



EMPIRICAL ARTICLE

Americans believe in the benevolence of nature, and this belief is not lower in people who have experienced natural disasters

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Abstract

American and European adults prefer natural products and often pay premiums to purchase natural products. They may do this because they believe natural products are better, either functionally or inherently. We present a measure that assesses belief in the 'benevolence of nature' across a range of products and a range of situations, including safety, sensory appeal, and effectiveness. American adults show a substantial belief in the benevolence of nature. This belief is sometimes erroneous, with participants attributing higher quality to some natural products that are in fact inferior to their artificial counterparts. In support of the belief that natural products are inherently better, many participants express a preference for a natural as opposed to an artificial product when both are stipulated to be chemically identical or to have identical effects. An original set of 24 items to measure belief in the benevolence of nature is refined into a more useful 10-item scale, and correlations with related scales are assessed. Belief in the benevolence of nature is not lower in participants who have experienced at least one natural disaster.

1. Introduction

Many studies on Western adults have established a general preference for 'natural' entities over their 'artificial' counterparts (e.g., Rozin et al., 2004; Rozin et al., 2012; Li & Chapman, 2012; reviewed in Meier et al., 2019). In part because of this preference, products are labeled and marketed as natural in the domains of food, medicine, cosmetics, cleaning supplies, and furnishings (Walters & Long, 2012). Why are people disposed to value natural products over unnatural or artificial ones? In this article, we examine whether, and to what extent, people's preference for natural products is related to their general attitudes toward nature. In particular, we demonstrate that people have a general tendency to view nature as benevolent. Our results suggest that this belief is not reduced by the experience of natural disasters. In the course of this investigation, we develop a 10-item measure of belief in the benevolence of nature.

Schultz (2002) characterizes natural attitudes and beliefs as cognitive (sometimes manifested as connection to nature), affective (often manifested as caring), and behavioral (often manifested as commitment to and participation in natural causes). Schultz (2002) reviews various measures of these and notes that they are, not surprisingly, positively correlated. But despite the antagonistic force that nature often plays in people's lives, people seem to value nature and view it as a benevolent force in

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human affairs. Just as terms like organic and natural have positive connotations, terms related to human production, like 'chemicals' and 'preservatives', have negative connotations.

In our initial work on natural preference (Rozin, 2005; Rozin et al., 2004), we found that people believe natural things are functionally superior, for example, with respect to safety or effectiveness. But the perceived efficacy of nature (instrumental reasons) does not completely account for people's natural preference. People also believe that nature possesses inherent or 'sacred' value (Baron & Spranca, 1997; Tetlock, 2003). For instance, most Americans prefer natural over artificial products even when they are stated to be chemically identical to each other (Rozin et al., 2004; though see Li & Chapman, 2012 for evidence that most Americans do not believe the stipulation of identity between natural and nonnatural products that has been used in prior studies). Likewise, people view unnatural-caused disasters as 'worse' even when the total consequences of a natural and unnatural disaster are stated to be equivalent (Rudski et al., 2011).

Additional evidence comes from interviews with American mothers (Moscato & Machin, 2018). Some mothers believe in the inherent positivity of nature via spiritual and magical means such that the positivity of nature can be transferred by contact. And recent work has suggested that many Americans (Scott et al., 2016) and a substantial majority of French and Germans (Inbar et al., 2023) oppose genetically engineered food on moralized, noninstrumental grounds. They believe it is immoral to tamper with nature and claim that risks and benefits are not relevant to their opposition (but see Cusimano et al., 2018; Royzman et al., 2020, for substantial concerns about this evidence). Of course, there is no inherent inconsistency between instrumental and absolute/moral beliefs, and they can reinforce each other (Li & Chapman, 2012).

It is not obvious that nature should be associated with superior quality or desirability. People suffer from nature all the time, including from weather, animal attacks, viruses, and large-scale natural disasters. Indeed, in the nineteenth-century United States, 'natural' products were strongly associated with 'perishability and contamination' (Stanziani, 2008). There is no net evidence in favor of the actual benevolence of nature; our verdict is that 'natural is neutral' (Scott & Rozin, 2020). Natural disasters probably occur at a higher rate than human-caused disasters. The world's deadliest poison, botulinum, is natural, most of the most potent known poisons are natural, and there are many more harmful natural than human-made pesticides (Ames, 1989).

Evidence for greater healthfulness of organic foods is mixed (Smith-Spangler et al., 2012), and organically grown agricultural products do not seem to taste better than nonorganic products (Schutz & Lorenz, 1976). Moreover, while Americans think that natural and organic products are more sustainable (Rozin et al., 2023), organic produce requires more land per unit of output and may actually be less sustainable (Borlaug, 2007; Searchinger et al., 2018). A wide range of information that counters the superiority of natural things is presented in two books by Jayson Lusk (2013, 2016). There is no reason to think that, as a generalizable rule, nature and natural things are superior to artificial ones; rather, an objective evaluation of natural versus artificial risks and benefits must be made on a case-by-case basis.

We hypothesize that many people have a belief that nature is *benevolent*, in other words, a belief that nature is inherently better than human activity in virtually all respects. This belief in the benevolence of nature may help explain the widely demonstrated natural preference. In addition to the work cited above, some evidence for a general belief in nature's benevolence comes from Li and Chapman (2012). In a sample of U.S. adults, most participants agreed with statements that, compared with unnatural food products, natural food products are tastier, safer, healthier, and better for the environment. This is evidence for what Li and Chapman (2012) call a 'natural is better' belief or heuristic, which is supported by other studies (reviewed in Meier et al., 2019).

We build on these findings in several ways. First, we document belief in the benevolence of nature for a wide range of products (that extend beyond just food products) and test, as did Li and Chapman (2012), the ways in which this perceived superiority may manifest. Benevolence means more than just 'natural is better'. The latter is a comparative statement, which is consistent with the position that natural and unnatural are both bad, but natural is better (or less bad) than unnatural. To address this, we include in our measure some noncomparative statements, such as 'Nature is wonderful'

(agree/disagree). Second, we also record beliefs in both general and specific product natural superiority and consider situations where the safety and effectiveness of natural and artificial products are stated to be equal. Third, relevant to research about how people incorporate evidence about the safety and potency of nature, we measure whether belief in the benevolence of nature varies depending on whether people have had negative experiences with nature.

2. Methods

2.1. Participants

We administered a Qualtrics survey to 301 American adults via Prolific, an online research platform. All measures, conditions, and data exclusions are reported herein¹. Materials, data, and analysis syntax are available at https://osf.io/7tjcg/. The sample size goal of 300 participants was determined *a priori*, and any deviation from that is due to the Prolific software. Each participant received compensation from Prolific upon the completion of the 15-minute survey. To increase the proportion of participants who had experienced natural disasters, we restricted subject selection to some states that have high incidences of natural disasters: California, Texas, Oklahoma, Louisiana, and Florida. The sample was age and gender representative. Due to an oversight, we do not have age data on individual participants. Gender was 146 male, 154 female, and 1 nonbinary.

We also specified that the sample should be half Republican and half Democrat. We asked, 'In general, how liberal (left-wing) or conservative (right-wing) are you on social issues?', with the following response options: very liberal, liberal, slightly liberal, moderate, slightly conservative, conservative, very conservative, don't know, and can't pick one label. On this scale, 140 participants said they were liberal (selected either 'very liberal', 'liberal', or 'slightly liberal'), 33 participants said 'moderate', 126 participants said conservative (either 'very conservative', 'conservative', or 'slightly conservative'), 1 participant said 'don't know', and 1 participant said 'can't pick one label'.

For race/ethnicity, 201 participants identified as White, 32 identified as Latinx, 28 identified as East Asian, and 22 identified as Black or African American. Most participants' highest level of education was a bachelor's degree (118 people), a graduate school degree (69 people), or some college (59 people). For religion, most were Christian (169 people) or atheist/agnostic (95 people).

2.2. Procedure

Participants filled out the following measures. Measures were presented in a fixed order, which is the same as the order in which they are described, except that attention checks were interspersed throughout the survey. As we will describe, some variables are created that combine more than one score (e.g., an average of 14 items in a scale). Throughout the paper, when we do so, the variable name begins with C (for combined). This is followed by a brief descriptive term, then R if the measure is reverse scored, and then the number of scores combined (e.g., CBenev10, for the average across the 10 items measuring belief in the benevolence of nature).

2.2.1. Attention checks

As an assessment of the attentiveness of our participants, we asked three attention checks at different points in the survey, which were: 'A plastic toy gun is natural' and 'I have driven to Antarctica' on a 7-point scale from strongly disagree to strongly agree, and 'I am a human being' on a 5-point scale

¹We obtained data from two other variables that are not discussed further here. One is a four-item measure on attitudes to technology (World View A items in Siegrist 1999), which was presented right after the Connectedness to Nature Scale. The second was an item invented for this study in which we gave participants 1 minute to think of as many natural disasters as they could and another minute to think of as many human-caused disasters as they could. Participants completed this right after the natural preference scale. Our measure was the number of natural disasters minus the number of human-caused disasters. We did not explore the relation of this pilot measure to benevolence for two reasons: 1. It was difficult to score, in many cases, whether the reference to a specific disaster was specific enough and 2. the natural – human score was significantly related to which category (natural or human) was asked first.

from definitely false to definitely true. Of 301 people, 265 disagreed that a plastic toy gun is natural, 291 disagreed that they had driven to Antarctica, and 299 indicated it was true that they were a human being. We included all respondents in subsequent analyses.

2.2.2. Belief in the Benevolence of Nature Scale

We generated 24 candidate items to measure the perceived benevolence of nature, with the expectation that after examining the results, we would construct a shorter, more useful measure. There were two subsets of items. One subset, the first 14 items, was based on a standard 7-point agreement scale ranging from -3 (strongly disagree) to +3 (strongly agree). For this scale and all other scales (except the measures using overlapping circles, described in this section below), participants did not see numbers in the scale's response options. They only saw verbal labels, such as 'strongly disagree'. These first 14 candidate items to measure perceived benevolence are listed in Table 1. All these items were written so that the neutral midpoint (scored as zero) would be a divider between a benevolence (positive), pronatural view, and the alternative. Two questions, 'Most deaths are natural' and 'In general, artificial things are better for the environment than their natural versions', were reverse-scored, so that for all items, higher scores meant a more benevolence, pro-natural view. In the survey, we included two additional questions (not shown in Table 1) to check for reverse scoring and attentiveness. These items were: 'The basic process of death is not natural', which correlated with the reverse-scored 'Most deaths are natural' at r = 0.20, p < 0.001; and 'In general, natural things are better for the environment than their artificial versions', which correlated with the reverse-scored 'In general, artificial things are better for the environment than their natural versions' r = 0.32, p < 0.001). These correlations are significant and in the predicted direction, but are much lower than we had hoped.

The second subset of items was about the consequences of natural events and products. These are the last 10 items listed in Table 1. Four items (items 15 through 18 in Table 1) were derived from prior research (Rudski et al., 2011). Subjects were given two situations, one natural and the other artificial, with negative consequences that were stated to be equivalent. Then, subjects were asked which seemed like the worse event, if any. The 5-point rating scale was (natural event) much worse, (natural event) worse, equally bad, (artificial event) worse, (artificial event) much worse. (See https://osf.io/p3m6g for exact wording of the response options, which varied by item.) We used three of Rudski's negative items and added one. Additionally, we constructed four more scenarios (items 19 through 24 in Table 1) where the outcomes were positive and subjects rated which event was better. The 5-point rating scale was definitely (synthetic), slightly (synthetic), equally good, slightly (natural), definitely (natural). (Again, exact wording of response options varied by item and can be found at https://osf.io/p3m6g.) In one event (the soap scenario), subjects rated multiple positive attributes (which would do a better job at laundry, which was safer, which smelled better). One item was included for exploratory purposes but is not part of the scale nor listed in Table 1, which asked which mask participants would want to purchase for the mask scenario. As with the first 14 items described earlier, these last 10 items were scored so that higher scores supported the benevolence, pro-natural view. Because we averaged 7-point items (the first 14 items described in the previous paragraph) and 5-point items (the last 10 items), we coded the 5-point items as -3, -1.5, 0, 1.5, and 3.

We selected 24 belief in the benevolence of nature items to range across negative and positive effects, to cover different domains (e.g., food, medicine, environments, and general), and to cover different kinds of consequences (e.g., safety, effectiveness, and sensory features). The items were averaged together to create the CBenev24 scale ($\alpha = 0.80$). We also created a more useful, shortened scale with a subset of 10 items averaged together (CBenev10 scale, $\alpha = 0.72$, described further in the Results section under Belief in the Benevolence of Nature). These CBenev10 items are indicated with asterisks in Table 1.

Finally, we created two sets of two items that measured perceived benevolence in a way that could not be integrated with the neutral point approach for the 24 items. Two items measured perceptions of the relative incidence of natural causes in negative events ('What percentage of world disasters are natural?' and 'What percentage of world deaths are natural?') using a 100-point sliding scale. These

Table 1. Twenty-four Belief in the Benevolence of Nature Scale items.

Table 1.	. Iwenty-Jour Bellej in the Benevolence of Nature Scale items.
Item abbreviation	Item text
BV1NatBeauty*	Most of the most beautiful things in the world are natural rather than produced by humans.
BV2NatSafe*	In general, natural things are safer than their artificial versions.
BV3NatEffective*	In general, natural things are more effective than their artificial versions.
BV4PoisonsHuman*	Most of the deadliest poisons in the world are created by humans.
BV5FdPoisonsHuman	Food poisoning occurs more frequently after eating processed foods than after eating natural foods.
BV6PesticideHuman*	There are many more kinds of man-made pesticides compared to natural pesticides.
BV7DeathNatR	Most deaths are natural.
BV8NatMedSafer	Natural medicines are usually safer than their artificial versions.
BV9NatWonder	Nature is wonderful.
BV10NatFoodTastier*	Natural foods are usually tastier than processed versions of the same food.
BV11NatFoodHealth*	Natural foods are usually healthier than processed versions of the same food.
BV12NatMedEffective	Natural medicines are usually more effective than their artificial versions.
BV13NatCheaper	In general, natural things are cheaper than their artificial versions.
BV14NatWorseEnvR*	In general, artificial things are better for the environment than their natural versions.
BV15Burn	You suffer electrical burns from A) lightning hitting several feet away from you or B) stepping on a downed electrical power line. Both burns are equally severe. Which, if any, seems like the "worse" event?
BV16Poison	You contract food poisoning from a toxic strain of E. coli after eating at A) an organic health food restaurant or B) a fast food restaurant. Both cases of food poisoning are equally severe. Which, if any, seems like the "worse" event?
BV17BreakLeg	You break your leg A) slipping while hiking or B) in a car accident where you swerved to avoid a cinder block in the middle of the road. Both breaks are identical in severity and pain. Which, if any, seems like the "worse" events
BV18Choke*	A child chokes on A) a cherry pit or B) a small rubber ball of the same size, requiring a trip to the emergency room to remove it. The effects are equally serious. Which, if any, seems like the "worse" event?
BV19Vitamin*	Consider a natural vitamin extracted from a plant as opposed to the same vitamin, synthesized in a laboratory. Assume that the two vitamins are chemically identical. Which vitamin do you think is better?
BV20Mask	Consumer Reports (CR) rates the protective value of a particular brand of synthetic material face mask as equal to that of a particular brand of natura material face mask. Which one do you think provides better protection?
BV21Antibiotic	A newly discovered natural antibiotic is used against a bacterial infection in a country in West Africa and is reported to have saved 1,000 lives. A newly manufactured synthetic antibiotic is used against an infection of the same bacteria in another West African country and is reported to have saved 1,000 lives. Which antibiotic do you think is better?
BV22SoapEff	Two new laundry soaps, one natural and the other synthetic, are rated equally effective in consumer tests. Which soap do you think would do a better job on your laundry?
BV23SoapSafe	Which soap do you think is safer?
BV24SoapSmell	Which soap do you think smells better?

Note: The last 10 items are in the Rudski equal consequences format (for exact wording of the response options see https://osf.io/p3m6g). * indicates inclusion in the CBenev10 scale.

were averaged together and reverse-scored for a final measure (CPercentR2), so that higher scores indicated more pro-natural beliefs (that is, less disaster and death caused by nature). The other two items employed seven pairs of circles, ranging from two circles with no overlap to two circles nearly completely overlapping (adapted from Aron et al., 1992). Participants were asked to choose the circle pair that best represented the relationship between nature and good and between nature and health, with more overlapping circles indicating a closer relationship. These were averaged together into CCircle2. A third pair, representing you and nature, was included as a second measure of connectedness to nature (see The Connectedness to Nature Scale section for primary measure) and correlated with the Connectedness to Nature Scale (r = 0.60, p < 0.001). These five items were filled out by participants in between the first and second sets of perceived benevolence of nature scale items.

The remaining scales measured related beliefs and attitudes to nature.

2.2.3. Natural Perspectives Scale

We developed the 12-item Natural Perspectives Scale. Responses to the questions were on a standard 7-point agree–disagree scale (scored -3 to 3). A factor analysis indicated three types of questions, which measured spiritual reverence of nature (7 items, $\alpha=0.80$, which we averaged together and call CSpirituality7), fear (3, $\alpha=0.68$, which we averaged together and call CFear3), and mastery (2, r=0.42, which we averaged together and call CMastery2). Here is a sample item from each subscale: spiritual reverence: 'The natural world is intrinsically sacred'; fear: 'I fear the natural world'; mastery: 'Mastery of nature is one of the great human achievements'.

2.2.4. The Connectedness to Nature Scale

Participants next responded to Mayer and Frantz's (2004) Connectedness to Nature scale. A sample item is: 'I often feel a sense of oneness with the natural world around me'. We coded the original 5-point agree—disagree rating scale's response options as -3, -1.5, 0, 1.5, and 3, to put them on a comparable scale to other 7-point rating scales (ranging from -3 to 3) in the paper. The total score was the mean of the 14 items ($\alpha = 0.88$, which we call CConnected14).

2.2.5. Natural preference

Participants responded to the nine-item scale about the importance of naturalness of food (Michel & Siegrist, 2019) using a 7-point agree–disagree scale (scored -3 to 3). A sample item is: 'I avoid food that contains additives'. The nine items were averaged for each participant ($\alpha = 0.94$). We use this as a measure of natural preference and call this measure CNatPref9.

2.2.6. Natural- or human-caused disaster experiences

Participants were also asked 'Have you, a friend, or a family member been directly affected by one or more disasters since the year **2000** (e.g. a major flood, toxins in water, hurricane, or an oil spill)?' (yes or no). If they answered yes, participants then provided details about the event including (a) a description of the event and when and where it happened (in text boxes), (b) whether the event was a natural disaster, a human-made disaster, or a combination of both (multiple-choice question), (c) the specific consequences experienced (check all that apply: loss of life, major bodily injury, loss of property, other), and (d) the parties affected (check all that apply: self, family, friend). Participants could submit descriptions of up to three disasters.

2.2.7. Disaster rating task

Subjects read a list of nine disasters that occurred within the last 20 years: the COVID-19 pandemic, 9/11 attacks, California wildfires, flood of the Mississippi River, tsunami-induced nuclear disaster in Fukushima, Japan, lead poisoning of water in Flint Michigan, Mount St. Helens volcanic eruption, Hurricane Katrina, and BP Oil Spill in the Gulf of Mexico. They were asked to rate how natural each event was, with 0 as entirely human-made and 100 as entirely natural. We hypothesized that people who more strongly believed in the benevolence of nature would rate these disasters as less natural. Naturalness scores for nine disasters were averaged for each subject to create an overall measure.

This measure, called CDegNatR9, was reverse-scored (100 – average) to make the larger score denote greater benevolence of nature.

2.2.8. Demographics

Participants were asked to answer questions on standard demographic information, which included gender, education, occupation, political stance on social issues, ethnicity, religion, and religiosity.

3. Results

We adopt a minimal significance level of p < 0.01 (two-tailed).

3.1. Belief in the benevolence of nature

The 24 benevolence items (listed in Table 1) all had a neutral (0) point that did not favor either natural or artificial options. With the -3 to 3 scoring, a positive mean indicates a belief in the benevolence of nature. Table 2 provides statistical summaries of each item. The mean score on the average of all items (CBenev24) was 0.66 (SD = 0.61) with a median of 0.65. Of 301 participants, only 45 (15%) had a score of 0 or less, indicating that the great majority of participants exhibited a belief in the benevolence of nature.

Table 2. Summary of Belief in the Benevolence of Nature Scale (CBenev24) descriptive statistics.

Item abbreviation	Mean	SD	Median	Mode	% positive	% positive of valenced	Correlation with CBenev24
BV1NatBeauty*	1.47***	1.38	2	2	79%	90%	0.49***
BV2NatSafe*	1.05***	1.43	1	2	64%	84%	0.66***
BV3NatEffective*	0.52***	1.53	0	0	48%	67%	0.63***
BV4PoisonsHuman*	0.54***	1.69	1	0	52%	67%	0.49***
BV5FdPoisonsHuman	0.12	1.56	0	0	38%	55%	0.55***
BV6PesticideHuman*	1.32***	1.36	2	2	70%	89%	0.28***
BV7DeathNatR	-0.53***	1.55	-1	-2	25%	31%	0.15**
BV8NatMedSafer	0.30 * *	1.64	0	0	42%	60%	0.65***
BV9NatWonder	2.50***	0.80	3	3	97%	99%	0.30***
BV10NatFoodTastier*	0.66***	1.66	1	2	54%	68%	0.51***
BV11NatFoodHealth*	2.00***	1.13	2	3	90%	97%	0.56***
BV12NatMedEffective	-0.35***	1.65	0	0	25%	36%	0.69***
BV13NatCheaper	-0.97***	1.69	-1	-2	19%	22%	0.31***
BV14NatWorseEnvR*	1.61***	1.38	2	2	82%	92%	0.21***
BV15Burn	0.26***	1.35	0	0	29%	68%	0.21***
BV16Poison	0.09	1.27	0	0	22%	59%	0.29***
BV17BreakLeg	0.73***	1.39	0	0	44%	83%	0.21***
BV18Choke*	0.75***	1.19	0	0	42%	93%	0.28***
BV19Vitamin*	1.17***	1.51	1.5	0	57%	88%	0.52***
BV20Mask	-0.03	1.26	0	0	15%	45%	0.32***
BV21Antibiotic	0.55***	1.26	0	0	34%	82%	0.52***
BV22SoapEff	0.51***	1.50	0	0	38%	70%	0.52***
BV23SoapSafe	1.78***	1.31	1.5	3	81%	95%	0.56***
BV24SoapSmell	-0.15	1.79	0	0	29%	42%	0.24***

Note: % positive = % of all responses that are positive; % positive of valenced = % of all valenced responses (not including 0) that are positive; correlation with CBenev24 = Pearson r with CBenev24. * next to item abbreviation indicates inclusion in the CBenev10 scale. In the correlation column, ** indicates p < 0.01, ***p < 0.001 (2-tailed). Similarly, in the mean column, ** indicates p < 0.01, ***p < 0.001 (2-tailed) in a one-sample t-test testing whether the mean differed from 0.

For each item, we assessed how many responses were positive (above 0, that is, indicative of nature being benevolent) out of all responses to the item. This is displayed in the third to the last column of Table 2. For some items, there were many responses of 0, which is neutral. This was common for the second set of items (items 15 through 24). These were the items where a natural and artificial thing were directly compared, and the two were specified to be equivalent in some way (e.g., the natural and synthetic vitamins are 'chemically identical. Which vitamin do you think is better?' in item 19). Therefore, as a second measure, we look at the number of positive responses (above 0) out of the number of valenced responses (positive or negative, but excluding answers of 0). This is displayed in the next to the last column of Table 2.

The majority of items (17/24) had a significant pro-natural response on average (i.e., a mean significantly above 0, in a one-sample t-test). Three items had an anti-natural response on average (i.e., a mean significantly below 0 in a one-sample t-test). One item with an anti-natural response was 'Most deaths are natural'. This item was a reverse-scored item, such that -3 means strongly agreed (the most anti-natural response, because it means attributing death, a generally negative phenomenon, to nature) and +3 means strongly disagreed (the most pro-natural response). The average on this item was M = -0.53, which meant an average anti-natural response of believing that most deaths are natural. Other items with means below 0 (which were not reverse-scored, so -3 means strongly disagreed and +3 means strongly agreed) were 'Natural medicines are usually more effective than their artificial versions' (M = -0.35); 'In general, natural things are cheaper than their artificial versions' (M = -0.97). Finally, four items did not significantly differ from zero. For more information, see Table 2.

Some of the items are subjective (e.g., 'Most of the most beautiful things in the world are natural rather than produced by humans'). For a few, however, there is a correct answer. For one of these items, 'Food poisoning occurs more frequently after eating processed foods than after eating natural foods', we could not find the data to indicate what the correct answer is, but we expect that food poisoning occurs more frequently for natural foods. The two items for which there are sufficient data are: (1) 'Most of the deadliest poisons in the world are created by humans'. This is false. Most notably, the deadliest known poison is botulism toxin, a natural substance; and (2) 'There are many more kinds of man-made pesticides compared to natural pesticides'. This is also false (Ames, 1989). Thus, people's belief in the benevolence of nature is sometimes erroneous.

Examining the items with pro-natural responses in Table 2, a few stand out as showing a very large benevolence score. These are, in the order of decreasing percent positive (of all responses): 'Nature is wonderful' (97%), 'Natural foods are usually healthier than processed versions of the same food' (90%), 'In general, artificial things are better for the environment than their natural versions' (reverse-scored, 82%).

All 24 items correlate positively with the CBenev24 total score (last column in Table 2), with correlations varying between 0.15 and 0.69. The CBenev24 measure showed a Cronbach's alpha of 0.80.

The 24 items, as a first venture, included some unusual items. Having examined the results, we created a shorter measure of 10 items. We refer to this subscale as CBenev10. We selected these items to preserve the diversity of items (including one negative and one positive from the second set of 'equal consequence' items), allowing for some emphasis on the food domain and eliminating unusual items ('Nature is wonderful', 'Most deaths are natural'), and eliminating some items with lower correlations with the total CBenev24 score. CBenev10 has reasonable internal reliability (Cronbach's alpha = 0.72). As with CBenev24, the unifying feature of these ten items is their relevance to the perceived benevolence of nature. Consistent with this aim, a confirmatory factor analysis suggested that participants respond to these items as if they share a single, common factor (RMSEA = 0.057, CFI = 0.92, SRMR = 0.052)². The unidim() function of the *psych* package (Revelle, 2022) also tests

²RMSEA scores lower than 0.06, SRMR scores below 0.08, and CFI scores above 0.95 are good rules of thumb for evaluating model fit (Hu & Bentler, 1999). By these criteria, RMSEA and SRMR, but not CFI, recommend a one-factor model for CBenev10. Exploratory analyses revealed that neither CBenev24 nor CBenev10 clearly decomposes into meaningful subscales. That said,

Table 3A. Summary of measures in the correlation matrix in *Table 3B*.

Scale	Summary
CBenev24	24-item Belief in the Benevolence of Nature Scale. The range is from -3 to 3. Higher scores indicate a stronger belief in the benevolence of nature. Scores above 0 indicate a belief in the benevolence of nature.
CBenev10	10-item Belief in the Benevolence of Nature Scale. The range is from −3 to 3. Higher scores indicate a stronger belief in the benevolence of nature. Scores above 0 indicate a belief in the benevolence of nature.
CPercentR2	2-item measure of belief in the benevolence of nature, which is the reverse-scored average of (1) percentage of world deaths which are natural and (2) percentage of world disasters which are natural. The range is 0 to 100. Higher scores indicate more pro-natural beliefs (that is, less disaster and death caused by nature).
CCircle2	2-item measure of belief in the benevolence of nature, averaging the perceived extent of overlap between (1) nature and good and (2) nature and health. The range is 1 to 7. Higher scores indicate more pro-natural beliefs (that is, more overlap).
CNatPref9	9-item measure about the importance of naturalness of food. The range is -3 to 3. Higher scores indicate a stronger natural preference.
CConnected14	14-item Connectedness to Nature Scale. The range is -3 to 3. Higher scores indicate more connectedness to nature.
CSpirituality7	7-item measure of spiritual reverence of nature (from the Natural Perspectives Scale). The range is -3 to 3. Higher scores indicate more spiritual reverence of nature.
CMastery2	2-item measure of approval of mastery of nature (from the Natural Perspectives Scale). The range is -3 to 3. Higher scores indicate more approval of mastery of nature.
CFear3	3-item measure of fear of nature (from the Natural Perspectives Scale). The range is −3 to 3. Higher scores indicate more fear of nature.
CDegNatR9	9-item measure of how natural people perceived different disasters to be. The range is 0 to 100. This has been reverse-scored such that higher scores on this measure are more pro-natural responses (viewing disasters as more human-made than natural).

whether a single dimension accounts for all intercorrelations in the scale. Using this metric, CBenev10 had a unidimensionality score equal to 1, and CBenev24 had a unidimensionality score equal to 0.99. These suggest that both scales are best considered to be measuring unidimensional constructs. We likewise evaluated each scale's unidimensionality by examining the residual correlations between scale items (Svedholm-Häkkinen et al., 2023). If a scale is multidimensional, then there should be significant residual intercorrelations between some scale items after factoring out the way that they are related to each other assuming a unidimensional factor. However, for both CBenev10 and CBenev24, residual correlations among scale items were low and exhibited poor reliability (CBenev10: std.alpha = 0.004; CBenev24: std.alpha = 0.023). The average residual correlation for CBenev10 was 0.023, t(9)=0.74, p = 0.477, and was 0.007 for CBenev24 (t(23) = 0.587, p = 0.563). The items that are included in CBenev10 are marked with an asterisk in Tables 1 and 2. The mean score for CBenev10 was 1.11 (SD = 0.76), which was higher than CBenev24 (partly because we removed 'Most deaths are natural'). The median score was 1.20. There were 25 (8.3%) participants with scores at zero or below for CBenev10, and the correlation with CBenev24 was 0.87 (p < 0.001).

both of these scales would benefit from additional testing and validation (e.g., assessment of discriminant validity) in other populations. We conducted these analyses using the *lavaan* package (Rosseel, 2012).

Table 3B. Basic statistics and correlations between benevolence measures and other variables.

	Mean	Median	SD	CBenev24	CBenev10	CPercentR2	CCircle2	CNatPref9	CConnected14	CSpirituality7	CMastery2	CFear3	CDegNatR9
CBenev24	0.66	0.65	0.61	_									
CBenev10	1.11	1.20	0.76	0.87	_								
CPercentR2	36.53	35.00	17.03	0.20	0.11	_							
CCircle2	5.59	6.00	1.23	0.45	0.50	-0.08	_						
CNatPref9	0.16	0.22	1.41	0.56	0.49	0.06	0.35	_					
CConnected14	0.76	0.86	0.99	0.48	0.45	0.08	0.48	0.46	_				
CSpirituality7	0.97	1.14	1.07	0.53	0.54	0.07	0.55	0.46	0.68	_			
CMastery2	-0.21	0.00	1.39	-0.02	-0.05	-0.02	-0.13	-0.05	-0.22	-0.22	_		
CFear3	-1.27	-1.33	1.23	-0.19	-0.22	0.11	-0.19	-0.11	-0.28	-0.14	0.05	_	
CDegNatR9	53.00	51.89	12.04	0.09	0.09	0.16	0.02	0.06	0.08	0.18	-0.14	0.04	_

Note: In this table, the means, medians, and standard deviations for these measures are listed in the first three columns. Then, beginning with column 4, the correlation matrix is presented in the remaining columns. When |r| > 0.15, p < 0.01.

Relationships between CBenev10, CBenev24, and other measures are summarized in Table 3. Here, Table 3A provides a summary of the measures, and Table 3B shows their relations to each other. In Table 3B, in general, correlations for CBenev10 are very close to those for CBenev24.

3.2. Two other measures of benevolence

The overlapping circle measure for nature and health showed a high mean overlap of 5.50 (out of a maximum of 7). The perceived overlap between nature and good was similarly high: 5.68. Both scores suggest a high belief in benevolence. The two scores correlated at r = 0.67, p < 0.001, and were averaged into a CCircle2 score (Table 3).

The other pair of items included estimates of the percentage of world deaths that were natural (mean = 60.6%, SD = 20.6%) and the percentage of world disasters that were natural (mean = 66.3%, SD = 19.9%). These high means suggest awareness of the major influence of natural forces on these negative events, which opposes benevolent views of nature. However, we believe that at least one of these estimates minimizes the importance of natural forces for negative events, relative to objective estimates. We estimate, based on tables from the World Health Organization (2020), that 92% of world deaths derive from natural causes, and in particular, from communicable and noncommunicable diseases. This estimate is well above our subjects' mean estimate of 60.6%. We attempted to estimate the percentage of disasters that are natural, but this turned out to be very difficult, as there is not a clear way to enumerate disasters. For example, how many 'human-caused disasters' does one count for World War II? How many natural disasters does one count for the 1918 world flu pandemic? Participants' two percentage estimates correlated at 0.41 (p < 0.001). These two scores were averaged and reverse-scored to form CPercentR2 in Table 3. High scores indicate pro-natural views (mean = 36.5%, SD = 17.0%).

3.3. Relations between CBenev24, CBenev10, and other measures

We assessed relationships between CBenev24, CBenev10, and other measures. Table 3A provides a summary of the measures. Table 3B shows means, medians, and standard deviations (first three columns) and correlations (remaining columns) between CBenev24, CBenev10, and our other measures. In general, when an item strongly correlated with CBenev24, it did with CBenev10, too.

The correlations between CBenev24, CBenev10, and our two other measures of benevolence are shown in Table 3B. CBenev24/CBenev10 correlate 0.45/0.50 (ps < 0.001) with CCircle2 (perceived degree to which nature overlaps with good/health). CBenev24/CBenev10 correlate 0.20 (p < 0.001)/0.11 (p = 0.047) with CPercentR2 (reverse-scored percentage of deaths/disasters that are natural). There is not a significant correlation between CCircle2 and CPercentR2 (r = -0.08, p = 0.158).

The natural preference (CNatPref9) correlates 0.56 with CBenev24, 0.49 with CBenev10, and 0.35 with CCircle2 (ps < 0.001). Additionally, the Connectedness to Nature Scale (CConnected14) correlates a substantial 0.48 with CBenev24, 0.45 with CBenev10, and 0.48 with CCircle2 (ps < 0.001). People who prefer natural foods and people who feel connected to nature also tend to believe in the benevolence of nature.

Our own three-component Natural Perspectives Scale correlations are striking. CSpirituality7 shows high correlations with CBenev24/CBenev10 (r = 0.53/0.54) and CCircle2 = 0.55 (ps < 0.001). Spiritual reverence of nature correlates with perceived benevolence of nature. The highest correlation among the many we have generated is 0.68 between CSpirituality7 and CConnected14. This high overlap between spiritual reverence of nature and connectedness to nature is potentially meaningful and is covered in the discussion. CFear3 correlates very modestly, -0.19/-0.22 (ps < 0.001), in the expected negative direction, with our benevolence measures. People who feel more fear in nature tend to view nature as less benevolent. We had no prior expectation regarding the relationship between mastery (CMastery3) and benevolence, and the correlations are near zero.

Table 4.	The (null)) relationships	between	experiencing	a natural	disaster	and	perceived	benevolence
of nature									

	Natural disaster-affected group $(N = 120)$	Unaffected group (N = 181)	Natural disaster-affected vs. unaffected <i>t</i> -test	Natural disaster-affected self group $(N = 59)$	Self unaffected group $(N = 242)$	Natural disaster-affected self vs. self unaffected <i>t</i> -test
CBenev24	M = 0.69 ($SD = 0.58$)	M = 0.64 $(SD = 0.63)$	t = 0.635, p = 0.526		M = 0.65 ($SD = 0.62$)	t = 0.494, p = 0.621
CBenev10	M = 1.13 ($SD = 0.72$)	M = 1.10 $(SD = 0.80)$	t = 0.323, p = 0.747	M = 1.15 $(SD = 0.73)$	M = 1.10 $(SD = 0.77)$	t = 0.447, p = 0.655

We predicted that the higher a person's benevolence score, the more they would attribute various disasters as being caused by man (vs. nature) in our disaster rating task. We asked participants to determine the degree to which disasters were caused by man (vs. nature) for nine different disasters. Some of the events, like forest fires and the Fukushima tsunami/nuclear disaster, allow for considerable variation in these judgments. CDegNatR9 is our measure of these beliefs averaged across the nine disasters, reverse-scored such that 0% = entirely natural and 100% = entirely human-made. Thus, higher scores on this measure are more pro-natural responses because high scores mean the disasters are attributed less to nature. The mean for CDegNatR9 was 53.0%. We expected CDegNatR9 to positively correlate with benevolence scores. Our hypothesis is not confirmed, though correlations with CBenev24/CBenev10 were in the expected positive direction (0.09/0.09).

3.4. Relationship between natural disaster experience and benevolence beliefs

In total, 147 participants indicated that either they or a friend or family member had been affected by at least one disaster. Of these 147 people, most (N = 112) only listed one disaster, but some listed two disasters (N = 24) or three disasters (N = 11).

For the first disaster listed (N = 147), 112 people (76%) indicated the disaster was natural, 7 people (5%) indicated the disaster was man-made, and 25 people (17%) indicated the cause was mixed (both natural and man-made). Three people (2%) indicated they had experienced a disaster but did not fill in this question. For the second disaster listed (N = 35), 22 people (63%) indicated the disaster was natural, 6 people (17%) indicated the disaster was man-made, and 4 people (11%) indicated the cause was mixed (both natural and man-made). Three people (9%) indicated they had experienced a disaster but did not fill in this question. For the third disaster listed (N = 11), 7 people (64%) indicated the disaster was natural, 2 people (18%) indicated the disaster was man-made, and 2 people (18%) indicated the cause was mixed (both natural and man-made).

We examined how belief in the benevolence of nature depended on whether the person had experienced a natural disaster. First, we checked whether the participant listed any disaster as purely nature-caused, of all the disasters they listed (up to three disasters). Participants either were in the natural disaster-affected group (N = 120) or the unaffected group (N = 181). On the preliminary measure (CBenev24), those who had been affected by a natural disaster had a benevolence of nature score of 0.69 (SD = 0.58) and those who had not experienced a natural disaster (unaffected) had a benevolence of nature score of 0.64 (SD = 0.63). The difference was not statistically significant (t(299) = 0.635, p = 0.526), and the results were similar for the shortened scale (CBenev10, natural disaster-affected group: M = 1.13, SD = 0.72, unaffected group: M = 1.10, SD = 0.80, t(299) = 0.323, p = 0.747).

	CBenev24	CBenev10	Gender	Politics	Education	Religiosity
CBenev24	_					
CBenev10	0.87	_				
Gender	0.02	-0.01	_			
Politics	0.13	0.11	-0.10	_		
Education	-0.02	-0.06	0.12	0.02	_	
Religiosity	0.32	0.27	0.02	0.47	0.14	_

Table 5. Correlations with demographic variables.

Note: Correlations are displayed, where when |r| > 0.15, p < 0.01. For gender, male = 0, female = 1. For politics, very liberal = 1 to very conservative = 7. On gender, one person indicated nonbinary, and they were not included in the gender correlations. For politics, one participant said 'don't know', and one participant said 'can't pick one label', and they were not included for politics correlations.

Second, we ran the same analysis, but limiting it to people who indicated they had personally been affected directly by the disaster (checked 'self' as affected) as a robustness check. Fifty-nine people had personally been affected by a natural disaster, and these people had similar benevolence scores (CBenev24 M = 0.70, SD = 0.59/CBenev10 M = 1.15, SD = 0.73) to those who had not been personally affected by a natural disaster (CBenev24 M = 0.65, SD = 0.62, t(299) = 0.494, p = 0.621/CBenev10 M = 1.10, SD = 0.77, t(299) = 0.447, p = 0.655). Table 4 summarizes these (nonsignificant) relationships between experiencing natural disasters and belief in the benevolence of nature.

Thus, those who had experienced natural disasters had a nonsignificantly *greater* belief in the benevolence of nature. It is reasonable to conclude that direct experience with serious negative consequences as a result of natural disasters is not associated with a decreased belief in the benevolence of nature.

3.5. Correlations with demographic variables

Correlations between the perceived benevolence of nature and demographic variables are displayed in Table 5. The only significant demographic effects were a positive relationship between CBenev24/CBenev10 and religiosity (r = 0.32/0.27, ps < 0.001). Though directionally political conservativeness correlated with higher benevolence scores, this did not meet significance at our p < 0.01 threshold (between CBenev24 and Politics, r = 0.13, p = 0.022; between CBenev10 and Politics, r = 0.11, p = 0.055). Education and gender were not significantly associated with benevolence of nature beliefs.

4. Discussion

We have accomplished three things in this paper. First, we have confirmed a broad natural preference in Americans and presented evidence for a broader concept of belief in the benevolence of nature. Second, using a broad range of product types and attributes, we have created a longer (24-item) measure of belief in the benevolence of nature and then refined it into a shorter (10-item) measure. Third, we have provided initial evidence suggesting that belief in the benevolence of nature is not influenced by experience with natural disasters.

There is a question as to whether the phenomenon we are exploring is better described as a benevolence belief—that is, a positivity toward nature—or rather a preference for natural over nonnatural ('natural is better'). Indeed, the sentiment that 'natural is better' is comparative, and so it could simply result from negativity toward nonnatural things, rather than positive feelings about nature. For instance, when people from five different Western countries were asked to define natural, they did

so predominantly by citing the absence of negative features such as additives and human contact or intervention (Rozin et al., 2012). One challenge to identifying whether people view nature as benevolent absolutely—absent any explicit comparison—is that most studies measure attitudes toward nature by asking participants to compare natural and nonnatural things.

Despite these challenges, there is evidence that people view nature as positive (or 'benevolent') in an absolute, noncomparative manner. The word 'natural' is broadly used as a label to attract purchases. There is a sense of something very positive in the items of the Connectedness to Nature Scale (Mayer & Frantz, 2004) and the Nature Relatedness Scale (Nisbet et al., 2009), including a desire to spend time in nature. The spirituality subscale of our Natural Perspectives Scale (present paper) includes specific items that imply a positive valence (e.g., 'I am often overwhelmed by the beauty of nature', 77% agree; 'The natural world is intrinsically sacred', 73% agree). One of our items in the preliminary 24-item measure, 'nature is wonderful' (agree/disagree), received the highest score of all 24 items (-3 to 3 scale, M = 2.50, 97% agree), which is not easily explained by a nonnatural aversion account. Likewise, our results on the scale of overlapping circles show that people see a lot of overlap between nature and good (mean 5.68 on a 1-7 scale, with 7 indicating nearly total overlap).

The high correlation between a preference for the natural (CNatPref9) and CBenev24 (0.56) and CBenev10 (0.49) is unsurprising—inherent positivity should go with preference. The highest correlation among the many we measured is 0.68 between CSpirituality7 and CConnected14. This high overlap is interesting since spiritual reverence of nature does not directly imply connectedness to nature. There is only one item in CSpirituality7 about being one with nature and nothing about the beauty, purity, or sacredness of nature in CConnected14. Therefore, it is notable that there is a tight link between these two measures. Both imply strong positivity to nature and are consistent with the idea of benevolence, as opposed to just a natural preference.

These results should not be interpreted as an unconditional everyday 'worship' of nature. Only 25% of our subjects disagreed that 'Most deaths are natural', and only 25% of our subjects agreed that 'Natural medicines are usually more effective than their artificial versions'. And subjects recognized that most disasters and most deaths are natural when asked to estimate the percentage of disasters and deaths that were natural.

These results are consistent with some prior published work. Meier and Lappas (2016) were able to reduce the substantial preference for natural drugs with information about the relatively poor safety of natural as opposed to synthetic drugs. And Scott et al. (2020) show natural is less preferred for curatives than for preventatives because natural curatives are perceived to lack potency. It therefore seems that specific 'anti-natural' information may be assimilated by people, but the evidence we present on natural disasters suggests that people's generic sentiments toward nature resist direct evidence of nature's non-benevolence.

As we indicated in the introduction, there is good reason to believe that in the real world, nature is not reliably benevolent toward humanity (Scott & Rozin, 2020). The fact that the public does not seem to realize this, as manifested by belief in the benevolence of nature and 'natural is better', could lead to some maladaptive decisions, as in the choices of medicines, or consumption of more natural/organic foods to promote sustainability (Rozin et al., 2023), or in opposition to vaccinations.

The present study is limited to Americans, and the 'evidence insensitivity' we describe is instantiated by only one type of evidence, experience of natural disasters. Our exploration is not only culturally limited but severely limited as a snapshot in time. The historian Keith Thomas in his book, *Man and the Natural World: Changing attitudes in England 1500–1800* (1991) has described in depth changes in the British sensibility to nature. The biblical view of humans as dominating the natural world becomes more qualified by the other biblical theme, of human responsibility for the natural world, over time. Thomas' erudite review terminates before Darwin, who knocked humans off their throne as a qualitatively different and superior creature compared to all others. How fascinating it would be to get survey data on attitudes to nature before and after Darwin.

Data availability statement. Data and code are available in the OSF repository at https://osf.io/7tjcg/.

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