

Concept, Manifestations, and Causes of Naturalness Preference: Postprint

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Abstract

“Nature” is often ascribed sacred and benevolent positive values. Although natural and artificial items may sometimes have no objective difference, people still esteem naturally generated things and innate capacities—this is the “naturalness preference (naturalness preference/naturalness bias)” . Existing research on its conceptual definition, specific manifestations, and psychological origins remains fragmented and lacks systematic synthesis. This article aims to clarify the conceptual definition of naturalness preference, propose a “Three-Domain Conceptual Model of Naturalness Preference,” summarize the developmental trajectory and specific manifestations of naturalness preference across the domains of natural environment, natural objects, and innate ability preference, and for the first time attribute its origins to three factors: cognitive (psychological essentialism), affective (positive and negative emotions), and normative (sacred moral values). Future research should thoroughly investigate the negative consequences of naturalness preference, cultural-psychological differences, and its influence on the acceptance of emerging technologies.

Full Text

The Concept, Manifestations, and Causes of Naturalness Preference

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Abstract

“Natural” is often endowed with sacred and benevolent positive values. Despite the absence of objective differences between natural and artificial objects, people consistently advocate for naturally occurring entities and innate abilities—a psychological tendency known as “naturalness preference” or “naturalness

bias.” This paper aims to clarify the conceptual definition of naturalness preference by proposing a “three-domain conceptual model of naturalness preference,” synthesizing its developmental trajectory and specific manifestations across natural environments, natural products, and innate abilities. Furthermore, this paper is the first to systematically summarize the causes of naturalness preference into three factors: cognitive (psychological essentialism), affective (positive and negative emotions), and normative (sacred moral values). Future research should further investigate the negative consequences of naturalness preference, its cultural-psychological variations, and its impact on the acceptance of emerging technologies.

Keywords: naturalness preference, psychological essentialism, morality, acceptance of emerging technology

People generally prefer natural environments or objects and often attribute positive value to natural things. This psychological tendency, known as naturalness preference (or naturalness bias), serves as an important criterion for aesthetic judgment, daily consumption, and evaluating others’ achievements (Scott & Rozin, 2020). Regarding natural environments, people typically enjoy contact with nature, perceiving pristine natural settings as more beautiful than built environments (Meidenbauer et al., 2020), and artistic works often celebrate nature’s healing effects on physical and mental health. However, naturalness preference extends beyond external natural environments, transcending these boundaries to become an abstract, ideational value (Rozin et al., 2004). For instance, people favor foods labeled “purely natural” over those with additives (Rahman et al., 2020; Scott & Rozin, 2017), prefer handmade goods to machine-made products (Judge, Fernando, Paladino, & Kashima, 2020), and advocate for traditional production methods while rejecting emerging technologies such as gene editing and embryonic cloning (Scott et al., 2016, 2018) because the former are perceived as more “natural.”

In the human domain, people believe that innate abilities and traits are more natural, attributing others’ achievements more to talent than to effort (Tsay, 2016; Tsay & Banaji, 2011). Yet what exactly do people mean by “natural” or “unnatural,” and does it necessarily equate to the natural environment? Although scholars have examined naturalness preference from philosophical, ethical, and psychological perspectives, discussions of its conceptual definition, specific manifestations, and formation mechanisms remain fragmented, lacking systematic synthesis of this common psychological phenomenon.

In this paper, we define naturalness preference as a psychological tendency to value things or people that are naturally generated and minimally human-intervened. This article systematically reviews the concept, developmental trajectory, and manifestations of naturalness preference, proposes a “three-domain conceptual model of naturalness preference” and a “perceived naturalness continuum model,” and summarizes its formation mechanisms from cognitive, affective, and normative perspectives. Future research should further clarify the conceptual definition of naturalness preference, construct more comprehensive

theoretical models of its formation mechanisms, examine its potential negative consequences, and investigate its cultural-psychological variations and impact on emerging technology acceptance.

2. Concept and Development of Naturalness Preference

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2.1 What is Naturalness?

The concept of “naturalness” is rich and complex. Despite extensive discussion in philosophy, ethics, and psychology, no consensus definition exists. The Cambridge Dictionary defines “natural” as “from nature, not man-made or caused,” “innate abilities and inherent characteristics,” “pure, without additives,” “biological,” and “normal.” Research on laypeople indicates that the core meaning of “naturalness” involves natural objects or environments that have not (or have minimally) undergone human processing, such as chemical additives (Rozin et al., 2012; Scott & Rozin, 2020). Moreover, research on naturalness preference extends beyond natural environments and objects to the human domain, where researchers define preference for human naturalness as the tendency to view innate abilities as superior to acquired effort (Ma et al., 2023; Tsay & Banaji, 2011).

It is important to note that “naturalness” and “nature” are not equivalent; the former has richer connotations than the latter. “Nature” primarily refers to the narrow sense of natural environments or objects, whereas “naturalness” is not confined to objective natural environments or objects but represents a more abstract, ideational value (Rozin et al., 2004)—that is, a preference for things or abilities that are “free from human intervention” or “innate.” For example, people’s perception of naturalness in food flavors or handmade products is not directly related to natural environments, and the concept of “naturalness” applies not only to natural environments or objects but also to preferences for innate human abilities (Tsay & Banaji, 2011). Based on authoritative dictionaries and existing empirical research, naturalness preference manifests across numerous domains, making it difficult to capture all phenomena with a single definition. This paper proposes a three-domain conceptual model of naturalness preference, encompassing macro-level natural environments, specific natural objects, and the human domain. Specifically, we define naturalness preference as a tendency to value people or things that are naturally generated and minimally human-intervened. Conceptually, naturalness preference can be broadly divided into three domains: natural environment, natural objects, and human beings. The natural environment domain reflects preference for pristine, non-human-made settings from nature. The natural objects domain reflects preference for naturally generated items. The human domain primarily reflects preference for innate abilities and traits (see Table 1).

2.2 Developmental Trajectory of Naturalness Preference

Previous research has primarily identified stable naturalness preference in adults. In fact, studies have found that naturalness preference emerges early in childhood. Balling and Falk (1982) surveyed participants aged 8 to 70 and found that nearly all significantly preferred natural environments, though preferences varied by age: children and adolescents aged 8 to 15 preferred pristine savanna environments, but this preference gradually declined with age, shifting toward familiar natural environments such as temperate coniferous forests. Balling et al. argued that preference for natural environments likely stems from humans' long evolutionary history in the East African savanna. However, Meidenbauer et al. (2019) found that children aged 4 to 11 preferred urban environments, while adults showed stronger preference for natural environments, raising questions about whether naturalness preference is innate or learned.

Beyond natural environments, researchers have also identified naturalness preference for natural foods in children (Girgis & Nguyen, 2020; Wilks & Bloom, 2022). Girgis and Nguyen (2020) found that by age 5, children can distinguish between natural and processed foods. Wilks and Bloom (2022) conducted two preregistered studies comparing preferences for natural versus lab-cultured foods among American children aged 5 to 10 and adults. Results showed that, like adults, children as young as 5 exhibited naturalness preference for food: they preferred natural foods over cultured ones, perceiving them as more natural, better tasting, and safer.

Finally, young children also demonstrate preference for innate talent. Lockhart et al. (2013) examined American children at different developmental stages—including young children (5–6 years), older children (8–13 years), and college students—asking their views on innate versus acquired traits (including intelligence, courage, charisma, and height). All age groups considered innate traits most natural and enduring, expressed greater willingness to reward individuals with innate traits and desire to befriend them, with older individuals showing stronger preference for talent. Ma et al. (2023) similarly found preference for talent among 5- to 6-year-old children in mainland China: even when told two protagonists achieved identical performance, children perceived those who succeeded through talent as more competent and warm, and expressed greater willingness to learn from them and befriend them. Adults also perceive high-talent individuals as more capable. In summary, whether regarding natural environments, natural foods, or talent preference, existing research supports the view that naturalness preference emerges clearly in early childhood, is reinforced by culture, and becomes increasingly stable with age (Lockhart et al., 2013).

3. Manifestations of Naturalness Preference

3.1 Natural vs. Built Environments

Humans evolved in natural environments for millions of years, and the preference for nature is deeply ingrained, even becoming an instinctive need (Wilson, 1984).

Psychologists refer to individuals' closeness to and identification with nature as "nature connectedness" (Li & Cao, 2020), encompassing both physical interaction with natural environments and psychological connection to nature (Yang Ying et al., 2017). Numerous studies show that people universally prefer natural environments over built ones, perceiving them as more beautiful (Weinberger et al., 2021). Contact with nature benefits physical and mental health in multiple ways: physiologically, it reduces hypertension and cortisol levels and enhances immune function; psychologically, it increases subjective well-being, alleviates stress, anxiety, and depression, and improves attention and memory-related cognitive performance (Bratman et al., 2019). Even viewing nature-related videos, slideshows, and virtual reality simulations can significantly improve emotional states (Meidenbauer et al., 2020).

Existing theories primarily explain the positive effects of nature contact from an evolutionary psychology perspective, emphasizing that human ancestors developed adaptive physical and mental functions for nature during evolution. Representative theories include the Biophilia hypothesis (Wilson, 1984), Savanna hypothesis (Orians & Heerwagen, 1992), and stress-reduction theory (Ulrich et al., 1991). The Biophilia and Savanna hypotheses are similar, positing that natural environments provide essential material resources and shelter, ensuring human survival, and that human ancestors developed specific preferences for natural environments during evolution that persist today, rooted in our genes. Consequently, humans have an innate need to connect with nature, and this preference shows cross-cultural and cross-age consistency (Kaplan, 1992). Stress-reduction theory, also called "psycho-evolutionary theory," suggests that humans lived and evolved in nature for long periods and only gradually moved to cities in recent centuries, potentially failing to adapt to urban environments or built architecture, resulting in cognitive and emotional exhaustion. Therefore, when encountering non-threatening natural environments, people experience significant reductions in physiological and psychological stress (Ulrich et al., 1991). Additionally, Attention Restoration Theory proposes that modern urban environments diverge substantially from ancestral natural settings, and the fast pace of daily life depletes attentional and other cognitive resources, leading people to restore depleted attention—particularly directed attention requiring volitional control—through nature contact (Kaplan, 1995).

3.2 Natural Objects and Handmade Products

People generally consider natural objects superior to artificial ones, showing strong naturalness preference in consumption domains such as food, medicine, and art. Even when artificial products are equivalent in appearance, function, or taste, people tend to choose the latter. Research indicates that perceived naturalness is the primary psychological mechanism driving consumers' food choices (Perkovic et al., 2022; Rahman et al., 2020), and people generally believe natural products are healthier and more trustworthy (Lang & Rodrigues, 2022), willing to purchase them at premium prices (d' Astous & Labrecque, 2021).

Similarly, even when natural and synthetic drugs have no objective differences in efficacy or safety, consumers overwhelmingly choose natural medicines, and even professional physicians tend to recommend natural drugs to patients (Lappas et al., 2022; Scott et al., 2020).

Furthermore, for synthetic foods such as cultured meat, although it represents a more environmentally friendly production method with virtually no taste difference from animal meat, consumers perceive it as highly unnatural and show low acceptance due to its extensive human production and modification (Siegrist et al., 2018). Additionally, using additives in food production significantly reduces perceived naturalness of raw materials, even without synthesizing or altering the food itself (Scott & Rozin, 2017). Based on these studies, the motivation to prefer naturalness is not based on instrumental considerations such as health, efficacy, or practicality, but rather ideational—ascribing sacred or aesthetic positive values to natural objects (Rozin et al., 2004).

However, not all human processing triggers rejection. People's perception of naturalness applies not only to pristine natural objects but also to handmade products. Compared to machine-made goods, people often perceive handmade products as having higher naturalness (Abouab & Gomez, 2015). Handmade production is considered a traditional production method that humans have practiced for millennia, representing a more natural approach (Judge, Fernando, Paladino, & Kashima, 2020). Research shows that compared to automated machine production, people perceive handmade goods as having more human contact, believing that manual production better preserves the natural essence of products (Abouab & Gomez, 2015). This contact extends beyond physical touch to the transmission of naturalness preference values. Moreover, creators incorporate their respect and reverence for nature into products during production, which also represents an important manifestation of “craftsmanship spirit” (Huang Kai, 2020). On the other hand, creators also consider consumers' strong preference for naturalness, investing more time and effort to preserve or enhance product naturalness to increase price and sales (Droege, 2022; Judge, Fernando, Paladino, & Kashima, 2020). While machine-made products offer advantages such as high standardization, efficiency, and cost savings, machines themselves are human-made objects lacking mental capacities (H. M. Gray et al., 2007). Machine production involves no direct human-product contact, and machines only passively and mechanically execute human commands without considering humans' naturalness preference, thus machine-made goods lack naturalness (Job et al., 2017). From this comparison, “natural” and “unnatural” are not diametrically opposed dimensions but rather represent degrees of difference along a dimension of “perceived naturalness,” forming a perceived naturalness continuum: natural objects (or environments) are perceived as most natural, followed by handmade products, with machine-made products perceived as least natural (see Figure 1 [Figure 1: see original paper]).

3.3 Talent vs. Effort Preference

Naturalness preference is not limited to judgments about environments and objects but also extends to preference for human talent. Although hard work is often considered a virtue (Celniker et al., 2022), people tend to view success through talent as more natural and believe more talented individuals are more likely to succeed. Researchers found that when participants evaluated musicians who succeeded through talent versus effort, implicit and explicit attitudes diverged: although people explicitly valued effort training more, they implicitly believed musicians who relied on natural talent were more natural, more likely to succeed in the future, and more desirable to hire (Tsay & Banaji, 2011). This preference for talent exists not only among laypeople but also among music experts (Brown et al., 2018). While experts value effort more than laypeople and believe effortful musicians have greater psychological resilience to cope with setbacks, experts still view effort as less natural than innate ability, with lower potential and more difficulty achieving high success in the future (Brown et al., 2018; Tsay & Banaji, 2011). Although researchers have suggested that naturalness preference for talent may be domain-specific because music indeed requires high innate ability, this preference does not weaken in fields considered to require more effort, such as business. People still believe talented businesspeople are more natural, can achieve higher success, and are more desirable to hire, a judgment shared even by experienced entrepreneurs (Tsay, 2016).

Beyond the talent-effort dichotomy, effort itself is perceived as “natural effort” or “unnatural effort,” creating a continuum effect (see Figure 1 [Figure 1: see original paper]). For example, athletes using performance-enhancing drugs like steroids are perceived as using highly unnatural and immoral means to improve athletic performance (Landy et al., 2017). Similarly, using cosmetic surgery to enhance appearance is viewed as unnatural effort compared to dieting or exercise (Bonell et al., 2022). Thus, people consider more natural effort to involve minimal external assistance. Although effort implies greater cost, achievements based on individual effort are considered more valuable (Inzlicht et al., 2018) and morally superior (Celniker et al., 2022).

4. Causes of Naturalness Preference

Despite extensive philosophical, ethical, and psychological discussions, no research has systematically summarized the causes of naturalness preference. Addressing the three manifestations discussed above, this paper is the first to propose a framework summarizing the causes into three factors: cognitive (psychological essentialism), affective (positive and negative emotions), and normative (sacred moral values).

4.1 Cognitive Factors

The cognitive cause of naturalness preference is primarily manifested in psychological essentialism—the intuitive belief that all things possess inherent, unchang-

ing, and unobservable essential features beneath their surface characteristics (Gelman, 2013). An important psychological cause of naturalness preference is the existence of a “natural essence” in people’s lay theories (Szántó, 2018). In specific domains, even when people do not understand what this abstract “essence” represents, they use more concrete “placeholders” that may have scientific explanations to represent the abstract essence; for example, genes serve as an important placeholder for human essence (Heine, 2017). Genetic essentialism—the belief that genes determine biological traits and unchanging inner essence—leads people to endorse eugenics, viewing human traits and abilities as innate and difficult to change, thus preferring talent and devaluing effort (Dar-Nimrod & Heine, 2011; Ryazanov & Christenfeld, 2018).

Another core psychological mechanism is the perception that human intervention destroys or enhances naturalness through the transmission of essence. Rozin et al. proposed the “contagion principle,” suggesting that intangible essence can be transferred between objects through physical contact (Nemeroff & Rozin, 2018). For example, people generally reject additives in food production as destroying food’s naturalness, regardless of whether the substance is healthy. The psychological cause is that when people perceive unnatural additives 融入 natural foods, the food’s natural essence becomes “contaminated” (Rozin, 2005; Scott & Rozin, 2017). Similarly, integrating two biologically distant genes reduces naturalness, triggering risk perception and moral condemnation (Swiney, 2020). In short, whether adding or modifying, the original essence of natural objects becomes “polluted” by non-natural essence, destroying perceived purity. Additionally, people perceive handmade products as more natural than machine-made ones because the handmade production process transfers the creator’s positive emotions toward nature, including love (Fuchs et al., 2015; Judge, Fernando, Paladino, Mikolajczak et al., 2020) and positive values such as warmth, friendliness, and sincerity (Job et al., 2017). These transmitted human values lead people to perceive handmade goods (especially compared to machine-made ones) as more natural, increasing purchase intentions.

Furthermore, another important cause of naturalness preference is that natural people or things often possess higher “authenticity” (Frizzo et al., 2020; Zheng & Alba, 2023). From a psychological essentialism perspective, the more an object embodies or reflects natural essence, the stronger its perceived authenticity (Newman, 2016, 2019; van Gerven et al., 2019). Authenticity related to natural environments or objects is termed “natural authenticity.” Gilmore and Pine (2007) summarize natural authenticity as emphasizing raw materials, minimal processing, rustic character, bareness, and green principles. Specifically, to display natural authenticity, designers should select raw materials from natural environments, minimize human processing and over-packaging, emit rustic charm, and incorporate green elements (Gilmore & Pine, 2007). Empirical research shows that natural authenticity enhances trust, transparency, and control (Moscato & Machin, 2018), and more natural packaging colors increase perceived product authenticity, thereby boosting purchase intentions (Marozzo et al., 2020). On the other hand, people perceive handmade products as more

authentic than machine-made ones (Frizzo et al., 2020), while unnatural mechanical products or foods trigger aversion to inauthenticity. For example, genetically modified foods and machine-synthesized simulations lose the authentic naturalness of natural objects, leading consumers to perceive these creations as “adulterated,” evoking disgust and anger, and viewing these production methods as immoral (Silver et al., 2021).

4.2 Affective Factors

Affective causes of naturalness preference include positive and negative emotions. Positive emotions generate approach motivation toward natural objects, while disgust and fear generate avoidance motivation toward unnatural objects. Environmental psychology research shows that nature contact enhances positive emotions such as high-arousal pleasure and vitality, as well as low-arousal relaxation and calmness (McAllister et al., 2017), while increasing subjective well-being (Richardson et al., 2016). Similarly, consuming natural or organic foods enhances satisfaction and comfort (Jiang et al., 2014). Regarding hand-made product naturalness, people believe that handmade goods transfer positive emotions from creators, including love for nature (Fuchs et al., 2015; Judge, Fernando, Paladino, Mikolajczak et al., 2020) and positive values like warmth and sincerity (Job et al., 2017). These transmitted human values increase perceived naturalness and purchase intentions.

Negative emotions related to naturalness preference primarily include disgust and fear. Disgust is a negative emotion evoked by repulsive objects. Evolutionarily, disgust helps humans avoid pathogen transmission and protect safety, serving as a basic component of the behavioral immune system. Thus, disrupting natural order and potential health risks trigger disgust (Koch et al., 2021). Surveys show that artificial foods like cultured meat and genetically modified foods evoke disgust (Siegrist et al., 2018; Wilks et al., 2021), and individuals higher in disgust sensitivity (the trait tendency to easily feel disgust) more strongly reject artificial foods (Inbar & Scott, 2018; Scott et al., 2016). Fear primarily manifests in risk perception of emerging food safety, avoidance of unfamiliar objects or uncertainty, and panic about environmental hazards (Chambers et al., 2018; Royzman et al., 2017). Additionally, emerging technologies deepen fears of technological tampering with nature, termed “technology neophobia,” with higher levels predicting lower acceptance of artificial products (Krings et al., 2022).

4.3 Normative Factors

The normative cause of naturalness preference is primarily manifested in sacred moral values. People generally view the natural world as sacred and “benevolent” (Scott et al., 2018), believing that protecting nature is a moral responsibility and rejecting sacrificing nature for economic gain (Billet et al., 2023). Some natural objects (e.g., foods) are also endowed with sacred moral value (Hingston, 2018; Mallinson et al., 2018). Research shows that sacred moral beliefs are the pri-

mary reason for preferring natural foods, while trust in science or assessment of benefits and risks of artificial foods are secondary (Mallinson et al., 2018). Regarding genetically modified foods, 71% of opponents are moral absolutists who believe food naturalness is sacred and inviolable (Scott et al., 2016). This moral judgment even generalizes to consumers themselves: people perceive consumers of natural foods as more moral and trust them more in economic games (Taylor & Stevenson, 2018).

The reasons why people endow natural objects with sacred moral value are debated. Some scholars find that disgust toward unnatural products or trait-based disgust sensitivity primarily drives moral judgments (Sanyal et al., 2023; Scott et al., 2016). Others argue that not all unnatural products evoke disgust, and that perceived potential risk and harm (Gray & Schein, 2016) or fear of the unknown (Cusimano et al., 2018; Royzman et al., 2017) predict naturalness preference more strongly than disgust. However, most existing research relies on self-report measures, which are inevitably susceptible to social desirability biases. Future research should use implicit measures to clarify the moral psychological mechanisms of naturalness preference.

4.4 Summary and Commentary

Although numerous studies have examined naturalness preference, no literature has systematically summarized its causes. This paper is the first to comprehensively summarize these causes from cognitive, affective, and normative perspectives, advancing beyond previous work but still requiring further integration and interpretation. First, although research confirms that these three factors cause naturalness preference, from an evolutionary psychology perspective, they may not be primary causes. As discussed in Section 3.1, some scholars argue that humans' long evolutionary history in natural environments has made preference for nature an instinctive need (Wilson, 1984), suggesting evolutionary factors may be primary while cognitive, affective, and normative factors are secondary. That is, innate preference for nature leads to nature-related cognitive, affective, and normative beliefs, which are then reinforced by learned sociocultural factors that further strengthen naturalness preference values. Future research should integrate evolutionary psychology perspectives to clarify interactions among different causes, distinguishing primary from secondary factors to construct more systematic theoretical models. Second, this paper explains causes through three manifestations of naturalness preference, but the three domains—natural environment, natural objects, and talent preference—are substantively different. The three causes summarized here may not apply equally to each domain; for example, normative factors may be less relevant to talent preference. Future research should examine domain-specific causes and explore whether integration across factors is possible. Overall, exploration of naturalness preference concepts and causes remains in early stages, providing opportunities for future research to refine these directions.

5. Summary and Outlook

Naturalness preference is a common heuristic and deeply rooted value preference that is ubiquitous in daily life. Although philosophy, ethics, and psychology have discussed this phenomenon, research remains plagued by conceptual ambiguity and unclear causes. This paper proposes a three-domain conceptual model of naturalness preference, defining the concept more specifically across natural environments, natural objects, and talent preference, and systematically reviews its developmental trajectory, manifestations, and formation mechanisms. However, considerable room for development remains, and many research topics require further exploration. We suggest future research on naturalness preference could proceed in three directions.

5.1 Negative Consequences of Naturalness Preference

People tend to attribute positive value to natural environments or objects (Meier, Dillard, & Lappas, 2019). While natural environments and objects indeed benefit human physical and mental health, people often overlook their negative effects and underestimate the role of human intervention: human processing makes natural foods containing toxins or bacteria safer and tastier, and many synthetic drugs (e.g., penicillin) have saved millions of lives. Thus, the value attribute of natural environments or objects should be “neutral” (Scott & Rozin, 2020). Believing that nature is necessarily sacred and benevolent while ignoring potential hazards commits the “naturalistic fallacy” (Lull & Scheufele, 2017).

Research has found that advertisements with “natural” labels reduce public awareness of cigarette dangers, and even explicit health warnings cannot decrease consumers’ interest in “natural” cigarettes (Baig et al., 2019). Importantly, naturalness preference also contributes to anti-science beliefs (Philipp-Muller et al., 2022); for example, individuals who prefer natural medicines and natural immunity more strongly reject COVID-19 vaccination (Meier et al., 2022, 2023). Consequently, businesses often exploit consumers’ naturalness values through deceptive marketing, such as “greenwashing”: despite advertising products as environmentally friendly with visual designs featuring “natural,” “green,” or “eco-friendly” labels, companies may not implement related measures. While greenwashing companies bear primary legal and moral responsibility, consumers’ lack of rational discrimination for “natural”-labeled products may also facilitate such practices.

Therefore, considering the potential negative effects of naturalness preference, psychologists urgently need to develop strategies to attenuate it. Some scholars have attempted rational persuasion using scientific evidence to explain the safety and efficacy of synthetic drugs and informing participants that some natural drugs can also be harmful (Meier, Dillard, Osorio et al., 2019). Others have explained the subjectivity of naturalness preference (Berry et al., 2017) and people’s mistaken expectations for “natural”-labeled products (Schirmacher et al., 2023), finding these interventions significantly reduce naturalness preference.

However, most existing research holds positive value assumptions about naturalness preference, with few studies on attenuating it. Future research should examine the negative consequences of naturalness preference and scientifically popularize beneficial products considered “unnatural,” using “nudge” techniques such as setting default options, increasing availability of “non-natural” product alternatives, and providing descriptive social norm information to correct biased views and irrational consumption resulting from naturalness preference.

5.2 Cultural-Psychological Differences in Naturalness Preference

Second, future research should deeply examine cultural-psychological differences in naturalness preference. Most existing research focuses on Western populations, with less investigation of Chinese people’s naturalness preference and scarce cross-cultural comparisons. A recent study found that although both Chinese and Western participants showed clear naturalness preference for medicines, Chinese participants’ preference was significantly stronger than Western participants’ (Ji et al., 2023), though the mechanisms underlying this difference remain unclear.

From a comparative philosophical perspective, Plato’s “Theory of Forms” suggests that the sensory world is not real, and that “Forms” constitute the true essence of all things. Thus, from a Western philosophical perspective, nature should be transformed to approach the perfect Forms (Xu Gang, 2002). In contrast, traditional Chinese philosophy has long emphasized harmonious co-existence between humans and nature, with Daoist concepts like “Dao follows nature,” “unity of heaven and humanity,” and “governing by non-action” all reflecting Chinese culture’s advocacy for following nature (Yu Feng, 2021). From a socio-ecological cultural perspective, China has traditionally been an agricultural culture deeply dependent on natural environments, requiring farmers to learn to follow natural timing and emphasizing grasping and revering natural laws (Fei Xiaotong, 2012). These perspectives may explain differences in attitudes toward nature between Eastern and Western populations. Recent research found that Chinese Daoists show stronger naturalness preference than atheists (Cao & Li, 2022), suggesting that religious beliefs or traditional cultural ideas shape naturalness preference. Future research could explore how indigenous religious beliefs and traditional cultural ideas shape different attitudes toward nature across cultures.

5.3 Impact of Naturalness Preference on Emerging Technology Acceptance

Finally, rapid scientific and technological development has profoundly transformed nature. Emerging technologies such as cloning and gene editing have sparked widespread ethical controversy. The public often feels unfamiliar with or even fearful of new production technologies and their products (Inbar et al., 2020; Krings et al., 2022). The reason is that people generally believe genetic modification violates natural laws, breaks species barriers, and disrupts nat-

ural evolutionary order, leading to rejection (Scott et al., 2018; Yunes et al., 2021). In contrast, people strongly prefer more traditional processing methods, believing that production methods passed down for thousands of years are very natural (Etale & Siegrist, 2021). For example, compared to gene editing, animal domestication retains more perceived naturalness (Rozin, 2005), suggesting that although both genetic technology and domestication cause genetic changes, people view changes from human labor as more natural than technological intervention. Therefore, understanding naturalness preference helps reflect on how technology transforms nature and explore how to make technology better serve humanity and promote harmonious coexistence between humans and nature.

However, unstoppable technological advancement has ushered humanity into the “Fourth Industrial Revolution” —the information intelligence revolution. Scientists have moved beyond mechanized assembly lines to develop artificial intelligence (AI) with autonomous learning capabilities that further mimic human minds. As highly intelligent human-made objects, AI provides numerous conveniences and has become indispensable to social development, yet remains rejected in some domains. Research shows that even when people cannot objectively distinguish products made or created by humans versus AI, they prefer human over robotic labor for products with high symbolic value related to personal beliefs and self-expression, such as tattoos (Granulo et al., 2021). People also dislike food cooked by robots (Nozawa et al., 2022) and generally reject AI-generated artworks aesthetically (Chamberlain et al., 2018). Researchers have explored factors affecting AI acceptance from perspectives such as anthropomorphism, human uniqueness, and human traits (Xu Liying, Yu Feng, 2020), but the “unnaturalness” of machine-made art or food may also contribute to human rejection of AI. However, few empirical studies have examined AI acceptance from the perspective of naturalness preference, with only occasional opinion pieces in philosophy or ethics literature (Li Zhen, 2020).

Finally, to cure human diseases and maximize physical and mental enhancement, scientists and tech companies have developed brain-computer interfaces or implanted smart chips in human bodies. Such human enhancement technologies are also viewed as highly unnatural (Banks et al., 2021) and raise numerous ethical controversies (Koverola et al., 2022). Westerners believe scientists are “playing God,” altering natural human structures and violating the sacredness of natural evolution (Waytz & Young, 2019). Chinese culture also emphasizes that “our bodies—every hair and bit of skin—are received from our parents,” leading people to view implanting non-living objects into human bodies as unnatural and immoral, resulting in rejection (Zhang et al., 2022). In summary, while technological development brings positive impacts to human society, its disruptive transformation of natural objects and evolutionary processes also triggers deep-seated anxiety and fear about emerging technologies like AI. Therefore, deeply investigating naturalness preference is important for understanding acceptance of various emerging technologies.

References

- Abouab, N., & Gomez, P. (2015). Human contact imagined during the production process increases food naturalness perceptions. *Appetite*, 91, 273–277. <https://doi.org/10.1016/j.appet.2015.04.002>
- Balling, J. D., & Falk, J. H. (1982). Development of visual preference for natural environments. *Environment and Behavior*, 14(1), 5–28. <https://doi.org/10.1177/0013916582141001>
- Bratman, G. N., Anderson, C. B., Berman, M. G., Cochran, B., de Vries, S., Flanders, J., ...Daily, G. C. (2019). Nature and mental health: An ecosystem service perspective. *Science Advances*, 5(7), eaax0903. <https://doi.org/10.1126/sciadv.aax0903>
- Cao, Y., & Li, H. (2022). Harmony between humanity and nature: Natural vs. synthetic drug preference in chinese atheists and taoists. *Journal of Religion and Health*, 61(4), 2743–2752. <https://doi.org/10.1007/s10943-021-01314-6>
- Celniker, J. B., Gregory, A., Koo, H. J., Piff, P. K., Ditto, P. H., & Shariff, A. F. (2023). The moralization of effort. *Journal of Experimental Psychology: General*, 151(1), 60–79. <https://doi.org/10.1037/xge0001259>
- Chamberlain, R., Mullin, C., Scheerlinck, B., & Wagemans, J. (2018). Putting the art in artificial: Aesthetic responses to computer-generated art. *Psychology of Aesthetics, Creativity, and the Arts*, 12(2), 177–192. <https://doi.org/10.1037/aca0000136>
- Chambers, E., Chambers, E., & Castro, M. (2018). What is “natural” ? Consumer responses to selected ingredients. *Foods*, 7(4), 65. <https://doi.org/10.3390/foods7040065>
- Cusimano, C., Royzman, E. B., Leeman, R. F., & Metas, S. (2018). Measurement the core disgust problem: Response to inbar and scott. *Judgment and Decision Making*, 13(6), 639–651.
- d’Astous, A., & Labrecque, J. (2021). The impact of responsible food packaging perceptions on naturalness and healthiness inferences, and consumer buying intentions. *Foods*, 10(10), 2366. <https://doi.org/10.3390/foods10102366>
- Dar-Nimrod, I., & Heine, S. J. (2011). Genetic essentialism: On the deceptive determinism of DNA. *Psychological Bulletin*, 137(5), 800–818. <https://doi.org/10.1037/a0021860>
- Droege, J. (2022). The handmade effect: A model of conscious shopping in an industrialised economy. *Review of Industrial Organization*, 60(2), 263–292. <https://doi.org/10.1007/s11151-021-09844-9>
- Etale, A., & Siegrist, M. (2021). Food processing and perceived naturalness: Is it more natural or just more traditional? *Food Quality and Preference*, 94, 104323. <https://doi.org/10.1016/j.foodqual.2021.104323>
- Fei, X. (2012). *Rural China*. Peking University Press.

Frizzo, F., Dias, H. B. A., Duarte, N. P., Rodrigues, D. G., & Prado, P. H. M. (2020). The genuine handmade: How the production method influences consumers' behavioral intentions through naturalness and authenticity. *Journal of Food Products Marketing*, 26(4), 279–296. <https://doi.org/10.1080/10454446.2020.1765936>

Fuchs, C., Schreier, M., & van Osselaer, S. M. J. (2015). The handmade effect: What's love got to do with it? *Journal of Marketing*, 79(2), 98–110. <https://doi.org/10.1509/jm.14.0440>

Gelman, S. A. (2013). *Essentialism: The meaning of naturalness*. Oxford University Press.

Girgis, H., & Nguyen, S. P. (2020). Grown or made? Children's determination of the origins of natural versus processed foods. *Cognitive Development*, 56, 100887. <https://doi.org/10.1016/j.cogdev.2020.100887>

Granulo, A., Fuchs, C., & Puntoni, S. (2021). Preference for (vs. Robotic) labor is stronger in symbolic consumption contexts. *Journal of Consumer Psychology*, 31(1), 72–80. <https://doi.org/10.1002/jcpy.1181>

Gray, H. M., Gray, K., & Wegner, D. M. (2007). Dimensions of mind perception. *Science*, 315(5812), 619–619. <https://doi.org/10.1126/science.1134475>

Gray, K., & Schein, C. (2016). No absolutism here: Harm predicts moral judgment 30× better than disgust—Commentary on Scott, Inbar, & Rozin (2016). *Perspectives on Psychological Science*, 11(3), 325–329. <https://doi.org/10.1177/1745691616635598>

Heine, S. J. (2017). DNA is not destiny. *W. W. Norton & Company*.

Hingston, S. T. (2018). *Essentialism, moral opposition, and the aversion to genetically modified foods* [Unpublished doctoral dissertation]. York University.

Huang, K. (2020). Analysis of the value and path of inheriting and innovating craftsmanship spirit through “handmade.” *Jinyang Academic Journal*, (3), 140–143.

Inbar, Y., & Scott, S. E. (2018). People respond to GM food with disgust more than fear: Comment on Rozyman, Cusimano and Leeman (2017). *Judgment and Decision Making*, 13(6), 636–638.

Inbar, Y., Phelps, J., & Rozin, P. (2020). Recency negativity: Newer food crops are evaluated less favorably. *Appetite*, 154, 104754. <https://doi.org/10.1016/j.appet.2020.104754>

Inzlicht, M., Shenhav, A., & Olivola, C. Y. (2018). The effort paradox: Effort is both costly and valued. *Trends in Cognitive Sciences*, 22(4), 337–349. <https://doi.org/10.1016/j.tics.2018.01.007>

Ji, L.-J., Lappas, C. M., Wang, X., & Meier, B. P. (2023). The naturalness bias influences drug and vaccine decisions across cultures. *Medical Decision Making*, 43(2), 252–262. <https://doi.org/10.1177/0272989X221140803>

- Jiang, Y., King, J. M., & Prinyawiwatukul, W. (2014). A review of measurement and relationships between food, eating behavior and emotion. *Trends in Food Science & Technology*, 36(1), 15–28. <https://doi.org/10.1016/j.tifs.2014.01.003>
- Job, V., Nikitin, J., Zhang, S. X., Carr, P. B., & Walton, G. M. (2017). Social traces of generic humans increase the value of everyday objects. *Personality and Social Psychology Bulletin*, 43(6), 785–792. <https://doi.org/10.1177/0146167217697095>
- Judge, M., Fernando, J. W., Paladino, A., & Kashima, Y. (2020). Folk theories of artifact creation: How intuitions about human labor influence the value of artifacts. *Personality and Social Psychology Review*, 24(3), 195–211. <https://doi.org/10.1177/1088868320905763>
- Judge, M., Fernando, J. W., Paladino, A., Mikolajczak, G., & Kashima, Y. (2020). Lay concepts of art, craft, and manufacture: Implications for sustainable consumption. *Journal of Social Issues*, 76(1), 19–34. <https://doi.org/10.1111/josi.12368>
- Kaplan, S. (1992). Environmental preference in a knowledge-seeking, knowledge-using organism. In J. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 581–598). Oxford University Press.
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, 15(3), 169–182. [https://doi.org/10.1016/0272-4944\(95\)90001-2](https://doi.org/10.1016/0272-4944(95)90001-2)
- Koch, J. A., Bolderdijk, J. W., & van Ittersum, K. (2021). Disgusting? No, just deviating from internalized norms: Understanding consumer skepticism toward sustainable food alternatives. *Journal of Environmental Psychology*, 76, 101645. <https://doi.org/10.1016/j.jenvp.2021.101645>
- Koverola, M., Kunnari, A., Drosinou, M., Palomäki, J., Hannikainen, I. R., Jirout Košová, M., ...Laakasuo, M. (2022). Treatments approved, boosts eschewed: Moral limits of neurotechnological enhancement. *Journal of Experimental Social Psychology*, 102, 104351. <https://doi.org/10.1016/j.jesp.2022.104351>
- Krings, V. C., Dhont, K., & Hodson, G. (2022). Food technology neophobia as a psychological barrier to clean meat acceptance. *Food Quality and Preference*, 96, 104409. <https://doi.org/10.1016/j.foodqual.2021.104409>
- Landy, J. F., Walco, D. K., & Bartels, D. M. (2017). What's wrong with using steroids? Exploring whether and why people oppose the use of performance enhancing drugs. *Journal of Personality and Social Psychology*, 113(3), 377–392. <https://doi.org/10.1037/pspa0000089>
- Lang, M., & Rodrigues, A. C. (2022). A comparison of organic-certified versus non-certified natural foods: Perceptions and motives and their influence on purchase behaviors. *Appetite*, 168, 105698. <https://doi.org/10.1016/j.appet.2021.105698>

- Lappas, C. M., Coyne, N., Dillard, A. J., & Meier, B. P. (2023). Do physicians prefer natural drugs? The natural versus synthetic drug bias in physicians. *European Journal of Health Psychology*, 30(1), 40–47. <https://doi.org/10.1027/2512-8442/a000116>
- Li, H., & Cao, Y. (2020). For the love of nature: People who prefer natural versus synthetic drugs are higher in nature connectedness. *Journal of Environmental Psychology*, 71, 101496. <https://doi.org/10.1016/j.jenvp.2020.101496>
- Li, Z. (2020). The natural dimension of artificial intelligence. *Yunnan Social Sciences*, (1), 40–46.
- Lockhart, K. L., Keil, F. C., & Aw, J. (2013). A bias for the natural? Children's beliefs about traits acquired through effort, bribes, or medicine. *Developmental Psychology*, 49(9), 1669–1682. <https://doi.org/10.1037/a0030769>
- Lull, R. B., & Scheufele, D. A. (2017). Understanding and overcoming fear of the unnatural in discussion of GMOs. In K. H. Jamieson, D. M. Kahan, & D. A. Scheufele (Eds.), *The Oxford Handbook of the Science of Science Communication* (pp. 409–412). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780190497620.013.44>
- Ma, S., Tsay, C. J., & Chen, E. E. (2023). Preference for talented naturals over hard workers emerges in childhood and shapes behavior. *Child Development*, 94(3), 674–690. <https://doi.org/10.1111/cdev.13886>
- Mallinson, L., Russell, J., Cameron, D. D., Ton, J., Horton, P., & Barker, M. E. (2018). Why rational argument fails the genetic modification (GM) debate. *Food Security*, 10(5), 1145–1161. <https://doi.org/10.1007/s12571-018-0842-7>
- Marozzo, V., Machin, J. E., & Moscato, E. M. (2020). The effect of packaging color on perceived naturalness and purchase intentions. *Journal of Consumer Behavior*, 19(5), 467–476.
- Marsh, L. E., Kanngiesser, P., & Hood, B. (2018). When and how does labour love? The ontogeny and mechanisms of the IKEA effect. *Cognition*, 170, 245–253. <https://doi.org/10.1016/j.cognition.2017.10.012>
- McAllister, E., Bhullar, N., & Schutte, N. S. (2017). Into the woods or a stroll in the park: How virtual contact with nature impacts positive and negative affect. *International Journal of Environmental Research and Public Health*, 14(7), 786. <https://doi.org/10.3390/ijerph14070786>
- Meidenbauer, K. L., Stenfors, C. U. D., Bratman, G. N., Gross, J. J., Schertz, K. E., Choe, K. W., & Berman, M. G. (2020). The affective benefits of nature exposure: What's nature got to do with it? *Journal of Environmental Psychology*, 72, 101498. <https://doi.org/10.1016/j.jenvp.2020.101498>
- Meidenbauer, K. L., Stenfors, C. U. D., Young, J., Layden, E. A., Schertz, K. E., Kardan, O., Decety, J., & Berman, M. G. (2019). The gradual development of

- the preference for natural environments. *Journal of Environmental Psychology*, 65, 101328. <https://doi.org/10.1016/j.jenvp.2019.101328>
- Meier, B. P., Dillard, A. J., & Lappas, C. M. (2019). Naturally better? A review of the natural-is-better bias. *Social and Personality Psychology Compass*, 13(8), e12494. <https://doi.org/10.1111/spc3.12494>
- Meier, B. P., Dillard, A. J., & Lappas, C. M. (2022). Predictors of the intention to receive a SARS-CoV-2 vaccine. *Journal of Public Health*, 44(3), 713–715. <https://doi.org/10.1093/pubmed/fdab013>
- Meier, B. P., Dillard, A. J., Fetterman, A. K., Ji, L.-J., & Lappas, C. M. (2023). Religiosity and the naturalness bias in drug and vaccine choices. *Journal of Religion and Health*, 62(1), 702–719. <https://doi.org/10.1007/s10943-022-01609-7>
- Meier, B. P., Dillard, A. J., Osorio, E., & Lappas, C. M. (2019). A behavioral confirmation and reduction of the natural versus synthetic drug bias. *Medical Decision Making*, 39(4), 360–370. <https://doi.org/10.1177/0272989X19838527>
- Moscato, E. M., & Machin, J. E. (2018). Mother natural: Motivations and associations for consuming natural foods. *Appetite*, 121, 18–28. <https://doi.org/10.1016/j.appet.2017.10.002>
- Newman, G. E. (2016). An essentialist account of authenticity. *Journal of Cognition and Culture*, 16(3-4), 294–321.
- Newman, G. E. (2019). The psychology of authenticity. *Review of General Psychology*, 23(1), 8–18.
- Nozawa, C., Togawa, T., Velasco, C., & Motoki, K. (2022). Consumer responses to the use of artificial intelligence in luxury and non-luxury restaurants. *Food Quality and Preference*, 96, 104436. <https://doi.org/10.1016/j.foodqual.2021.104436>
- Orians, G. H., & Heerwagen, J. H. (1992). Evolved responses to landscapes. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 555–579). Oxford University Press.
- Perkovic, S., Otterbring, T., Schärli, C., & Pachur, T. (2022). The perception of food products in adolescents, lay adults, and experts: A psychometric approach. *Journal of Experimental Psychology: Applied*. <https://doi.org/10.1037/xap0000384>
- Philipp-Muller, A., Lee, S. W. S., & Petty, R. E. (2022). Why are people antiscience, and what can we do about it? *Proceedings of the National Academy of Sciences*, 119(30), e2120755119. <https://doi.org/10.1073/pnas.2120755119>
- Rahman, S., Zasadzinski, L., Zhu, L., Edirisinghe, I., & Burton-Freeman, B. (2020). Assessing consumers' understanding of the term "Natural" on food labeling. *Journal of Food Science*, 85(6), 1891–1896. <https://doi.org/10.1111/1750-3841.15128>

- Richardson, M., McEwan, K., Maratos, F., & Sheffield, D. (2016). Joy and calm: How an evolutionary functional model of affect regulation informs positive emotions in nature. *Evolutionary Psychological Science*, 2(4), 308–320. <https://doi.org/10.1007/s40806-016-0065-5>
- Rozin, P. (2005). The meaning of “natural” : Process more important than content. *Psychological Science*, 16(8), 652–658. <https://doi.org/10.1111/j.1467-9280.2005.01589.x>
- Rozin, P., Fischler, C., & Shields-Argeles, C. (2012). European and American perspectives on the meaning of natural. *Appetite*, 59(2), 448–455. <https://doi.org/10.1016/j.appet.2012.06.001>
- Rozin, P., Spranca, M., Krieger, Z., Neuhaus, R., Surillo, D., Swerdlin, A., & Wood, K. (2004). Preference for natural: Instrumental and ideational/moral motivations, and the contrast between foods and medicines. *Appetite*, 43(2), 147–154. <https://doi.org/10.1016/j.appet.2004.03.005>
- Rutjens, B. T., Sutton, R. M., & van der Lee, R. (2018). Not all skepticism is equal: Exploring ideological antecedents of science acceptance and rejection. *Personality and Social Psychology Bulletin*, 44(3), 384–405. <https://doi.org/10.1177/0146167217741314>
- Ryazanov, A. A., & Christenfeld, N. J. S. (2018). The strategic value of essentialism. *Social and Personality Psychology Compass*, 12(1), e12370. <https://doi.org/10.1111/spc3.12370>
- Sanyal, M., McAuliffe, W. H. B., & Curry, O. S. (2023). Gross values: Investigating the role of disgust in bioethics. *Current Psychology*, 42(4), 2888–2895. <https://doi.org/10.1007/s12144-021-01609-7>
- Schirmacher, H., Elshiewy, O., & Boztug, Y. (2023). That’ s not natural! Consumer response to disconfirmed expectations about ‘natural’ food. *Appetite*, 180, 106270. <https://doi.org/10.1016/j.appet.2022.106270>
- 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. <https://doi.org/10.1177/1745691615621275>
- Scott, S. E., Inbar, Y., Wirz, C. D., Brossard, D., & Rozin, P. (2018). An overview of attitudes toward genetically engineered food. *Annual Review of Nutrition*, 38(1), 459–479. <https://doi.org/10.1146/annurev-nutr-071715-051223>
- Scott, S. E., & Rozin, P. (2017). Are additives unnatural? Generality and mechanisms of additivity dominance. *Judgment and Decision Making*, 12(6), 572–583.
- Scott, S. E., & Rozin, P. (2020). Actually, natural is neutral. *Nature Human Behaviour*, 4(10), 989–990. <https://doi.org/10.1038/s41562-020-0891-0>
- Scott, S. E., Rozin, P., & Small, D. A. (2020). Consumers prefer “natural” more for preventatives than for curatives. *Journal of Consumer Research*, 47(3),

454–471. <https://doi.org/10.1093/jcr/ucaa034>

Shtulman, A., Share, I., Silber-Marker, R., & Landrum, A. R. (2020). OMG GMO! Parent-child conversations about genetically modified foods. *Cognitive Development*, 55, 100895. <https://doi.org/10.1016/j.cogdev.2020.100895>

Siegrist, M., Sütterlin, B., & Hartmann, C. (2018). Perceived naturalness and evoked disgust influence acceptance of cultured meat. *Meat Science*, 139, 213–219. <https://doi.org/10.1016/j.meatsci.2018.02.007>

Silver, I., Newman, G., & Small, D. A. (2021). Inauthenticity aversion: Moral reactance toward tainted actors, actions, and objects. *Consumer Psychology Review*, 4(1), 70–82. <https://doi.org/10.1002/arcp.1064>

Swiney, L. (2020). Intuitive biology, moral reasoning, and engineering life: Essentialist thinking and moral purity concerns shape risk assessments of synthetic biology technologies. *Cognition*, 201, 104264. <https://doi.org/10.1016/j.cognition.2020.104264>

Szántó, V. (2018). Essentialism, vitalism, and the GMO debate. *Philosophy & Technology*, 31(2), 189–208. <https://doi.org/10.1007/s13347-017-0276-0>

Taylor, Z., & Stevenson, R. J. (2018). People believe and behave as if consumers of natural foods are especially virtuous. *Frontiers in Psychology*, 9, 1823. <https://doi.org/10.3389/fpsyg.2018.01823>

Tsay, C.-J. (2016). Privileging naturals over strivers: The costs of the naturalness bias. *Personality and Social Psychology Bulletin*, 42(1), 40–53. <https://doi.org/10.1177/0146167215611638>

Tsay, C.-J., & Banaji, M. R. (2011). Naturals and strivers: Preferences and beliefs about sources of achievement. *Journal of Experimental Social Psychology*, 47(2), 460–465. <https://doi.org/10.1016/j.jesp.2010.12.010>

Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11(3), 201–230. [https://doi.org/10.1016/S0272-4944\(05\)80184-7](https://doi.org/10.1016/S0272-4944(05)80184-7)

van Gerven, D. J., Land-Zandstra, A. M., & Damsma, W. (2019). From Hitler's sweater to dinosaur fossils: An essentialist outlook on authenticity. *Review of General Psychology*, 23(3), 371–381.

Waytz, A., & Young, L. (2019). Aversion to playing God and moral condemnation of technology in science. *Philosophical Transactions of the Royal Society B*, 374(1771), 20180041. <https://doi.org/10.1098/rstb.2018.0041>

Weinberger, A. B., Christensen, A. P., Coburn, A., & Chatterjee, A. (2021). Psychological responses to buildings and natural landscapes. *Journal of Environmental Psychology*, 77, 101676. <https://doi.org/10.1016/j.jenvp.2021.101676>

Wilks, M., & Bloom, P. (2022). Children prefer natural food, too. *Developmental Psychology*. <https://doi.org/10.1037/dev0001387>

Wilks, M., Hornsey, M., & Bloom, P. (2021). What does it mean to say that cultured meat is unnatural? *Appetite*, 156, 104960. <https://doi.org/10.1016/j.appet.2020.104960>

Wilson, E. O. (1984). *Biophilia*. Cambridge, MA: Harvard University Press.

Xu, G. (2002). Natural philosophy twin peaks: A comparative study of Zhu Xi and Plato. *Journal of Shangrao Normal College*, 22(4), 23–29.

Xu, L., & Yu, F. (2020). Factors influencing robot acceptance. *Science Bulletin*, 65(6), 496–510.

Yang, Y., Geng, L., Xiang, P., Zhang, J., & Zhu, L. (2017). Nature connectedness: Concept, measurement, function, and intervention. *Advances in Psychological Science*, 25(8), 1360–1371.

Yunes, M. C., Osório-Santos, Z., von Keyserlingk, M. A. G., & Hötzel, M. J. (2021). Gene editing for improved animal welfare and production traits in cattle: Will this technology be embraced or rejected by the public? *Sustainability*, 13(9), <https://doi.org/10.3390/su13094966>

Yu, F. (2021). What are the differences between Chinese and Western thinking? *Journal of Shanxi Normal University (Social Science Edition)*, 48(2), 20–26.

Zhang, H., Yu, F., & Ding, X. (2022). Why are people averse to becoming a cyborg? Untangling the roles of moral attitudes and perceived identity change in technological implant acceptance. *Preprint*, Retrieved from https://www.researchgate.net/publication/366200912_{{Why}}{{are}}}{{people}}}{{averse}}}{{to}}}{{b

Zheng, Y., & Alba, J. W. (2023). Origin versus substance: Competing determinants of disruption in duplication technologies. *Journal of Consumer Research*, 49(6), 944–966. <https://doi.org/10.1093/jcr/ucac031>

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