < .001$). However, trait natural preference did not moderate the impact of brand novelty (no trait natural preference by brand novelty interaction; $b^* = -.02$, $p = .59$). In other words, consumers preferred natural more for novel brands regardless of their trait tendencies to purchase natural products.

Internal Meta-Analysis of Brand Familiarity Studies

I conducted seven studies in total examining the impact of brand familiarity on the natural preference. In order to get an accurate estimate of the effect size, I conducted a meta-analysis on the file drawer of studies.

Method

I assessed the impact of familiar vs. novel brand on the preference for naturalness in $k = 7$ studies across 3,217 participants. These studies followed a similar format to study 3.1 (which is included in this meta-analysis and referred to as "study 6"). Participants were recruited on Amazon's mechanical Turk and completed an online survey in exchange for monetary compensation. In all surveys, participants indicated their preference for natural vs. synthetic product alternatives. In each survey, through random assignment, half of participants considered products from familiar brands and half of participants considered products from novel brands. Participants always completed the trait natural preference scale and a few demographic measures as in study 3.1 and were debriefed.

Methods differed across studies in a few ways, as summarized in Table 3.1. First, sample size ranged from $N = 400$ to $N = 801$. Second, product domain varied across studies. Participants evaluated foods, cleaning products, or both. Third, in four studies, each scenario was followed by manipulation checks. Participants indicated which product was more natural and how familiar the brand was on a 9-point Likert scales. Fourth, in three studies, I created the unfamiliar brand images using GIMP 2.8 (an open source graphics editor), and in three studies, a hypothesis-blind research assistant created the unfamiliar brand images. In one study, no images were used and each scenario only involved a verbal description of two products. Finally, in six studies, I examined the natural preference on a relative Likert scale, where high scores indicated a preference for natural and lower scores indicated preference for synthetic. In one study, I instead used an absolute preference measure, where participants rated the natural and the synthetic product separately on overall desirability (1 = not at all desirable, 9 = extremely desirable). In this study, the natural preference was calculated as the difference between desirability of natural and desirability of synthetic, where higher scores indicated a stronger preference for naturalness.

Results

First, I examined the average effect of novel vs. familiar brand on the natural preference across studies. This analysis was conducted using the metafor package in R (Viechtbauer, 2010). For each study, I calculated a standardized mean difference by calculating the difference in means between the two experimental conditions divided by the pooled standard deviation (the Cohen's *d*). Positive scores indicated an increased natural preference when brands were novel. Because I wanted to allow for the possibility that the true effect size differed across studies depending on methodological choices and exact stimuli, I used a random effects model.

The standardized mean difference across studies significantly differed from zero, indicating a small but reliable effect of brand novelty increasing a preference for natural ($d = .11$, 95% CI [.02, .21], $Z = 2.29$, $p = .022$)[6]. The forest plot of effect sizes and confidence intervals and the overall estimate is displayed in Figure 3.3.

[6] In a fixed effects model, the estimated effect size is very similar: $d = .11$, 95% CI [.04, .18], $Z = 3.19$, $p = .001$.

Next, I assessed the effect of brand familiarity including trait natural preference as a potential moderator. For each study, I averaged the natural preference across scenarios to create a composite natural preference score. Additionally, I computed a trait natural preference score—a regression factor score from a factor analysis on the 12-item trait natural preference scale with a one-factor solution. Then, I conducted an ordinary least squares regression for each study, with composite natural preference as the outcome variable and brand novelty (novel = 1, familiar = 0), trait natural preference, and their interaction as simultaneous predictors. The results are displayed in Table 3.2.

I conducted a meta-analysis on the regression coefficients in Table 3.2 by following the recommendations of Becker and Wu (2007). A meta-analysis of regression coefficients across the six studies revealed a small but reliable effect of brand novelty increasing the natural preference ($b^* = .06$, 95% CI [.03, .09]), consistent with the standardized mean effect size estimates above. In addition, there was an effect of trait natural preference ($b^* = .59$, 95% CI [.56, .62]), and a small brand novelty by trait natural preference interaction ($b^* = -.03$, 95% CI [-.06, -.00]). The results suggest that consumers who are very devoted to purchasing natural products may be less influenced by the key experimental manipulation (brand familiarity). However, pragmatically this effect is very small and should be replicated in future studies.

General Discussion

I present initial evidence that consumers use naturalness as a trustworthiness cue and therefore find natural products most appealing when there are no other trustworthiness cues. I find that when brands are novel (trustworthiness cue absent), natural alternatives are more strongly preferred. In a meta-analysis across 7 studies and 3,217 participants, I find this effect is small but reliable (d = .11).

Implications

The present research is particularly important as consumers interact in contexts where trust is important and difficult to discern, such as online markets (Resnick, Zeckhauser, Friedman, and Kuwubara 2000). As consumers go to Amazon, eBay and other online sellers, they often interact with strangers and do not necessarily expect repeated transactions. In these markets, there are fewer reciprocal relationships and dyadic histories between a buyer and a seller. Trustworthiness must be indicated in other ways. In these markets, the present research suggests that naturalness will be particularly appealing to consumers; Naturalness provides a trustworthiness cue that is otherwise absent.

I will reiterate that, as I argue in Chapter 2 (p. 55), the preference for natural products and inferences about natural products are similar to heuristic thinking about branded products being better than generics (Becker & Murphy, 1993; Bronnenberg et al., 2015) or about "disclaimer speed" signaling untrustworthiness (Herbst et al., 2012). This thinking might generally lead to good decisions, but like any other heuristic thinking, could also go awry or lead to false inferences.

Future Directions

While these studies provide initial evidence for our proposed account of trustworthiness cues, there are many future directions to bolster generalizability and internal validity. One important future step will be to use other trustworthiness cues besides brand familiarity. For example, ratings and reputations could be used to manipulate trustworthiness of brands. First, this will increase the generalizability of our account by extending our effects to cues other than brand familiarity. Second, it will rule out one possible alternative explanation regarding brand extension. It is possible that the fit between the particular brands I chose and "naturalness" is poor, which leads to natural alternatives for these brands being less preferred (Park, Milberg, & Lawson, 1991).

Another future direction would be to directly measure trustworthiness inferences. In the present studies, trustworthiness beliefs are inferred from preference ratings. Another possibility is to directly measure trustworthiness of natural vs. synthetic products. I expect the difference in trustworthiness will be greater for novel brands than for familiar brands. Additionally, by measuring general positivity or affect simultaneously, I could rule out a possible alternative account: that general affective reactions, not trust specifically, are changing. I expect that trustworthiness inferences specifically are driving the key effect based on the strong connection between trustworthiness and naturalness outlined in the introduction, but my data cannot at present rule out this alternative.

Finally, an attentive reader might notice a seeming contradiction between the findings in this chapter and Chapter 2. In particular, one dimension of trustworthiness is reliability, or ability to perform a job. I have argued that natural products are inferred to be more reliable (this chapter) but also that they are inferred to be *less* potent (see Study 2.2A in Chapter 2). I believe that reliability maps most closely to safety but that (like efficacy) reliability sometimes *also* entails potency. This implies one possible boundary condition: If people are primed to think of trustworthiness in terms of potency, and underweight the dimensions of safety and benevolence, the interaction between brand familiarity and naturalness should attenuate. In this case, naturalness will not lead to strong inferences about trustworthiness in any context and so natural products should be equally appealing across contexts.

Table 3.1. Summary of methods of novel vs. familiar brand studies.

Study	Sample Size	Product Domain	Manipulation Check	Photographs	Dependent Variable
1	406	5 pairs of natural and unnatural cleaning products	Yes	Created by S.S.	Relative
2	403	4 pairs of natural and unnatural food	Yes	Created by S.S.	Relative
3	801	5 pairs of natural and unnatural cleaning products and 4 pairs of natural and unnatural food	No	Created by S.S.	Relative
4	400	5 pairs of natural and unnatural cleaning products	Yes	N/A (No Photographs)	Relative
5	402	5 pairs of natural and unnatural cleaning products	Yes	Created by hypothesis-blind research assistant	Relative
6 (i.e., study 3.1)	401	5 pairs of natural and unnatural cleaning products and 4 pairs of natural and unnatural food	No	Created by hypothesis-blind research assistant	Relative
7	404	5 pairs of natural and unnatural cleaning products and 4 pairs of natural and unnatural food	No	Created by hypothesis-blind research assistant	Absolute

Note. For each study examining the effect of novel vs. familiar brands, study design and stimuli details are displayed.

Table 3.2. Least squares regressions predicting composite natural preference.

Study	Effect of Brand Familiarity	Effect of Trait Natural Preference	Effect of Brand Familiarity by Trait Natural Preference Interaction
1	$b = .13, p = .002$	$b = .58, p < .001$	$b = -.09, p = .020$
2	$b = .11, p = .014$	$b = .48, p < .001$	$b = -.06, p = .121$
3	$b = .05, p = .059$	$b = .63, p < .001$	$b = -.08, p = .003$
4	$b = -.01, p > .25$	$b = .68, p < .001$	$b = .023, p > .25$
5	$b = .03, p > .25$	$b = .62, p < .001$	$b = .00, p > .25$
6	$b = .11, p = .007$	$b = .59, p < .001$	$b = -.02, p > .25$
7	$b = .08, p = .069$	$b = .47, p < .001$	$b = -.01, p > .25$

Note. Each row displays estimated betas from an ordinary least square regression with composite natural preference (averaged across scenarios) as the outcome variable, and brand familiarity (dummy variable), trait natural preference, and the interaction between brand familiarity and trait natural preference as simultaneous predictors.

Imagine you are shopping for a soda. You are choosing between Fresh Pop and Fresh Pop Natural. These two products are the same price.

Which product would you prefer?

Strongly prefer				Indifferent				Strongly prefer
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
○	○	○	○	○	○	○	○	○

Figure 3.1. Example stimuli from study 3.1.

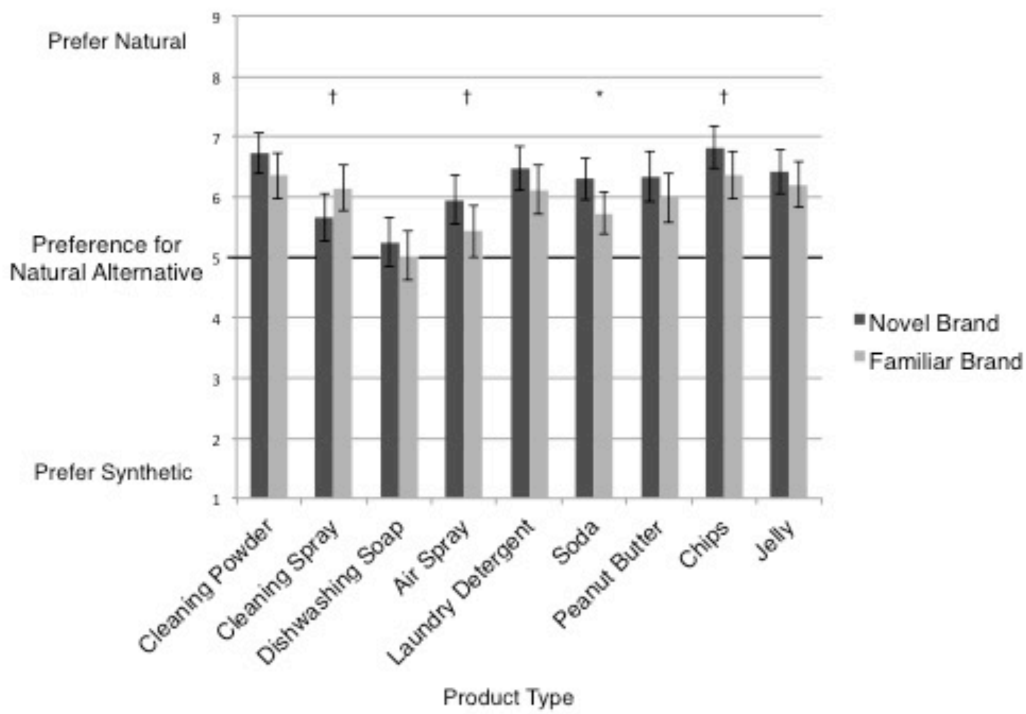


Figure 3.2. Preference for natural alternative of novel vs. familiar brands in study 3.1. The bolded line of five represents indifference between natural and synthetic alternatives. Error bars represent 95% confidence intervals of the mean. † = $p < .1$, * = $p < .05$

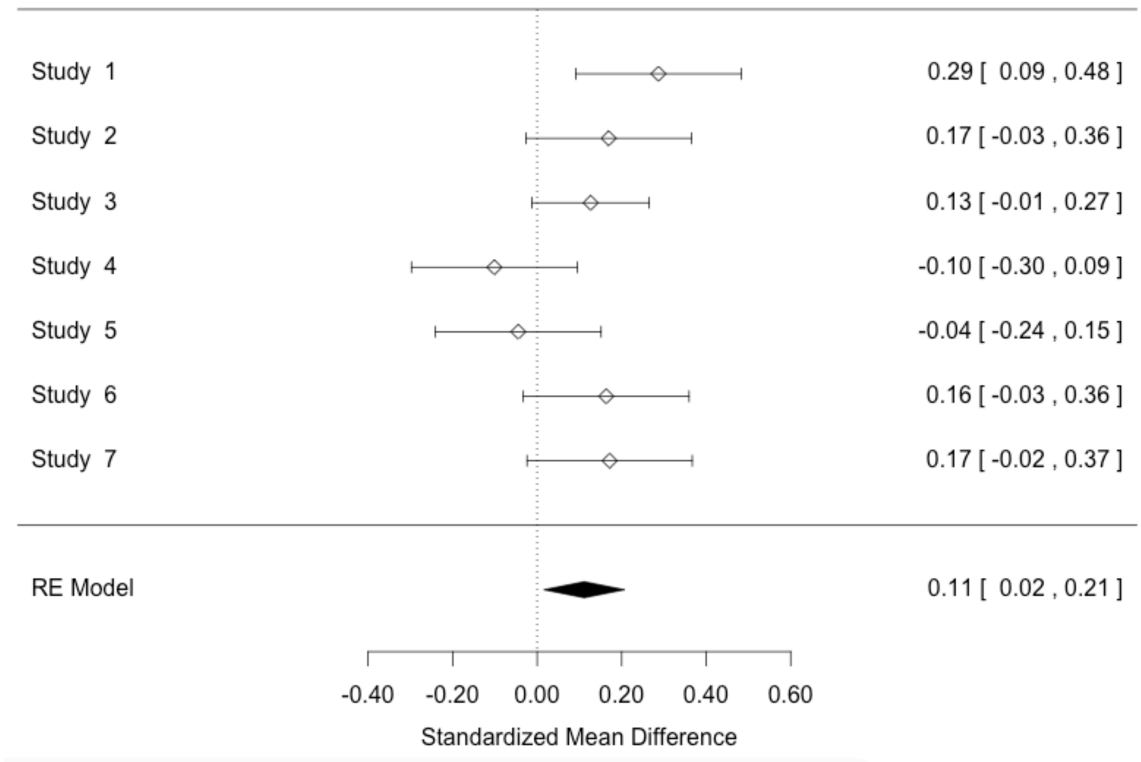


Figure 3.3. Forest plot with standardized mean difference and 95% confidence interval. The estimated mean difference from a random effects model across studies is displayed at the bottom.

GENERAL DISCUSSION

In the present dissertation, I examined the preference for natural and its implications. In Chapter 1, I examined individual differences in moral intuitions about an unnatural product—genetically modified food. Many consumers have strong moral intuitions that genetically modified food is unacceptable no matter the costs and benefits. It is possible these consumers are opposed to genetically modified food they see it as tampering with nature. In Chapters 2 and 3, I examined how the preference for natural varies across contexts. In Chapter 2, I found that consumers view natural products as safer and less potent. Because consumers place more importance on safety (vs. potency) when preventing than when curing, natural products are preferred more strongly for preventing than curing. In Chapter 3, I proposed that consumers view natural as trustworthy, and therefore natural products are most appealing when there are no other trustworthiness indicators (e.g., when the trustworthiness indicator of a familiar brand is absent). Consistent with this theory, I find that consumers prefer natural more when brands are novel than when brands are familiar.

Individual differences in the natural preference did not reliably moderate our key manipulations in Chapters 2 and 3. In particular, I measured overall individual differences in the desire for natural products (i.e., trait natural preference). In Chapter 2, consumers' greater preference for natural products when preventing (vs. curing) was not moderated by trait natural preference. In Chapter 3, I found only weak evidence of moderation: consumers with high trait natural preference may be less affected by manipulations of brand familiarity when choosing natural vs. synthetic alternatives. Even if this moderation proves to be replicable, it is quite small in size. Future research might investigate whether heterogeneity in the effects of other contextual factors on natural preference can be predicted by individual differences in intuitions about natural.

The present work has expanded our understanding of the appeal of naturalness, but future work might examine when and by whom natural products are preferred in other cultures. For example, some cultures feel more connected to nature than other cultures (see Medin & Bang, 2014). It is also possible that consumers might make different inferences about natural products in different cultures, where nature may be viewed as more benevolent and safe in some cultures than in others.

Throughout this dissertation, one persistent question is whether the average consumer is behaving rationally. I have examined lay intuitions and heuristics many consumers use to determine the permissibility of tampering with nature (Chapter 1), the safety and potency of natural things (Chapter 2), and the trustworthiness, reliability and benevolence of natural products (Chapter 3). This question harkens back to debates on the rationality of heuristics generally (e.g., Gigerenzer, 2008; Kahneman & Tversky, 1996). Heuristics can be very useful and often accurate, and indeed it might usually be correct to view natural as safe, less potent, or trustworthy. However, as with any shortcut, sometimes heuristics will lead to inaccurate inferences—sometimes the natural product will be unsafe, or more potent, or less trustworthy. The question therefore becomes how often consumers are inaccurate, how much these inaccuracies affect their well-being, and whether it would make consumers better off to either encourage deeper cognitive processing or change lay heuristics and intuitions about natural.

APPENDIX A: SUPPLEMENTARY MATERIAL FOR CHAPTER 1

Participants and Demographics

Sex. Four hundred fifteen participants (48.3%) were male; 444 (51.7%) were female.

Age. Twenty participants who reported ages below 18 or above 100 were excluded from analyses with age. The remaining ages ranged from 18 to 91, with a mean of 46.9 (*SD* = 16.5).

Race. Seven hundred fifty-eight participants (88.2%) were Caucasian, 49 (5.7%) were Black, 7 (.8%) were Hispanic/Latino, 41 (4.8%) were East Asian or Pacific Islander, 12 (1.4%) were Southeast Asian, and 14 (1.6%) were Native American. Each participant was allowed to select more than one ethnicity.

Sexual orientation. Seven hundred fifty-nine participants (88.4%) described themselves as heterosexual; 21 (2.4%) as gay or lesbian; 32 (3.7%) as bisexual. Forty-seven (5.5%) declined to answer.

Income. Participants were asked to report their yearly pre-tax household income using the ranges *less than $25,000* (209; 24.3%); *$25,000-$50,000* (233; 27.1%); *$50,001-$75,000* (164; 19.1%); *$75,001-$100,000* (87; 1.1%); and *greater than $100,000* (166; 19.3%).

Education. I asked participants to report the highest level of education they had completed. Fourteen participants (1.6%) did not complete high school; 213 (24.8%) held a high school diploma or GED; 75 (8.7%) had completed junior college (associate degree) or a technical school; 251 (29.2%) had completed some college; 175 (2.4%) held a bachelor's degree; 26 (3%) had completed some graduate school; and 105 (12.2%) held an advanced degree (either masters or doctorate).

Religion. One hundred two participants (11.9%) described their religious affiliation as atheist/agnostic, 226 (26.3%) as Catholic, 294 (34.2%) as Protestant, 15 (1.7%) as Judaism, 4 (.5%) as Islam, 6 (.7%) as Hinduism, 8 (.9%) as Buddhism, and 204 (23.7%) as "Other."

Politics. One hundred ninety-nine participants (23.2%) described themselves as Republicans, 275 (32%) as Democrats, 225 (26.2%) as independents, and 32 (3.7%) as members of another party. One hundred twenty-eight (14.9%) selected "don't know/no preference." I also asked participants whether they usually thought of themselves as "liberal, moderate, conservative, or something else." One hundred seventy-seven chose "don't know/not political" (112; 13%), "libertarian" (20; 2.3%), or "other" (45; 5.2%). The remaining 682 participants placed themselves on a seven-point scale anchored by "Very liberal" and "Very conservative." The mean score ($M = 4.08$; $SD = 1.77$) was very close to the scale midpoint of 4, labeled "Moderate." I also asked participants to place themselves on the same scale (except that this scale did not contain the "libertarian" option) separately for "social issues" ($N = 693$; $M = 3.91$; $SD = 1.86$) and "economic issues" ($N = 695$, $M = 4.32$, $SD = 1.84$).

Location. As a proxy for state of residence, I looked up our participants' locations using their IP addresses (using the geolocation service http://www.telize.com/geoip). Twenty-three IP addresses could not be mapped; results for the remaining participants are displayed below.

Materials and Methods

Absolute GM Opposition

I adapted these items from Baron and Spranca (1997). Participants were asked four agree/disagree questions about "genetically engineering plants and animals." These were: 1) "I do not oppose this"; 2) "This should be prohibited no matter how great the benefits and minor the risks from allowing it"; 3) "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 4) "This would be wrong even in a country where everyone thought it was not wrong."

Control absolute opposition

I also asked participants the same four absolute opposition questions regarding "fishing in a way that leads to the death of dolphins."

GM scenarios

Participants read four scenarios about people either intentionally or unintentionally consuming fictitious genetically modified foods:

1. *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.*

2. *Laura is at a restaurant for lunch, and she eats a tuna fish sandwich. She knows [does not know] that the tuna she is eating has been genetically modified. Scientists have inserted genes in them so that they grow more rapidly.*

3. *Tim knows [does not know] the apples at a local cafe have been genetically modified. He purchases and eats an apple from the cafe. Scientists have inserted genes in these apples so that they stay crisp longer.*

4. *Amanda knows [does not know] that conventional milk comes from genetically modified cows. She purchases a bottle of conventional milk and drinks it. Scientists have inserted genes in the cows so that their milk is less likely to induce allergic reactions.*

For each scenario, each participant was randomly assigned to read about intentional or unintentional consumption. For example, a participant might have read the intentional versions of scenarios 1 and 4 and the unintentional versions of scenario 2 and 3. The effects of intentionality were small and did not substantially affect the main results. For further information about intentionality effects, see Appendix A analyses below.

Immediately after reading each scenario, participants were asked about their emotional responses to it. I first asked participants to choose whether they felt primarily disgusted or angry. Participants did so in one of two ways: Half of participants were randomly assigned to always choose between verbal emotion labels; the other half were randomly assigned to always choose a face from one of two sets of anger and disgust facial expressions (a Caucasian or Indian female; pictures were from Rozin, Lowery, et al., 1999). Participants were asked to select the emotion or face that they thought best matched their emotion/facial expression upon viewing the situation (for verbal and facial expression conditions, respectively). Regardless of whether they chose between words or faces, participants were significantly more likely to choose disgust than anger (full analyses of this measure can be found in the supplemental analyses below). Subsequently, all participants were asked to report how angry and disgusted they felt imagining the situation (on nine-point scales; 1=*Not at all angry/disgusted* to 9=*Extremely angry/disgusted*). The order of these two questions was randomized.

Control scenarios

In order to verify that participants were using the emotion response scales as intended, I included two control scenarios, one expected to primarily evoke disgust and one expected to primarily evoke anger. After reading each scenario, participants completed the emotion measures described above.

Control Anger Scenario: *Sam is fishing in a way that leads to the death of dolphins.*
Control Disgust Scenario: *Josh is a 70 year-old male having sex with a 17 year-old female.*

GM risks, benefits, trust, and regulation

I asked participants to rate the severity of four possible risks of genetically modified food, the promise of four possible benefits of genetically modified food, their trust in five GM-related institutions, and their support for five different regulations restricting genetically modified foods, all on nine-point scales. Risk, benefit, and trust measures were adapted from Siegrist (2000).

Below are some possible negative consequences of GMO technology. How much risk do you think each poses for society? (1=”No risk at all” to 9=”Extreme risk”)

1. Genes from genetically modified plants spreading to other plants or animals, contaminating the environment

2. Genetically modified crops giving big corporations too much power over small farmers

3. Genetically modified foods having unknown side-effects, increasing risks of cancer or other diseases for people who consume them

4. Genetically modified foods being more toxic or less nutritious, harming people who consume them

Below are some possible positive consequences of GMO technology. How much benefit do you think each promises for society? (1=”Not at consequential” to 9=”Extremely consequential”)

1. Genetically modified plants increasing crop yields

2. Genetically modified plants requiring less fertilizer and fewer pesticides

3. Genetically modified foods being more nutritious for consumers

4. Genetic modification increasing animals' milk or meat production

In general, how much do you trust the following institutions or persons to deal with GMO technology safely and honestly? (1=”Not at all” to 9=”A great deal”)

1. Food companies

2. The U.S. government

3. Science

4. Scientists and researchers at universities

5. Agricultural companies

In general, do you support the following? (1="Certainly oppose" to 9="Certainly support")

1. *Your government requiring companies to label foods that have been genetically modified, so that consumers can identify them.*
2. *Your government requiring companies to submit every new GM food for strict and thorough testing, which can take years to complete.*
3. *Your government forbidding imports of GM foods from other countries.*
4. *Your government adding extra regulations for companies that produce or sell GM foods.*
5. *Your government forbidding any sale of GM foods within the nation's borders.*

Disgust Scale-Revised (Haidt, McCauley, & Rozin, 1994; Olatunji et al., 2007).

The 25-item DS-R measures individual differences in the propensity to feel disgust. DS scores are stable over time and predict people's willingness to perform actual disgusting actions (Rozin, Haidt, McCauley, Dunlop, & Ashmore, 1999). The DS-R also includes two attention-check questions to detect inattentive or random responding.

Trait Anger

I assessed trait anger using the Anger subscale of the Aggression Questionnaire (Buss & Perry, 1992).

Inclusion of Nature in Self

Participants saw a series of seven pairs of circles, which progressed from barely touching to almost completely overlapping (Aron, Aron, & Smollan, 1992; Schultz, 2001). The left circle was labeled “Self” and the right labeled “Nature”, and participants were instructed to “select the picture that best describes your relationship with nature.”

Connectedness to Nature (CNS)

The CNS is a widely-used measure of the extent to which people feel a connection to the natural world (e.g., “I often feel a sense of oneness with the natural world around me”). Higher scores on the CNS are strongly associated with environmentalist attitudes and behavior (Mayer & Frantz, 2004).

Demographics

Demographics included gender, age, income, religiosity, and political orientation.

Order and randomization

Half of participants were randomly assigned to first see the six scenarios (four genetically modified foods and two control) in random order; then the remaining measures. The other half completed the two blocks in the reverse order. Measure order was randomized, with each appearing on a separate page except for the risks, benefits, trust, and regulation questions (which appeared on the same page), and inclusion of nature in self (which was always presented on the last page, with the demographics). For all measures except disgust sensitivity and moral opposition, item order was randomized. All participants completed the demographics and inclusion of nature in self last, preceded by a short unrelated scale assessing lay views of obesity. Item order was randomized for all measures except disgust sensitivity and absolute opposition. Effects were consistent across order and I therefore collapse across it when reporting the results.

Supplemental Analyses

Alternative operationalizations of absolute opposition

I define absolute GM opposition using the "should be prohibited no matter how great the benefits and minor the risks from allowing it" question described in the Materials and Methods above. Descriptive statistics and regression models predicting absolute opposition were very similar using the other two questions (i.e., either defining absolutism as being quantity insensitive and agreeing to question 3 or as universalizing and agreeing to question 4). Using the quantity insensitivity question, 32.6% of respondents were supporters, 15.8% were non-absolutist opponents, and 51.6% were absolutist GM opponents (out of 764 participants, where ninety-five participants were excluded due to inconsistent responses). Using the universality question, 34.2% were supporters, 15.5% were non-absolutist opponents, and 5.3% were absolutist GM opponents (out of 783 participants, where seventy-six were excluded due to inconsistent responses).

For the analyses reported in Chapter 1, all significant results remained significant and all patterns of means remained the same when using either of the alternate classification schemes, with one exception. Using the universalist classification (i.e., "No" to question 1 and "Yes" to question 4), the difference between opponents' and supporters' frequency of choosing a disgust face for scenario 4 was marginal, whereas it was significant using the other classification schemes.

Disgust and absolute opposition

The relationships between disgust and absolutist opposition were robust to controlling for perceived risks and benefits of genetically modified foods, trust in GM-related institutions, demographic and individual difference variables. I conducted two multinomial logistic regressions with absolutist opponent as the reference category. In the first regression (Table A.2), average disgust in response to scenarios, perceived risks and benefits, trust, demographics, and individual differences were entered simultaneously as predictors. In the second regression (Table A.3), trait disgust sensitivity, perceived risks and benefits, trust, demographics, and individual differences were entered simultaneously as predictors. In both regressions, all continuous independent variables are standardized to facilitate comparison of regression coefficients.

Principal Components Analysis

In order to assess whether risk, benefit, and trust are differentiated by our participants, I used a principal components analysis with a varimax rotation. Three components emerged using the Kaiser criterion, explaining 75.2% of the variance. Below, the loadings of each item are displayed.

Correlation Matrix

To further assess whether variables were highly correlated, as might happen if predictor variables capture the same underlying latent construct, I examined the zero-order correlation matrix below.

Path Model

I further examined the relationships between disgust at genetically modified food consumption, disgust sensitivity, risk perceptions, and policy preferences using path modeling. These observed variables were the same unstandardized composite scores used in the main text, and in the correlation matrix above. Based on research showing that risk perceptions are often affectively based (Finucane, Alhakami, et al., 2000), I specified an indirect path from disgust reactions to genetically modified food consumption via risk perceptions. I also specified two paths for disgust sensitivity: one to risk perceptions via disgust reactions to GM, and one directly to risk perceptions. The first path reflects my expectation that more disgust-sensitive individuals would find genetically modified food consumption more disgusting; the second path reflects our expectation that they would also find GM aversive, and thus perceive greater risks, for other reasons—for example, because they find genetically modified organisms unnatural or contaminating. The complete model is shown in Figure A.1. I fit this model to the data using the "sem" procedure in Stata 12.0 (Mac OS X) with the default maximum-likelihood estimation procedure. The model fit the data well, as shown by a non-significant test for model lack of fit, $\chi^2(1) = 1.15$, $p = .28$. Other indices also indicated good overall model fit, RMSEA = .013, 95% CI [.00, .093], SRMR = .007, CFI = 1.0. The complete model, with standardized and unstandardized parameter estimates (as well as 95% confidence intervals for the latter), is shown in Figure A.1. All paths shown are significant at $p <$ .001, as are all indirect effects (Cohen & Cohen, 1983; Kline, 2011).

Demographic and Individual Difference Variables

Few demographic and individual difference variables predicted attitudes towards or desires to regulate genetically modified food in regression models (see Tables 1.1, A.1, A.2). One exception was attitudes towards the natural world (subjective connectedness to nature and inclusion of self in nature). Those who felt more one with nature were more opposed to GM and desired stricter regulations of GM technology, consistent with prior work (Siegrist, 1998). Additionally, older individuals desired stricter regulation of GM technology (Table 1.1), though surprisingly they were not more likely to be absolutist opponents to GM technology (Tables A.1, A.2) or view genetically modified food as riskier (see Table A.4). Thus, age appears to be related to more favorable attitudes towards regulation specifically. Finally, gender showed strong bivariate relationships, where women were more opposed to GM technology (see Table A.4), consistent with prior work (Siegrist, 1998). This relationship does not emerge in full regression models, suggesting that women are no longer more opposed after controlling for their heightened trait disgust sensitivity and/or risk perceptions. Gender effects were not capturing a "white male" effect on risk perception, as I did not find significant gender by white ethnicity interactions (Finucane, Slovic, Mertz, Flynn, & Satterfield, 2000).

Genetically Modified Food Scenarios: Forced-Choice Results

For all four genetically modified food consumption scenarios, individuals were more disgusted than angered. Participants were more likely to select a disgust face or word in responses (Scenario 1: 56.5% disgust, 43.5% anger; Scenario 2: 59.1% disgust, 4.9% anger; Scenario 3: 56.2% disgust, 43.8% anger; Scenario 4: 58.6% disgust, 41.4% anger; all binomial test *p*s $< .001$). Participants were about equally likely to select disgust when selecting faces as when selecting words (Scenario 1: face disgust = 57.2%, word disgust = 55.7%, $\chi^2(1) = .20$, $p > .10$; Scenario 2: face disgust = 59.1%, word disgust = 59.2%, $\chi^2(1) = .00$, $p > .10$; Scenario 3: face disgust = 53.7%, word disgust = 58.7%, $\chi^2(1) = 2.20$, $p > .10$; Scenario 4: face disgust = 56.3%, word disgust = 6.8%, $\chi^2(1) = 1.84$, $p > .10$). When choosing between disgust and anger faces, GM opponents were more likely than supporters to choose disgust faces in two out of four scenarios (Scenario 1: 54.1% supporters choose disgust, 59.8% opponents choose disgust, $\chi^2(1) = 1.21$, $p > .10$; Scenario 2: 5.7% supporters choose disgust, 64.1% opponents choose disgust, $\chi^2(1) =$

6.92, p = .009; Scenario 3: 54.1% supporters choose disgust, 52.2% opponents choose disgust, $\chi^2(1)$ = .14, p > .10; Scenario 4: 49.3% supporters choose disgust, 61.0% opponents choose disgust, $\chi^2(1)$ = 5.09, p = .024).

Genetically Modified Food Scenarios: Intentionality Manipulation

For each of the four genetically modified food scenarios, I randomly varied whether the food was consumed intentionally or unintentionally (i.e., with or without knowing the food was genetically modified; see full scenarios above). I examined the effects of intentions, emotion types, and opposition type in 2 (Intention: Intentional, Unintentional) x 2 (Emotion: Disgust, Anger) x 3 (Opposition: Absolutist Opponent, Non-absolutist Opponent, Supporter) mixed ANOVAs for each scenario. Overall, unintentional consumption evoked stronger emotion ratings, and this was especially the case for anger (Scenario 1: emotion: F(1, 797) = 5.04, p = .025, η_p^2 = .01, intention: F(1, 797) = 24.73, p < .001, η_p^2 =.03, opposition: F(2, 797) = 148.24, p < .001, η_p^2 =.27; emotion-intention interaction: F(1, 797) = 6.21, p = .013, η_p^2 = .01; emotion-opposition interaction: F(2, 797) = 2.59, p = .075, η_p^2 =.01; intention-opposition interaction: F(2, 797) = 2.20, p > .10; intention-emotion-opposition interaction: F(2, 797) = 1.05, p > .10; Scenario 2: emotion: F(1, 797) = 2.69, p = .101, η_p^2 = .00, intention: F(1, 797) = 1.03, p = .002, η_p^2 = .01, opposition: F(2, 797) = 155.93, p < .001, η_p^2 = .28; emotion-intention interaction: F(1, 797) = 12.88, p < .001, η_p^2 =.02; emotion-opposition interaction: F(2, 797) = 1.60, p > .10; intention-opposition interaction: F(2, 797) = .37, p > .10; intention-emotion-opposition interaction: F(2, 797) = .14, p > .10; Scenario 3: emotion: F(1, 797) = 1.41, p = .001, η_p^2 =.01, intention: F(1, 797) = 13.38, p < .001, η_p^2 =.02, opposition: F(2, 797) = 133.33, p < .001, η_p^2 = .25; emotion-intention interaction: F(1, 797) = 15.79, p

$< .001$, $\eta_p^2 = .02$; emotion-opposition interaction: $F(2, 797) = 1.64$, $p > .10$; intention-opposition interaction: $F(2, 797) = 1.47$, $p > .10$; intention-emotion-opposition interaction: $F(2, 797) = .73$, $p > .10$; Scenario 4: emotion: $F(1, 797) = 1.59$, $p = .001$, $\eta_p^2 = .01$, intention: $F(1, 797) = 8.56$, $p = .004$, $\eta_p^2 = .01$, opposition: $F(2, 797) = 135.46$, $p < .001$, $\eta_p^2 = .25$; emotion-intention interaction: $F(1, 797) = 7.87$, $p = .005$, $\eta_p^2 = .01$; emotion-opposition interaction: $F(2, 797) = .23$, $p > .10$; intention-opposition interaction: $F(2, 797) = 1.05$, $p > .10$; intention-emotion-opposition interaction: $F(2, 797) = .70$, $p > .10$).

In that anger was more responsive to intentions, these findings are consistent with prior work on moral anger and disgust (Russell & Giner-Sorolla, 2011a). I did not expect moral emotions to increase for unintentional consumption, but in retrospect I believe that this emotional reaction may have been directed towards genetically modified food producers, as opposed to unaware consumers. Indeed, a recent survey of a large sample of Americans revealed that 63% would be upset if they were served genetically modified food at a restaurant without knowing the food was genetically modified (Hallman et al., 2013). Consistent with this interpretation, disgust is not a reliably dominant response for unintentional consumption. For unintentional consumption scenarios, rated disgust and anger did not significantly differ (Scenario 1: $M_{anger} = 4.36$, $SD = 2.61$, $M_{disgust} = 4.43$, $SD = 2.57$, $t(435) = .98$, $p > .10$; Scenario 2: $M_{anger} = 4.98$, $SD = 2.71$, $M_{disgust} = 4.90$, $SD = 2.70$, $t(429) = 1.15$, $p > .10$; Scenario 3: $M_{anger} = 4.33$, $SD = 2.60$, $M_{disgust} = 4.36$, $SD = 2.57$, $t(439) = .37$, $p > .10$; Scenario 4: $M_{anger} = 4.34$, $SD = 2.58$, $M_{disgust} = 4.42$, $SD = 2.60$, $t(413) = 1.14$, $p > .10$). If anything, these results indicate that including unintentional consumption generates bias against finding a unique association between disgust and GM opposition.

I also repeated analyses reported in the main text only using intentional consumption scenarios. All significant results remained significant and all patterns of means remained the same as those reported with two exceptions, both related to likelihood of selecting disgusted facial expression or verbal label. 1) Participants still choose disgusted more than angered faces in two of four scenarios, though it was a different two scenarios that showed significant effects; 2) There was some indication that the likelihood of disgust more often was higher when choosing between verbal labels as opposed to facial expressions. A chi square test of verbal/facial manipulation by disgust/anger choice was significant in one scenario and marginal in another.

Genetically Modified Food Scenarios: Disgust to GM of Animals Versus Plants

Scenarios involving genetically modified animal products were on average rated more disgusting than scenarios involving genetically modified plant products. The relationship between increased disgust and absolute opposition was about equally strong for plant and animal modification scenarios. In a mixed ANOVA of the effect of opposition status (absolutist opponent, non-absolutist opponent, supporter) on average Likert scale disgust rating for the plant product scenarios and average Likert scale disgust rating for the animal product scenarios, level of opposition affected disgust ratings ($F(2, 800) = 177.28$, $p < .001$, $\eta_p^2 = .31$), animal product scenarios increased disgust ratings ($F(1, 800) = 45.89$, $p < .001$, $\eta_p^2 = .05$), and the effect of opposition status did not differ for animal versus plant products ($F(2, 800) = 2.21$, $p > .10$).

Control Scenario Analyses

As I expected, after reading the dolphin-killing scenario more individuals selected an anger face or word (8.9% anger versus 19.1% disgust, $p < .001$) and individuals indicated more anger than disgust in Likert responses (M_{anger} = 6.89, *SD* = 2.19, $M_{disgust}$ = 6.62, *SD* = 2.28, $t(858) = 4.91$, $p < .001$, $d = .17$). After reading the sex scenario, more individuals selected a disgust face or word (67.1% disgust versus 32.9% anger, $p < .001$) and individuals indicated more disgust than anger in Likert responses ($M_{disgust}$ = 7.29, *SD* = 2.38, M_{anger} = 6.40, *SD* = 2.79, $t(858) = 13.88$, $p < .001$, $d = .49$).

Trait anger

I expected trait anger to predict absolute opposition of dolphin killing, as state anger does. However, in a multinomial logistic regression with "absolutist opponent" as reference category, standardized trait anger did not predict levels of non-absolute opposition (b^* = .067, Wald χ^2 = .57, $p > .10$) or support (b^* = -.073, Wald χ^2 = .26, $p > .10$). For absolute GM opposition, in a multinomial logistic regression with "absolutist opponent" as reference category, lower standardized trait anger did not predict levels of non-absolutist opposition (b^* = .000, Wald χ^2 = .00, $p > .10$), though it was associated with lower likelihood of being a GM supporter (b^* = -.248, Wald χ^2 = 8.94, $p = .003$). Trait anger was uncorrelated with desire to regulate GM foods ($r(857) = .012$, $p = .725$).

Supplemental Study

Design

Three hundred fifty-five U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation (M_{age}=35.9, *SD*=12.7, 57.2% female). Participants rated the persuasiveness of a series of arguments about genetically modified food. Participants were randomly assigned (with equal probability) to either complete a measure of moral absolutism regarding genetically modification before rating these arguments, or to complete the absolutism measure *after* rating the arguments. All participants completed a series of demographic questions at the end of the survey.

Measures

Moral Absolutism. My moral absolutism measure was adapted from Baron & Spranca (1997) and is described fully in the main text. I used this measure to classify participants as supporters (194/337, or 57.6%), non-absolutist opponents (37/337, or 11.0%), or absolutist opponents (106/337, or 31.5%). Eighteen participants were excluded for inconsistent responses (i.e., they indicated the did not oppose GM but also would prohibit GM no matter the risks and benefits, as done in Chapter 1 and by Baron & Spranca, 1997).

Arguments. Participants were instructed to "rate the following arguments that people make about genetically modified food." Ten diverse arguments were presented in random order (one per page). Some arguments were based on welfare benefits to humanity (e.g., genetically modified food can help stop world hunger). Other arguments were based on assessments about risks and benefits to consumers (e.g., genetically modified foods look and taste better). Participants were asked to rate "How persuasive do you find this argument?" on a 7-point scale anchored by "Not at all persuasive" and "Extremely persuasive." The exact text of each argument is listed below (italicized labels were not shown to participants):

Hunger. Genetically modified crops could help stop world hunger. These crops can grow more units per square mile, which could be pivotal in an era where our population is outstripping our food production capacity.

Blindness. Genetically modified foods could prevent millions of people from going blind. For example, "golden rice" is a genetically modified form of rice with higher levels of vitamin A. It has the potential to prevent blindness from vitamin A deficiency, which is widespread in Asia.

Pesticides. GM crops actually reduce pesticide use, which could minimize environmental impacts.

Risk. There is widespread consensus among scientists that consuming genetically modified food is no riskier than consuming food modified by conventional plant improvement techniques.

Vitamins. GM foods could make it easier for consumers to get their vitamins. We now grow rice with more vitamin A, which could help people get enough Vitamin A and maintain a balanced diet.

Profit 1. GM crops could increase profitability of farming. These crops require fewer pesticides, which lowers cost of production.

Profit 2. GM crops could increase profitability of farming. These crops can grow more units per square mile, which increases revenue.

Allergens. There is no evidence that genetic modification would introduce new allergens (substances that cause allergic reactions).

Freshness. Some GM foods can last longer in your refrigerator.

Taste. Some GM foods look and taste better.

Demographics. Participants indicated their gender, age, income bracket, education, sexual orientation, political orientation, religion, religiosity, and whether they grew up in a rural, urban, or suburban location.

Results

Effects of Arguments on Moral Absolutism. Seeing pro-genetically modified food arguments did not reliably change overall frequencies of supporters, non-absolutist opponents, and absolutist opponents, $\chi^2(2, N = 337) = 2.79$, $p = .248$ with Yates continuity correction (see Table A.7). In addition to the non-significant overall effect of seeing pro-GM arguments, there was also so change in the proportion of absolutist opponents (vs. the two other categories), $\chi^2(1, N = 337) = 1.09$, $p = .297$ with Yates continuity correction. Looking only at GM opponents, there was a directionally lower proportion of absolutist opponents after seeing pro-GM arguments (52/76, or 68.4%) as compared to before seeing arguments (54/67, or 8.6%), but this difference in proportions did not reach significance, $\chi^2(1, N = 143) = 2.15$, $p = .142$ with Yates continuity correction. These results are broadly consistent with previous research finding that providing information or arguments does not reduce opposition to genetically modified food (Scholderer & Frewer, 2003).

Rated Persuasiveness of GM Arguments. Figure A.2 displays average persuasiveness ratings of the ten arguments, for supporters, non-absolutist opponents, and absolutist opponents. Unsurprisingly, supporters generally found the arguments most persuasive, absolutist opponents found the arguments least persuasive, and non-absolutist opponents fell somewhere in between. Absolutist opponents found none of the arguments particularly persuasive; on average they rated every argument below the scale midpoint of four.

Table A.1. Participant locations.

State	Number of Participants	Percentage of Participants
Alabama	13	1.6%
Alaska	3	.4%
Arizona	12	1.4%
Arkansas	7	.8%
California	52	6.2%
Colorado	14	1.7%
Connecticut	14	1.7%
Delaware	2	.2%
District of Columbia	3	.4%
Florida	69	8.3%
Georgia	25	3.0%
Hawaii	2	.2%
Idaho	5	.6%
Illinois	27	3.2%
Indiana	36	4.3%
Iowa	6	.7%
Kansas	7	.8%
Kentucky	17	2.0%
Louisiana	6	.7%
Maine	8	1.0%
Maryland	11	1.3%
Massachusetts	23	2.8%
Michigan	31	3.7%
Minnesota	10	1.2%
Mississippi	4	.5%
Missouri	29	3.5%
Montana	3	.4%
Nebraska	9	1.1%
Nevada	9	1.1%

New Hampshire	3	.4%
New Jersey	24	2.9%
New Mexico	4	.5%
New York	55	6.6%
North Carolina	33	3.9%
North Dakota	1	.1%
Ohio	49	5.9%
Oklahoma	11	1.3%
Oregon	17	2.0%
Pennsylvania	43	5.1%
Rhode Island	3	.4%
South Carolina	8	1.0%
South Dakota	2	.2%
Tennessee	15	1.8%
Texas	44	5.3%
Utah	9	1.1%
Vermont	2	.2%
Virginia	17	2.0%
Washington	10	1.2%
West Virginia	6	.7%
Wisconsin	20	2.4%
Wyoming	3	.4%

Table A.2. Relationship between state disgust at genetically modified food consumption and GM opposition.

Independent Variable	Non-Absolute Opposition (versus Absolute Opposition)			Support (versus Absolute Opposition)		
	Coefficient	Wald	*p*	Coefficient	Wald	*p*
State disgust	-.489	11.891	.001	-1.367	74.955	<.001
Risks	-.303	3.819	.051	-.970	39.284	<.001
Benefits	.131	1.027	.311	.501	11.367	.001
Trust	.049	.147	.702	.344	5.887	.015
Connectedness to Nature	-.408	7.566	.006	-.257	2.601	.107
Inclusion of Nature in Self	.303	4.526	.033	.280	3.694	.055
Date of Birth	.132	1.074	.300	-.054	.182	.669
Education	.107	.647	.421	-.113	.688	.407
Political Orientation (7 = most conservative)	-.183	1.938	.164	-.031	.052	.820
Income	.107	.711	.399	.200	2.367	.124
Religiosity	.037	.088	.766	-.051	.158	.691
Gender (1 = female)	-.145	.330	.565	-.399	2.455	.117
Ethnicity, White	1.421	1.201	.273	1.237	.885	.347
Ethnicity, Black	.727	.261	.609	.881	.386	.535
Ethnicity, Hispanic	2.167	1.890	.169	-.446	.054	.817
Ethnicity, East Asian	.563	.171	.679	.768	.325	.569

Ethnicity, Native American	.762	.381	.537	1.166	.840	.359
Ethnicity, Southeast Asian	2.119	1.540	.215	2.705	2.288	.130

Note. A multinomial logistic regression model predicting absolute GM opposition (reference category), non-absolute opposition, and support with disgust reactions from scenarios for $N = 621$ participants is displayed. All independent variables except gender and ethnicity are standardized. 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 are excluded.

Table A.3. Relationship between trait disgust sensitivity and GM opposition.

Independent Variable	Non-Absolute Opposition (versus Absolute Opposition)			Support (versus Absolute Opposition)		
	Coefficient	Wald	*p*	Coefficient	Wald	*p*
Disgust Sensitivity	-.372	7.645	.006	-.602	2.562	<.001
Risks	-.406	7.202	.007	-1.266	75.618	<.001
Benefits	.169	1.792	.181	.679	23.940	<.001
Trust	.116	.786	.375	.450	11.343	<.001
Connectedness to Nature	-.461	9.628	.002	-.355	5.785	.016
Inclusion of Nature in Self	.262	3.368	.066	.182	1.832	.176
Date of Birth	.138	1.172	.279	-.084	.514	.473
Education	.150	1.292	.256	.055	.189	.664
Political Orientation (7 = most conservative)	-.189	2.067	.151	.001	.000	.991
Income	.067	.283	.595	.096	.634	.426
Religiosity	.033	.073	.787	-.046	.144	.704
Gender (1 = female)	.044	.029	.864	-.033	.018	.893
Ethnicity, White	2.042	2.299	.129	1.589	1.535	.215
Ethnicity, Black	1.255	.738	.390	1.244	.835	.361
Ethnicity, Hispanic	2.581	2.311	.128	.100	.003	.959
Ethnicity, East Asian	1.207	.752	.386	1.198	.814	.367

Ethnicity, Native American	.645	.285	.594	.869	.579	.447
Ethnicity, Southeast Asian	2.835	2.525	.112	2.637	2.310	.129

Note. A multinomial logistic regression model predicting absolute GM opposition (reference category), non-absolute opposition, and support with trait disgust sensitivity for $N = 621$ participants is displayed. All independent variables except gender and ethnicity are standardized. 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 are excluded.

Table A.4. Principal components analysis of risk, benefit, and trust items.

	Factor 1	Factor 2	Factor 3
Risk Item 1	-.090	-.023	**.885**
Risk Item 2	-.054	-.041	**.907**
Risk Item 3	-.085	.023	**.817**
Risk Item 4	-.060	-.036	**.919**
Benefit Item 1	.123	**.907**	-.007
Benefit Item 2	.121	**.909**	-.031
Benefit Item 3	.141	**.882**	-.025
Benefit Item 4	.110	**.866**	-.012
Trust Item 1	**.823**	.141	.027
Trust Item 2	**.824**	.076	-.150
Trust Item 3	**.805**	.083	-.210
Trust Item 4	**.754**	.077	-.007
Trust Item 5	**.825**	.166	-.019

Note. Results of principal components analysis with a varimax rotation for risk, benefit, and trust are shown. Items that load above .3 are in bold.

Table A.5. Correlation matrix.

	Desire for Regulation	Disgust Sensitivity	GM Scenarios, Disgust	GM Scenarios, Anger	Risks	Benefits	Trust	Connectedness to Nature
Desire for Regulation	1	.205**	.361**	.352**	.601**	-.074*	-.127**	.251**
Disgust Sensitivity	.205**	1	.334**	.279**	.251**	-.01	.043	-.029
GM Scenarios, Disgust	.361**	.334**	1	.914**	.439**	-.196**	-.174**	.185**
GM Scenarios, Anger	.352**	.279**	.914**	1	.431**	-.180**	-.185**	.166**
Risks	.601**	.251**	.439**	.431**	1	-.053	-.170**	.273**
Benefits	-.074*	-.01	-.196**	-.180**	-.053	1	.269**	.031
Trust	-.127**	.043	-.174**	-.185**	-.170**	.269**	1	.052
Connectedness to Nature	.251**	-.029	.185**	.166**	.273**	.031	.052	1
Inclusion of Nature in Self	.090**	-.146**	.100**	.099**	.118**	-.018	-.004	.454**
Gender	.165**	.355**	.200**	.179**	.228**	-.045	-.019	.124**
Date of Birth	-.074*	.126**	.063	.018	.024	-.034	.075*	.019
Education	-.074*	-.146**	-.176**	-.150**	-.096**	.036	.013	-.037
Politics	-.109**	-.064	-.090*	-.085*	-.111**	.066	-.078*	-.296**
Income	-.093**	-.124**	-.096**	-.059	-.116**	.013	.005	-.118**
Religiosity	.092**	.090**	.072*	.082*	.082*	-.056	-.015	-.072*
Ethnicity, White	-.012	-.118**	-.068*	-.038	.021	-.01	-.117**	-.049
Ethnicity, Black	-.003	.114**	.062	.028	-.026	-.052	.068*	-.049
Ethnicity, Hispanic	.022	-.053	-.042	-.040	-.019	.042	-.035	.002
Ethnicity, East Asian	.048	.059	.04	.031	.037	.090**	.081*	.075*
Ethnicity, Native American	-.014	-.074*	-.019	-.032	-.076*	-.011	-.029	.045
Ethnicity, Southeast Asian	-.006	.029	.059	.071*	-.002	0	.012	.025

Ethnicity, East Asian	Ethnicity, Hispanic	Ethnicity, Black	Ethnicity, White	Religiosity	Income	Politics	Education	Date of Birth	Gender	Inclusion of Nature in Self
.048	.022	-.003	-.012	.092**	-.093**	-.109**	-.074*	-.074*	.165**	.090**
.059	-.053	.114**	-.118**	.090**	-.124**	-.064	-.146**	.126**	.355**	-.146**
.04	-.042	.062	-.068*	.072*	-.096**	-.090*	-.176**	.063	.200**	.100**
.031	-.040	.028	-.038	.082*	-.059	-.085*	-.150**	.018	.179**	.099**
.037	-.019	-.026	.021	.082*	-.116**	-.111**	-.096**	.024	.228**	.118**
.090**	.042	-.052	-.01	-.056	.013	.066	.036	-.034	-.045	-.018
.081*	-.035	.068*	-.117**	-.015	.005	-.078*	.013	.075*	-.019	-.004
.075*	.002	-.049	-.049	-.072*	-.118**	-.296**	-.037	.019	.124**	.454**
-.011	-.021	-.099**	.081*	.017	-.047	-.175**	.032	-.071*	-.045	1
.009	-.094**	.027	-.006	.086*	-.168**	-.095*	-.162**	.178**	1	-.045
.115**	.006	.064	-.163**	-.127**	-.057	-.158**	-.026	1	.178**	-.071*
.164**	-.048	-.028	-.078*	.009	.384**	-.022	1	-.026	-.162**	.032
-.037	-.014	-.146**	.167**	.238**	-.001	1	-.022	-.158**	-.095*	-.175**
.077*	-.019	-.108**	.02	-.035	1	-.001	.384**	-.057	-.168**	-.047
-.057	-.005	.06	-.024	1	-.035	.238**	.009	-.127**	.086*	.017
-.529**	-.088*	-.643**	1	-.024	.02	.167**	-.078*	-.163**	-.006	.081*
-.032	.034	1	-.643**	.06	-.108**	-.146**	-.028	.064	.027	-.099**
.04	1	.034	-.088*	-.005	-.019	-.014	-.048	.006	-.094**	-.021
1	.04	-.032	-.529**	-.057	.077*	-.037	.164**	.115**	.009	-.011
.014	.091**	.008	-.096**	.017	-.027	.008	.023	.016	-.06	-.002
.066	.100**	.013	-.295**	-.039	.016	-.085*	.006	.063	-.044	-.022

Ethnicity, Southeast Asian	Ethnicity, Native American
-.006	-.014
.029	-.074*
.059	-.019
.071*	-.032
-.002	-.076*
0	-.011
.012	-.029
.025	.045
-.022	-.002
-.044	-.06
.063	.016
.006	.023
-.085*	.008
.016	-.027
-.039	.017
-.295**	-.096**
.013	.008
.100**	.091**
.066	.014
.063	1
1	.063

Note. The correlation matrix among variables is displayed. ** indicates $P < .01$, * indicates $P < .05$

Table A.6. Variance-covariance matrix of the observed variables used in the path analysis.

	DS-R (disgust sensitivity)	GM scenarios disgust	Risks	Desire for regulation
DS-R (disgust sensitivity)	.47521			
GM scenarios disgust	.530146	5.30065		
Risks	.335472	1.95845	3.75147	
Preference for regulation	.251053	1.47623	2.0683	3.1559

Table A.7. Levels of moral absolutism before exposure versus after exposure to arguments in favor of genetically modified food.

	Supporter	Non-Absolutist Opponent	Absolutist Opponent
Before Arguments	89 (57%)	13 (8%)	54 (35%)
After Arguments	105 (58%)	24 (13%)	52 (29%)

Note. Each cell displays counts and percentages (by row).

Figure A.1. Path model showing relationships between disgust sensitivity, disgust at consumption of genetically modified food, GM risk perceptions, and desire to regulate GM. Unstandardized parameter estimates are displayed first; standardized estimates are in parentheses; 95% CIs of the unstandardized estimates are in brackets.

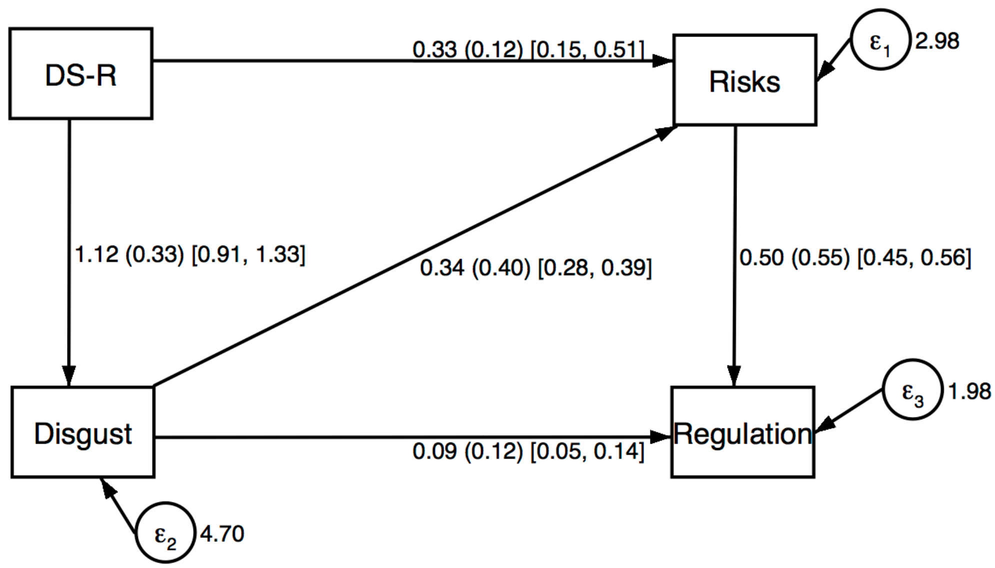
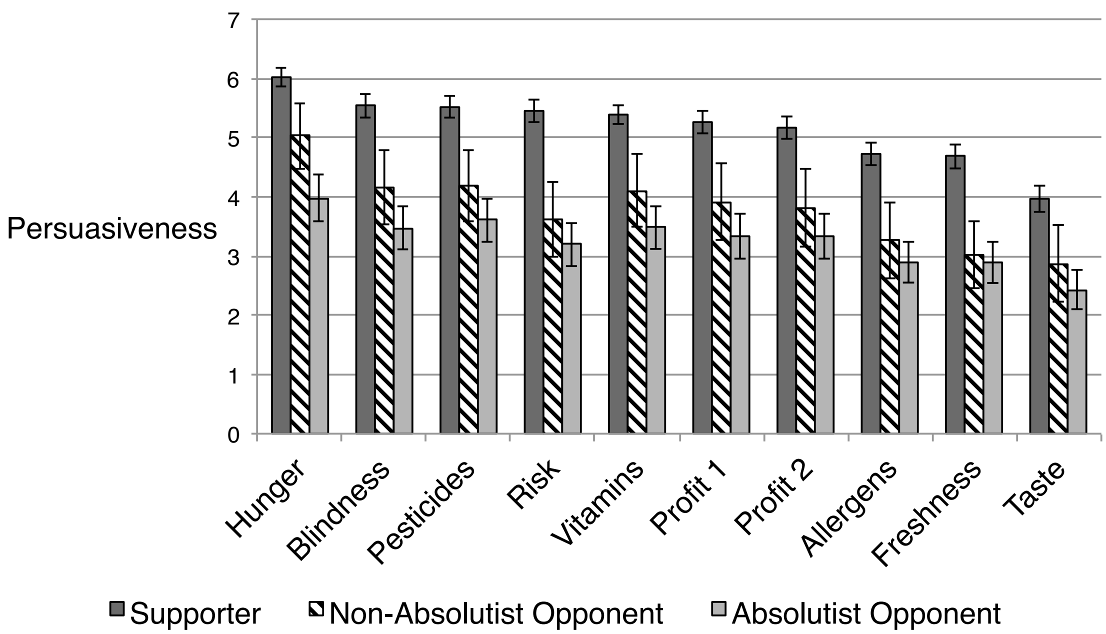


Figure A.2. Rated persuasiveness of ten arguments for supporters, non-absolutist opponents and absolutist opponents. Error bars show 95% confidence intervals.



APPENDIX B: SUPPLEMENTAL MATERIAL FOR CHAPTER 2

SUPPLEMENTAL ANALYSES

ANALYSES OF PREVENT VS. CURE EFFECT IN EACH SCENARIO (STUDIES 2.1, 2.2B AND 2.3)

In studies 2.1, 2.2B and 2.3, participants viewed a number of scenarios. In tables B.1 through B.3 I display the effect of prevent vs. cure manipulations broken down by scenario. In table B.1, I display the effect of prevent vs. cure on the natural preference for each of the nine ailments in study 2.1. In table B.2A, I display the effect of prevent vs. cure on the preferences for potent medicines for diseases of different severity in study 2.2B. In table B.2B, I display the effect of prevent vs. cure on tolerance of risks from medicines for diseases of different severity in study 2.2B. In table B.3A, I display the effect of prevent vs. cure on the natural preference for each of the three ailments in study 2.3, and in table B.3B I display the effect of prevent vs. cure on the relative importance of safety vs. potency for each of the three ailments in study 2.3.

ANALYSES OF PREVENT VS. CURE EFFECT USING ONLY FIRST SCENARIO PRESENTED (STUDIES 2.1 AND 2.2B)

Study 2.1

Due to the fact that participants viewed and made judgments across many similar scenarios, I also examined the effect of preventing vs. curing using only the first scenario that participants saw. I conducted two separate repeated measures ANOVAs—one on scenarios with medicines and one on scenarios with household products. (I conduct separate ANOVAs because combining the data into one ANOVA would be inappropriate given the unequal cell sizes. Since half of participants saw a medicine scenario first and half saw a household product scenario first via random assignment, but there were three medicine scenarios and six household product scenarios, cells in the medicine scenario contain approximately twice as many observations.)

Both ANOVAs revealed a significant effect of preventing vs. curing on natural preference. In a 2 (Treatment Purpose: Prevent, Cure) x 3 (Target Ailment: Vitamin B Deficiency, Scurvy, Common Cold) between-subjects ANOVA on ratings of preference for the natural medicine, participants preferred natural to a greater extent for preventing than for curing ($F(1, 497) = 3.76$, $p = .053$, $\eta_p^2 = .01$). Natural preference varied across target medicines ($F(2, 497) = 3.85$, $p = .022$, $\eta_p^2 = .02$), and there was no significant interaction between target ailment and treatment purpose ($F(2, 497) = .031$, $p > .25$). In a 2 (Treatment Purpose: Prevent, Cure) x 6 (Target Problem: Mold, Mouth Bacteria, Metal Stains, Wood Stains, Clothing Stains, Pipe Leaks) between-subjects ANOVA on ratings of preference for the natural products, participants preferred natural products more for preventing than for curing ($F(1, 489) = 14.29$, $p < .001$, $\eta_p^2 = .03$). Natural preference also varied across target problems ($F(5, 489) = 9.15$, $p < .001$, $\eta_p^2 = .16$) and there was no interaction between target problem and treatment purpose ($F(5, 489) = 1.59$, $p = .161$).

Study 2.2B

Because Study 2.2B also contained many similar scenarios, I again analyze just the first scenario that a participant read. In a 2 (Treatment Purpose: Prevent vs. Cure) X 3 (Disease Severity: Low, Medium, High) between subjects ANOVA on potency preference, prevent vs. cure purpose reduced preferences for potency ($F(1, 196) = 7.56$, $p = .007$, $\eta_p^2 = .04$). Additionally, participants preferred more potent treatments for more severe diseases ($F(2, 196) = 74.53$, $p < .001$, $\eta_p^2 = .43$) and there was no disease severity by treatment purpose interaction ($F(2, 196) = 1.75$, $p = .177$).

In a similar ANOVA but with risk tolerance as the dependent variable, prevent vs. cure purpose reduced risk tolerance ($F(1, 196) = 1.30$, $p = .002$, $\eta_p^2 = .05$). Additionally, participants tolerated more risk for more severe diseases ($F(2, 196) = 68.41$, $p < .001$, $\eta_p^2 = .41$) and there was no disease severity by treatment purpose interaction ($F(2, 196) = .73$, $p = .477$).

SUPPLEMENTAL STUDIES

STUDY B.1: OBSERVATIONAL STUDY USING LARGE, NATIONALLY REPRESENTATIVE DATASET

I examined what consumers' say about why they have used natural products in a large national survey about uses of alternative therapies. This survey fortuitously included a few items relevant for my predictions.

The Survey

I used a dataset from the National Health Interview Survey (CDC/NCHS, National Health Interview Survey 2012a, 2012b). The NHIS is conducted annually on a nationally representative sample of the U.S. population by the Centers for Disease Control and Prevention (CDC), and the data are publicly available at http://www.cdc.gov/nchs/nhis/nhis_questionnaires.htm. The 2012 survey included a set of questions about the use of complementary and alternative medicines.

Sample. The NHIS sampled adults (N = 34,525) in the U.S. population. Each adult completed a set of questions about his or her healthcare, including the supplementary questions on complementary and alternative medicines. In a few (N = 468) cases, a knowledgeable proxy answered for the adult, who was mentally or physically unable to answer. Additionally, some individuals (N = 931) opted out of or were unavailable to complete the complementary and alternative supplement.

Interview Method. Census interviewers collected NHIS data throughout the year through face-to-face interviews (though follow-ups to complete interviews may have been conducted via telephone). Interviews were computer-assisted. A computer program presented the questionnaire to an interviewer and interviewers entered survey responses directly into the computer. Based on previous responses, the computer program automatically routed the interviewer to appropriate questions.

Survey Questions.

Overview.

Respondents were first asked about whether or not they used eighteen different types of alternative treatment therapies in the past 12 months. Of all participants, 28.9 % (*N* = 9, 972) had used at least one alternative treatment. These participants listed their top three alternative treatments, in order of importance. Each participant answered a number of questions about their top three alternative therapies, including two measures of interest—whether *preventing* was a reason for usage (Yes or No) and whether *natural preference* was a reason for usage (Yes or No). For exact question wording of these items, see bolded items in "Questions for Top Three Treatments Only" section below. Participants would first complete all questions about their most important alternative treatment, then cycle through these items for their second and third most important alternative treatment. Participants who did not have a second or third most important alternative treatment bypassed this section of questions.

Questions for All Alternative Treatments. Participants were first asked about 18 alternative treatments: acupuncture, aryuveda, biofeedback, chelation therapy, chiropractic or osteopathic manipulation, craniosacral therapy, energy healing therapy, hypnosis, massage, naturopathy, traditional healers, movement therapies (Pilates/Trager/psychophysical integration/Feldenkrais), herbal and non-vitamin supplements, vitamins and minerals, homeopathy, special diets, yoga/tai chi/qi gong, and relaxation techniques (meditation/guided imagery/progressive relaxation).

For each treatment, participants were asked about whether they had used the treatment ever and in the past year; how frequently they had seen a practitioner for the treatment, insurance coverage versus out-of-pocket payment for the treatment, and materials purchased to learn about the treatment.

Questions for Top Three Treatments Only. After participants indicated the top three alternative treatments most important to their health, a number of questions were asked only about these three treatments. (For these treatments, the NHIS excluded Ayurveda, chelation therapy, and vitamins and minerals due to very low or high prevalence.) For each of the top three treatments, participants completed the following measures.

Participants were asked about five potential reasons for using the treatment. For each reason, participants could respond "Yes" or "No" (though a small percentage of participants' answers were coded as "Don't Know", "Refused" or "Not Ascertained"). These reasons included one of the measures relevant to my hypothesis, the *preventing* measure, which is bolded below.

"Did you [use this therapy] for any of these reasons?"

1. **"For general wellness or general disease prevention?"**
2. "To improve your energy?"
3. "To improve your immune function?"
4. "To improve your athletic or sports performance?"
5. "To improve your memory or concentration?"

Then, participants were asked a number of questions about whether the treatment motivated them to engage in healthy behaviors (e.g., exercise more regularly) or led to positive outcomes (e.g., better sleep, reduced stress). Participants were also asked which—of the reasons, motivations, and outcomes—was the most important reason for using the alternative therapy, and how effective the therapy was with regards to that reason. Next, participants indicated whether they used the treatment for specific health problems and, if yes, what those health problems, which was the most important health problem, and what other conventional treatments they used for the most important health problem (e.g., prescription medication).

Participants were then asked further questions about why they used the alternative treatment therapy. (Five reasons, not listed below, were only asked of participants who were using the alternative therapy in addition other conventional treatment(s) for a specific health problem.) Four reasons were asked of all participants using an alternative therapy. For each reason, participants could respond "Yes" or "No" (though a small percentage of participants' answers were coded as "Don't Know", "Refused" or "Not Ascertained"). These reasons included one of the measures relevant to my hypothesis, the *natural preference* measure, which is bolded below.

"Did you [use this therapy] for any of these reasons?"

1. **"It is natural?"**
2. "It focuses on the whole person, mind, body, and spirit?"
3. "It treats the cause and not just the symptoms?"
4. "It was part of your upbringing?"

Finally, a series of questions was asked about: whether the treatment had been recommended to them by someone (e.g., a medical doctor); whether they disclosed use of alternative therapy to a medical professional and, if not, why they chose not to disclose; and their sources of information about the treatment (e.g., the internet). More information about exact wording of questions is available at www.cdc.gov/nchs/nhis.htm.

Results

Bivariate Relationships between Treatment Purpose and Natural Preference.

First, I examined the bivariate relationships between using a treatment because it was natural and using it for prevention. I conducted separate analyses for the most important treatment ($N = 9{,}972$), the second most important treatment ($N = 4{,}611$), and the third most important treatment ($N = 2{,}045$). Because some participants only used one or two alternative treatments over the year, the number of participants decreases from the first to second and second to third most important treatments. I examine the percent of people who indicated they had used a treatment because it was natural. Consistent with my predictions, two-sample z-tests revealed that people are more likely to use a treatment because it was natural if they were using it for prevention (Most Important Treatment: $M_{\text{preventing}} = 65.3\%$, $M_{\text{not preventing}} = 39.8\%$, $z = 24.5$, $p < .001$; Second Most Important Treatment: $M_{\text{preventing}} = 72.4\%$, $M_{\text{not preventing}} = 45.2\%$, $z = 17.1$, $p < .001$; Third Most Important Treatment: $M_{\text{preventing}} = 77.4\%$, $M_{\text{not preventing}} = 59.5\%$, $z = 7.8$, $p < .001$). Additionally, there is a trend where the proportion of individuals preferring natural increases from first to second and second to third most important treatment. I expect this trend occurs because participants who more strongly prefer natural use more alternative medicines.

Robustness Checks.

Because prevent vs. cure purpose was not experimentally manipulated, it is possible that some third variable (e.g., being female) causes both a preference for natural and tendency towards preventative treatment. Therefore, I assessed whether this relationship was robust when assessing the effect of prevent vs. cure in a within-subjects comparison (where each individual is their own control) and in between subjects analysis including demographic control variables in the model.

Within Subjects Model.

It is possible that some individual difference variable causes people to both prefer natural and use preventative treatments, and that this confound caused the relationships above. In order to control for this possible selection bias, I isolated the 1,717 individuals who had used at least one alternative for preventing and one alternative not for preventing. I conducted a within subjects comparison on these participants, thereby controlling for selection on unobservable individual differences. I compared two proportions: the percentage of times a person indicated they had used a medicine because it was natural when preventing versus the percentage of times that same person indicated they had used a medicine because it was natural when *not* preventing. A paired, two-tailed Wilcoxon signed-ranks test indicated that consumers were more likely to say they had used a medicine because it was natural when they were using it for prevention ($M_{\text{preventing}}$ = 65.4%, SD = 45.5%; $M_{\text{not preventing}}$ = 53.1%, SD = 48.7%, V = 133483, p < .001).

Binary Choice Models with Demographic Controls.

As a further robustness check, I estimated the effect of treatment purpose on natural preference while controlling for demographic variables in a binary logistic regression. I entered whether or not a participant reported using a treatment because it was natural as the outcome variable, and entered as simultaneous predictors: whether the participant was using the treatment for prevention, region of residence in the U.S. (East, Midwest, West or South region), age, gender, ethnicity, and marital status.

I conducted separate regressions for the most important treatment ($N = 9{,}972$), the second most important treatment ($N = 4{,}611$), and the third most important treatment ($N = 2{,}045$). Because some participants only used one or two alternative treatments over the year, the number of participants decreases from the first to second and second to third most important treatments. In all three regressions, individuals who used a treatment for preventing were significantly more likely to use the treatment because it was natural (Most Important Treatment: $b = 1.05$, Wald z statistic = 24.02, $p < .001$, odds ratio = 2.85; Second Most Important Treatment: $b = 1.15$, Wald z statistic = 16.64, $p < .001$, odds ratio = 3.17; Third Most Important Treatment: $b = .85$, Wald z statistic = 7.64, $p < .001$, odds ratio = 2.34). (See Tables B.4-B.6 for more information.) The odds of using a treatment because it was natural was estimated to increase between 2.34 and 3.17 times if it was used for preventing. Additionally, for less important treatments (e.g., second or third treatment), the base rate of using a medicine because it was natural increased. I expect this is because individuals who use three alternative therapies in a year, as opposed to one, have a higher trait preference for natural products.

STUDY B.2A AND B.2B: WITHIN-SUBJECTS REPLICATIONS OF STUDY 2.1

Studies B.2A and B.2B replicate the central finding from study 2.1, that there is a stronger preference for natural products when preventing than when curing. Both studies use a within-subjects manipulation of preventing versus curing (as opposed to the between-subjects manipulation in study 2.1). Study B.2A replicates this finding in the domain of medicines, and study B.2B replicates this finding for household products.

Study B.2A

Study B.2A investigates whether there is a stronger preference for a natural medicine when the medicine is used as a preventative as opposed to a curative, using a within-subjects manipulation of preventing versus curing.

Methods

Participants. Two hundred and seven U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation (M_{age} = 36.1, *SD* = 12.9, 36.2% female).

Scenarios. The survey consisted of three different scenarios highlighting different target ailments. Each scenario described two cases: one for preventing and one for curing. The study thus consisted of a 2 (Treatment Purpose: Prevent, Cure) x 3 (Target Ailment: Vitamin B Deficiency, Scurvy/Vitamin C Deficiency, Common Cold) within-subjects design. Vitamin B deficiency, scurvy, and common cold were chosen as ailments because individuals can use the same medicine to prevent and to cure these ailments.

The scenario about vitamin B deficiency read as follows:

Imagine the following two cases. In case A, you are susceptible to hypocobalaminemia, a vitamin B12 deficiency, and your doctor prescribes a preventative medicine, vitamin B12. In case B, you already have hypocobalaminemia, and your doctor prescribes the exact same medicine, vitamin B12, in the exact same dose.

In both case A and case B, you will take vitamin B12 once a day for 3 weeks.

Suppose there are synthetic forms of vitamin B12 (generated in a lab) and natural forms of vitamin B12 (extracted from soybean plants).

The scenarios for the other two ailments were similar; the synthetic medicine was "generated in a lab" and the natural medicine was extracted from a plant (allicin extracted from garlic for the cold and vitamin C extracted from oranges for scurvy). In all cases, preventing and curing illnesses involved medicines prescribed by doctors and taken in the same doses for the same amount of time. After each scenario, participants responded to two questions on scales ranging from 1 = strongly prefer synthetic, to 7 = strongly prefer natural, with a midpoint of 4 = indifferent. For example, participants answered the following two questions for the vitamin B scenario (emphasis in original): "For [case A, <u>preventing hypocobalaminemia</u>/case B, <u>curing hypocobalaminemia</u>], would you prefer the natural or the synthetic medicine?" Scenarios were presented in randomized order, and participants were randomly assigned to either see questions about preventing before questions about curing or vice versa.

Ancillary Measures. Participants also answered eight questions about how beneficial and risky different medicines were in general, on scales from 1 = not at all beneficial/risky, to 7 = very beneficial/risky. They answered these questions with respect to a) natural preventative medicines, b) natural curative medicines, c) synthetic preventative medicines, and d) synthetic curative medicines. Thus, they answered eight questions (i.e., 2 (Consequence: Risk, Benefit) x 2 (Natural: Natural, Synthetic) x 2 (Treatment Purpose: Prevent, Cure)) presented in randomized order. Half of participants were randomly assigned to answer these questions before seeing the scenarios about preventing and curing specific illnesses, and half answered after the scenarios.

Individual Differences and Demographics. Additionally, participants completed fifteen items about general tendencies to prefer natural products and completed demographic measures (gender, age, income, political orientation, ethnicity, whether they grew up in a rural, suburban, or urban neighborhood, religion, and religiosity).

Results

Scenarios.

In a 2 (Treatment Purpose: Prevent, Cure) x 3 (Target Ailment: Vitamin B Deficiency, Scurvy, Common Cold) repeated measures ANOVA on ratings of preference for the natural medicine, participants preferred natural to a greater extent for preventing than for curing ($F(1, 206) = 44.97$, $P < .001$, $\eta_p^2 = .18$). Additionally, participants exhibited stronger natural preference for certain target ailments ($F(2, 205) = 6.65$, $P = .002$, $\eta_p^2 = .06$) and there was no interaction between target ailment and treatment purpose ($F(2, 205) = .70$, $P > .25$).

In paired t-tests, preferences for natural medicines significantly increased when preventing versus curing each of the three diseases (all *P*s < .001 and effect sizes ranged from *d* = .36 to *d* = .43; see Table B.7). However, it is worth noting that even when curing ailments, participants preferred the natural medicine, albeit more weakly than when preventing.

The effect of treatment purpose (prevent versus cure) held when only examining the first scenario presented. Because each scenario involved a comparison between preventing and curing, that experimental manipulation remained within-subjects even when examining only the first scenario. In a 2 (Treatment Purpose: Prevent, Cure) x 3 (Target Ailment: Vitamin B Deficiency, Scurvy, Common Cold) mixed ANOVA on ratings of preference for the natural medicine, participants preferred natural to a greater extent for preventing than for curing ($F(1, 204) = 29.10$, $p < .001$, $\eta_p^2 = .13$). Natural preference did not significantly vary across target ailments ($F(2, 204) = 1.71$, $p = .18$). There was an unpredicted significant interaction between target ailment and treatment purpose ($F(2, 204) = 3.13$, $p = .046$, $\eta_p^2 = .03$). In follow-up t-tests, the effect of treatment purpose was largest for scurvy (Scurvy: $M_{Prevent} = 5.82$, *S.D.* = 1.21, $M_{Cure} = 4.99$, *S.D.* = 1.65, $t(70) = 4.88$, $p < .001$, $d = .60$; Cold: $M_{Prevent} = 5.28$, *S.D.* = 1.52, $M_{Cure} = 4.82$, *S.D.* = 1.60, $t(60) = 2.73$, $p = .008$, $d = .35$; Vitamin B Deficiency: $M_{Prevent} = 5.57$, *S.D.* = 1.33, $M_{Cure} = 5.31$, *S.D.* = 1.62, $t(74) = 1.68$, $p = .098$, $d = .19$).

Ancillary Measures.

Natural medicines were, in general, perceived to be less risky when curing ($M_{natural} = 3.10$, $SD = 1.54$ vs. $M_{synthetic} = 4.34$, $SD = 1.36$, $t(206) = 9.17$, $p < .001$, $d = 1.27$) and when preventing ($M_{natural} = 3.06$, $SD = 1.49$ vs. $M_{synthetic} = 4.14$, $SD = 1.36$,

$t(206) = 8.18$, $p < .001$, $d = 1.14$). Natural medicines were perceived to be marginally less beneficial when curing diseases ($M_{natural}$ = 4.86, SD = 1.56 vs. $M_{synthetic}$ = 5.08, SD = 1.20, $t(206) = 1.73$, $p = .086$, $d = .24$). Perceived benefits of natural and synthetic medicines did not reliably differ when preventing diseases ($M_{natural}$ = 5.01, SD = 1.45 vs. $M_{synthetic}$ = 4.81, SD = 1.19, $t(206) = 1.64$, $P = .103$).

Study B.2B

Study B.2B is very similar to Study B.2A except that it looks at household problems and products rather than medical ones.

Methods

Two hundred two U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation (M_{age} = 36.5, SD = 14.0, 6.4% female).

The survey consisted of six different scenarios about household products. Each scenario described one case for preventing a target problem and one case for fixing that target problem. Thus, the study consisted of a 2 (Treatment Purpose: Prevent, Cure) x 6 (Target Problem: Mold, Mouth Bacteria, Metal Stains, Wood Stains, Clothing Stains, Pipe Leaks) within-subjects design. The study followed the exact same procedures as study B.2A, except that ancillary risk/benefit measures were excluded. For example, the scenario for household mold was as follows.

Imagine the following two cases. In case A, you are preventing mold from growing in your home. In case B, you are removing mold that is already growing in your home.

In both case A and case B, you plan to use an anti-mold solution. Suppose there are synthetic forms of anti-mold solution and natural forms of anti-mold solution.

After each scenario, participants were presented with questions about preferring natural products (adapted from study B.2A). In addition, participants completed the same trait natural preference measures and demographic measures from study B.2A.

Results

In a 2 (Treatment Purpose: Prevent, Cure) x 6 (Target Problem: Mold, Mouth Bacteria, Metal Stains, Wood Stains, Clothing Stains, Pipe Leaks) repeated measures ANOVA on ratings of preference for the natural products, participants preferred natural products more for preventing than for curing ($F(1,201) = 13.85$, $p < .001$, $\eta_p^2 = .06$). Natural preference also varied across target problems ($F(5,197) = 2.54$, $p < .001$, $\eta_p^2 = .34$) and there was an unpredicted interaction between target problem and treatment purpose ($F(5,197) = 12.77$, $p < .001$, $\eta_p^2 = .25$).

Paired t-tests revealed that natural was preferred significantly more when preventing as opposed to curing for four of the six target problems—mold, mouth bacteria, metal stains, and clothing stains. Effects for wood stains and pipe leaks were not significant, but were directionally consistent (see Table B.8; effect sizes range from $d = .07$ to $d = .45$, with average effect of $d = .23$). Additionally, as in study B.2A, for most target problems (except pipe leaks), the natural product was preferred even when curing the problem, albeit more weakly than when preventing that problem.

The effect of treatment purpose (prevent versus cure) holds when only examining the first scenario presented. As in study B.2A, because each scenario involved a comparison between preventing and curing, that experimental manipulation remained within-subjects even when examining only the first scenario. In a 2 (Treatment Purpose: Prevent, Cure) x 6 (Target Problem: Mold, Mouth Bacteria, Metal Stains, Wood Stains, Clothing Stains, Pipe Leaks) mixed ANOVA, participants preferred natural products to a greater extent for preventing than for curing ($F(1, 196) = 5.430$, $p = .021$, $\eta_p^2 = .027$). Natural preference also varied across target problems ($F(5,196) = 3.73$, $p = .003$, $\eta_p^2 = .09$) and there was no interaction between target problem and treatment purpose ($F(5,196) = 2.72$, $p = .088$).

STUDY B.3: MEDIATION MODEL WITH SAFETY AND POTENCY AS TWO SEPARATE PATHWAYS

Study B.3 serves two purposes. First, it further examines the mechanism of relative importance of safety and potency. It is similar to study 2.3. However in study 2.3, I cannot know whether relative importance of safety and potency shifts because safety becomes more important and potency's importance stays the same, potency becomes less important and safety's importance stays the same, or each attribute's importance changes. In this study, I estimate absolute importance of safety and potency as two indirect pathways in a mediation model. I show preventing increases natural preference because it both increases the importance of safety and decreases the importance of potency. Second, I use all nine treatments and problems from study 2.1, and show that the mediation model holds for both medicines and household products.

Method

Four hundred two U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation (M_{age} = 37.8, *SD* = 11.6, 54.0% female).

As in study 2.3, each participant viewed one scenario, and in each scenario participants considered a case where they were preventing a target problem and a case where they were curing the same target problem. Through random assignment, participants saw one of the nine target problems from study 2.1 (vitamin B deficiency, scurvy, common cold, mold, mouth bacteria, metal stains, wood stains, clothing stains, pipe leaks). Scenarios were identical to study 2.3.

Participants indicated their preferences for the natural alternative when preventing and when curing the target problem (as in study 2.3). In addition, they completed four measures of attribute importance: potency when preventing, safety when preventing, potency when curing, and safety when curing. Scales ranged from 1 = not at all to 7 = extremely. Before completing attribute importance measures, participants were told that:

> *We are interested in how important the potency and the safety of the medicine are to you. Potency refers to how strong and powerful the medicine is. Safety refers to the degree of risk and the extent of side effects that the medicine might entail."*

Through random assignment, half of participants completed importance questions before preference questions and half completed them after preference questions. Furthermore, through random assignment, half of participants considered curing before preventing and half considered preventing before curing. Finally, through random assignment, half of participants indicated the importance of potency before indicating the importance of safety and half considered safety before potency. In addition, participants completed the same trait natural preference measures and demographic measures from study B.2A.

Results

There were no main effects or interactions with order of questions, except a small mediator order by scenario interaction on natural preference ($p = .017$) and a small mediator order by attribute order interaction on potency importance ($p = .020$), so I collapse across order.

First, I examined preferences for natural products. In a 2 (Treatment Purpose: Prevent, Cure) X 9 (Target Problem: Vitamin B Deficiency, Scurvy, Common Cold, Mold, Mouth Bacteria, Metal Stains, Wood Stains, Clothing Stains, Pipe Leaks) mixed ANOVA, natural options were more strongly preferred for preventing than for curing ($F(1, 393) = 36.81$, $p < .001$, $\eta_p^2 = .09$). Additionally, the natural alternative was preferred more strongly for some problems ($F(8, 393) = 3.16$, $p = .002$, $\eta_p^2 = .06$). There was no interaction between treatment purpose and target problem ($F(8, 393) = 1.18$, $p > .25$). The effect of treatment purpose for each target problem is displayed in Table B.9A.

Next, I examined the importance of potency. In a 2 (Treatment Purpose: Prevent, Cure) X 9 (Target Problem: Vitamin B Deficiency, Scurvy, Common Cold, Mold, Mouth Bacteria, Metal Stains, Wood Stains, Clothing Stains, Pipe Leaks) mixed ANOVA on potency's importance, potency was rated as less important when preventing ($F(1, 393) = 7.95$, $p < .001$, $\eta_p^2 = .15$). Potency was considered more important for some target problems than for others ($F(8, 393) = 5.02$, $p < .001$, $\eta_p^2 = .09$). Preventing always decreased the importance of potency, but the magnitude of this effect varied across target problems ($F(8, 393) = 2.29$, $p = .021$, $\eta_p^2 = .05$; see Table B.9B).

Finally, I examined the importance of safety. In a 2 (Treatment Purpose: Prevent, Cure) X 9 (Target Problem: Vitamin B Deficiency, Scurvy, Common Cold, Mold, Mouth Bacteria, Metal Stains, Wood Stains, Clothing Stains, Pipe Leaks) mixed ANOVA on safety's importance, safety was rated as more important when preventing ($F(1, 393) = 2.18$, $p < .001$, $\eta_p^2 = .05$). Safety was marginally more important for certain types of problems ($F(8, 393) = 1.75$, $p = .086$, $\eta_p^2 = .03$). The effect of preventing on safety's importance varied across target problems ($F(8, 393) = 2.37$, $p = .017$, $\eta_p^2 = .03$; see Table B.9C).

In a (within-subjects) mediation analysis, I assessed the indirect effect of treatment purpose on preference for natural medicine through two pathways: importance of potency and importance of safety. Because my experimental design was within-subjects, I used *MEMORE* in SPSS (Montoya and Hayes 2017). This analysis revealed significant indirect effects of the importance of potency (indirect effect = .15, 95% CI [.09, .23]) and the importance of safety (indirect effect = .07, 95% CI [.03, .12]). Preventing (versus curing) an ailment reduced the importance of potency ($a_{potency} = -.45$), and reducing the importance of potency increased the natural preference ($b_{potency} = -.34$). Preventing (versus curing) an ailment increased the importance of safety ($a_{safety} = .18$), and increasing the importance of safety increased the natural preference ($b_{safety} = .29$). The importance of safety and potency accounted for 53% of the effect of preventing on natural preference ($c = .42$, $p < .001$; $c' = .20$, $p = .006$). A mediation model using only household product scenarios yielded very similar estimates (indirect effect of potency =

.15, 95% CI [.07, .23]; indirect effect of safety = .13, 95% CI [.07, .22]; *c* = .51, $p < .001$, *c*’ = .23, $p = .011$, 55% of total effect accounted for by indirect effects of safety and potency importance).

STUDY B.4: REGULATORY FOCUS AND THE PREFERENCE FOR NATURAL

In study B.4, I examined the relationship between regulatory focus and the preference for natural.

Methods

Two hundred three participants from Amazon’s Mechanical turk completed a survey in exchange for monetary compensation (M_{age} = 37.8, *SD* = 11.6; 49.8% female). Participants completed two measures in randomized order: the Regulatory Focus Questionnaire (Higgins et al. 2001) and a trait natural preference scale. After completing these two measures, participants completed demographic questions from study 2.1.

Regulatory Focus Questionnaire. The Regulatory Focus Questionnaire is one of the most widely used measures of chronic or trait regulatory focus. (The paper describing the scale -- Higgins et al. 2001 -- is cited over 1000 times on Google Scholar. It is also recommended on Tory Higgins’s website as a measure of chronic regulatory focus.) It consists of eleven items. Some items measure a history of success with prevention focus-related vigilance, such as “How often did you obey rules and regulations that were established by your parents?” (on 5 point likert scale from never/seldom to very often). Others items measure a history of success with promotion focus-related eagerness such as “I feel like I have made progress toward being successful in my life” (on 5 point likert scale from certainly false to certainly true).

Trait Natural Preference. Participants completed the following questions:

Participants answered an “inclusion of nature in self” item (Schultz, 2001). For this item, participants saw a series of seven pairs of circles, which progressed from barely touching to almost completely overlapping. The left circle was labeled “Self” and the right labeled “Nature”, and participants were instructed to “select the picture that best describes your relationship with nature.”

Participants indicated preferences for natural products by answering the five below items on a scale of 1 = less likely to buy it, 2 = indifferent, 3 = more likely to buy it.

Likely Buy Food Organic. If a food is labeled as organic, I am...

Likely Buy Food. If a food is labeled as natural, I am...

Likely Buy Medicine. If a medicine is labeled as natural, I am...

Likely Buy Cleaning Product. If a household cleaning product is labeled as natural, I am...

Likely Buy Body Product. If a body product is labeled as natural, I am...

Participants indicated ideational preference for natural products by answering the four below items on a scale of 1 = prefer the man-made product, 2 = indifferent, 3 = prefer the natural product. These items were adapted from Rozin et al. (2004).

ChemID Food. If a natural and a man-made food were chemically identical, I would...

ChemID Medicine. If a natural and a man-made medicine were chemically identical, I would...

ChemID Cleaning Product. If a natural and a man-made household cleaning product were chemically identical, I would...

ChemID Body Product. If a natural and a man-made body product were chemically identical, I would...

Participants indicated their purchasing behaviors by answering the four below items on a scale of 1 = never, 2 = rarely, 3 = sometimes, 4 = usually, 5 = always.

Purchase Food Organic. I buy organic foods.

Purchase Food. I buy natural foods.

Purchase Medicine. I buy natural medicines.

Purchase Cleaning Product. I buy natural household cleaning products.

Purchase Body Product. I buy natural body products.

Results

There were no significant effects of which scale was presented first (*p*s > .77) so I collapse across order. Predominant regulatory focus was computed by calculating the difference between the mean of promotion focus items and prevention focus items, where higher scores indicate a predominant promotion focus and lower scores indicate a predominant prevention focus. Trait natural preference was represented by a regression factor score from a one factor principal components analysis on the 13 items. There was no reliable correlation between trait natural preference and predominant regulatory focus ($r = .095$ ($t(201) = 1.35$, $p = .178$). In addition, I examined the promotion and prevention focus subscales independently. Promotion focus was positively correlated with the natural preference ($r = .258$, $t(201) = 3.79$, $p < .001$), but prevention focus was directionally positively correlated with natural preference as well ($r = .075$, $t(201) = 1.07$, $p = .288$).

Table B.1. Effect of prevent vs. cure treatment purpose on preference for natural product for each ailment in study 2.1.

	Mean Natural Preference when Preventing (SD)	Mean Natural Preference when Curing (SD)	*N*	T Value	P Value	Cohen's D
Vitamin B Deficiency	5.93 (1.34)	5.60 (1.55)	1,004	3.56	< .001	.23
Scurvy	6.14 (1.14)	5.89 (1.38)	1,004	3.17	.002	.20
Common Cold	5.84 (1.44)	5.41 (1.66)	1,004	4.35	< .001	.28
Mold	5.38 (1.76)	4.75 (1.98)	1,004	5.26	< .001	.34
Mouth Bacteria	5.71 (1.54)	5.23 (1.77)	1,004	4.65	< .001	.29
Metal Stains	5.25 (1.72)	4.72 (1.81)	1,004	4.75	< .001	.30
Wood Stains	5.55 (1.55)	5.19 (1.65)	1,004	3.55	< .001	.23
Clothing Stains	5.43 (1.61)	4.89 (1.84)	1,004	4.98	< .001	.32
Pipe Leaks	4.72 (1.93)	4.18 (1.95)	1,004	4.35	< .001	.27

Note. Unpaired t-tests on preference for natural product from 1 = strongly prefer synthetic to 7 = strongly prefer natural.

Table B.2A. Effect of prevent vs. cure treatment purpose on preferences for potent treatment for each scenario in study 2.2B.

Scenario	Mean Potency Preference when Preventing (SD)	Mean Potency Preference when Curing (SD)	*N*	T Value	P Value	Cohens D
Disease of Low Severity	3.26 (1.61)	3.59 (1.68)	202	3.64	<.001	.26
Disease of Medium Severity	4.93 (1.29)	5.23 (1.17)	202	3.77	<.001	.28
Disease of High Severity	6.01 (1.14)	6.31 (.90)	202	4.54	<.001	.34

Note. Paired t-tests on preferences for a potent treatment (7 point likert scales).

Table B.2B. Effect of prevent vs. cure treatment purpose on tolerance of risks from treatment for each scenario in study 2.2B.

Scenario	Mean Risk Tolerance when Preventing (SD)	Mean Risk Tolerance when Curing (SD)	*N*	T Value	P Value	Cohens D
Disease of Low Severity	2.41 (1.33)	2.65 (1.48)	202	2.93	.004	.21
Disease of Medium Severity	4.10 (1.31)	4.46 (1.24)	202	4.63	<.001	.34
Disease of High Severity	5.15 (1.38)	5.59 (1.24)	202	5.27	<.001	.39

Note. Paired t-tests on tolerance of risk in a treatment (7 point likert scales).

Table B.3A. Effect of prevent vs. cure treatment purpose on preference for natural product for each ailment in study 2.3.

	Mean Natural Preference when Preventing (SD)	Mean Natural Preference when Curing (SD)	*N*	T Value	P Value	Effect Size
Vitamin B Deficiency	5.32 (1.42)	5.13 (1.56)	68	1.4	.165	.17
Scurvy	6.00 (1.23)	5.60 (1.53)	67	2.68	.009	.33
Common Cold	5.24 (1.53)	4.73 (1.84)	70	2.86	.006	.38

Note. Paired t-tests on preference for natural product from 1 = strongly prefer synthetic to 7 = strongly prefer natural.

Table B.3B. Effect of prevent vs. cure treatment purpose on relative importance of safety vs. potency for each ailment in study 2.3.

	Mean Relative Importance when Preventing (SD)	Mean Relative Importance when Curing (SD)	*N*	T Value	P Value	Effect Size
Vitamin B Deficiency	6.44 (16.97)	51.38 (18.65)	68	5.48	<.001	.67
Scurvy	62.31 (14.65)	48.25 (18.44)	67	7.32	<.001	.92
Common Cold	64.99 (18.35)	53.14 (2.26)	70	5.76	<.001	.73

Note. Paired t-tests on importance of safety versus potency (constant sum scale, where 100 = safety is only important feature and potency not at all important and 0 = potency is only important feature and safety is not at all important).

Table B.4. Results for most important treatment in study B.1.

	Estimate	Std. Error	Z value	*P*
Intercept	-.444	.105	-4.226	<.001
Preventing	1.049	.044	24.022	< .001
Midwest Region	-.212	.068	-3.138	.002
South Region	.115	.066	1.754	.079
West Region	.097	.064	1.516	.130
Age	-.003	.002	-1.801	.072
Female	.104	.044	2.379	.017
African American	.251	.077	3.262	.001
AIAN	.091	.226	.4	.689
Asian	.438	.087	5.017	.000
Race not released	.064	.473	.136	.892
Multiple Race	.097	.134	.728	.466
Married, spouse not in household	.062	.179	.344	.730
Widowed	-.160	.088	-1.816	.069
Divorced	.196	.063	3.091	.002
Separated	.080	.142	.561	.575
Never married	.024	.059	.404	.686
Living with partner	.047	.093	.509	.610
Unknown marital status	-1.085	.479	-2.263	.024

Note. Binomial logistic regression predicting whether a treatment was used because it was natural, for the most important treatment (N = 9,972). Data Source: CDC/NCHS, National Health Interview Survey 2012a.

Table B.5. Results for second most important treatment in study B.1.

	Estimate	Std. Error	Z value	*P*
Intercept	-.106	.165	-.641	.521
Preventing	1.155	.069	16.637	<.001
Midwest Region	-.313	.106	-2.947	.003
South Region	-.133	.105	-1.262	.207
West Region	-.104	.099	-1.047	.295
Age	-.002	.002	-.71	.478
Female	.126	.068	1.846	.065
African American	.244	.128	1.899	.058
AIAN	.020	.318	.061	.951
Asian	.250	.140	1.787	.074
Race not released	.365	1.122	.326	.745
Multiple Race	.062	.193	.319	.750
Married, spouse not in household	.134	.272	.495	.621
Widowed	-.034	.139	-.242	.809
Divorced	.176	.094	1.867	.062
Separated	.128	.241	.529	.597
Never married	-.029	.089	-.323	.747
Living with partner	-.034	.145	-.234	.815
Unknown marital status	-2.168	1.138	-1.906	.057

Note. Binomial logistic regression predicting whether a treatment was used because it was natural, for the second most important treatment (N = 4,611). Data Source: CDC/NCHS, National Health Interview Survey 2012a.

Table B.6. Results for third most important treatment in study B.1.

	Estimate	Std. Error	Z value	*P*
Intercept	.347	.268	1.296	.195
Preventing	.851	.111	7.642	<.001
Midwest Region	-.071	.172	-.416	.677
South Region	-.143	.167	-.861	.389
West Region	.080	.154	.518	.605
Age	-.002	.004	-.549	.583
Female	.107	.111	.967	.334
African American	-.087	.204	-.425	.671
AIAN	-.431	.452	-.954	.340
Asian	.287	.244	1.175	.240
Race not released	12.196	377.633	.032	.974
Multiple Race	.042	.287	.145	.884
Married, spouse not in household	-.091	.410	-.223	.823
Widowed	-.064	.229	-.279	.780
Divorced	.240	.150	1.602	.109
Separated	.408	.410	.997	.319
Never married	.110	.138	.796	.426
Living with partner	.091	.229	.398	.690
Unknown marital status	-1.081	1.419	-.762	.446

Note. Binomial logistic regression predicting whether a treatment was used because it was natural, for the third most important treatment (N = 2,045). Data Source: CDC/NCHS, National Health Interview Survey 2012a.

Table B.7. Effect of prevent vs. cure treatment purpose for each ailment in study B.2A.

	Mean Natural Preference when Preventing (SD)	Mean Natural Preference when Curing (SD)	*N*	T Value	P Value	Cohen's D
Vitamin B Deficiency	5.51 (1.43)	5.04 (1.75)	207	5.09	<.001	.36
Scurvy	5.71 (1.32)	5.15 (1.73)	207	5.82	<.001	.43
Common Cold	5.45 (1.52)	4.91 (1.68)	207	5.73	<.001	.40

Note. Paired t-tests on preference for natural product from 1 = strongly prefer synthetic to 7 = strongly prefer natural.

Table B.8. Effect of prevent vs. cure treatment purpose for each ailment in study B.2B.

	Mean Natural Preference when Preventing (SD)	Mean Natural Preference when Curing (SD)	*N*	T Value	P Value	Cohen's D
Mold	5.22 (1.75)	4.41 (2.08)	202	6.30	<.001	.45
Mouth Bacteria	5.52 (1.60)	5.12 (1.81)	202	3.64	<.001	.25
Metal Stains	5.06 (1.69)	4.83 (1.73)	202	2.40	.017	.17
Wood Stains	5.25 (1.57)	5.09 (1.61)	202	1.59	.113	.12
Clothing Stains	5.24 (1.63)	4.92 (1.79)	202	3.32	.001	.26
Pipe Leaks	4.22 (1.94)	4.14 (1.95)	202	.94	.347	.07

Note. Paired t-tests on preference for natural product from 1 = strongly prefer synthetic to 7 = strongly prefer natural.

Table B.9A. Effect of prevent vs. cure treatment purpose on preference for natural product for each ailment in study B.3.

	Mean Natural Preference when Preventing (SD)	Mean Natural Preference when Curing (SD)	*N*	T Value	P Value	Cohen's D
Vitamin B Deficiency	5.60 (1.47)	5.47 (1.61)	43	.83	.412	.12
Scurvy	5.67 (1.41)	5.53 (1.69)	45	.8	.429	.14
Common Cold	5.46 (1.47)	5.02 (1.76)	46	2.38	.022	.36
Mold	5.46 (1.80)	4.74 (1.93)	46	3.07	.004	.45
Mouth Bacteria	5.44 (1.37)	5.09 (1.59)	45	2.33	.025	.35
Metal Stains	5.36 (1.61)	4.71 (1.83)	42	2.4	.021	.40
Wood Stains	5.96 (1.01)	5.54 (1.52)	46	2.06	.045	.33
Clothing Stains	5.58 (1.26)	4.86 (1.79)	43	3.02	.004	.48
Pipe Leaks	4.57 (1.85)	4.30 (1.92)	46	1.05	.300	.16

Note. Paired t-tests on preference for natural product from 1 = strongly prefer synthetic to 7 = strongly prefer natural.

Table B.9B. Effect of prevent vs. cure treatment purpose on importance of potency for each ailment in study B.3.

	Mean Potency Importance when Preventing (SD)	Mean Potency Importance when Curing (SD)	*N*	T Value	P Value	Cohen's D
Vitamin B Deficiency	5.44 (1.49)	5.88 (1.28)	43	-2.69	.01	-.42
Scurvy	5.96 (1.04)	6.36 (.80)	45	-3.11	.003	-.42
Common Cold	5.39 (1.22)	6.13 (.93)	46	-4.05	<.001	-.61
Mold	6.09 (1.01)	6.59 (.72)	46	-3.72	.001	-.57
Mouth Bacteria	5.82 (.96)	5.91 (.97)	45	-.68	.499	-.10
Metal Stains	5.36 (1.34)	5.83 (1.12)	42	-2.18	.035	-.31
Wood Stains	5.91 (1.15)	6.09 (.99)	46	-1.16	.253	-.18
Clothing Stains	5.07 (1.50)	5.93 (1.08)	43	-4.11	<.001	-.65
Pipe Leaks	6.17 (.90)	6.54 (.69)	46	-3.96	.001	-.50

Note. Paired t-tests on preference on importance of potency from 1 = not at all to 7 = extremely.

Table B.9C. Effect of prevent vs. cure treatment purpose on importance of safety for each ailment in study B.3.

	Mean Safety Importance when Preventing (SD)	Mean Safety Importance when Curing (SD)	*N*	T Value	P Value	Cohen's D
Vitamin B Deficiency	6.26 (1.347)	6.26 (1.293)	43	0	1	0
Scurvy	6.38 (1.007)	6.38 (.834)	45	0	1	0
Common Cold	6.52 (.836)	6.41 (.979)	46	.96	.341	.14
Mold	6.46 (.912)	6 (1.095)	46	3.71	.001	.56
Mouth Bacteria	6.31 (.9)	6.18 (1.051)	45	1.18	.244	.18
Metal Stains	6.19 (.969)	5.74 (1.231)	42	2.5	.017	.44
Wood Stains	6.43 (1.047)	6.07 (1.405)	46	3.14	.003	.50
Clothing Stains	6 (1.215)	5.88 (1.238)	43	1.09	.28	.17
Pipe Leaks	5.85 (1.52)	5.83 (1.48)	46	.18	.855	.02

Note. Paired t-tests on preference on importance of safety from 1 = not at all to 7 = extremely.

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