

The Evolutionary Bases for Sustainable Behavior: Implications for Marketing, Policy, and Social Entrepreneurship

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How can evolved human nature be leveraged to help eliminate or alleviate environmental problems? The authors examine the evolutionary bases of destructive and ecologically damaging human behavior. They propose that many modern environmental and social problems are caused or exacerbated by five adaptive tendencies rooted in evolutionary history: (1) propensity for self-interest, (2) motivation for relative rather than absolute status, (3) proclivity to unconsciously copy others, (4) predisposition to be shortsighted, and (5) proneness to disregard impalpable concerns. By considering the evolutionary processes that produced these tendencies, the authors present ways that marketers, policy makers, and social entrepreneurs can harness evolved human tendencies to lessen or even eradicate environmental and social problems. From an evolutionary perspective, optimally effective influence strategies must work with humans' evolved tendencies, rather than ignoring them or working against them.

Keywords: green marketing, sustainability, evolutionary psychology, social influence, prosocial behavior

Natural selection has shaped all living organisms to exploit resources effectively. Our human problem is that, through our cleverness, we have created a novel evolutionary circumstance—we now have such technology that the very behavioural tendencies which we evolved to do well are those most likely to ruin us.

—Joel Heinen and Bobbi Low (1992, p. 106)

Our ancestors were highly adept at extracting resources from the environment and using them to survive, thrive, and reproduce, but whereas we have inherited tendencies that were adaptive in the world of our forebears, we live in a world that is considerably different from the one inhabited by our predecessors. Our ancestors were nomadic hunter-gatherers living in bands of 50–150 people; they lived on a planet with fewer than one million people; and they continuously moved their camps to new locations when resources became exhausted, conditions changed, or waste accumulated. In contrast, today many of us permanently live in dense cities of millions on a planet populated by billions. The same behavioral tendencies that enabled our nomadic ancestors to thrive can wreak ecological and social havoc in a technologically advanced world with more than seven billion people.

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Although most people want to preserve the natural environment, changing old habits can be a formidable challenge, especially when those habits have been adaptive for many millennia. A recent survey shows that while an overwhelming majority of people have great enthusiasm for being green and lowering their carbon footprint, only 9% use any environmentally friendly products, only 7% turn off unneeded lights or appliances, and just 6% curb water consumption (The Home Depot 2009). When surveyed one year later, people were even more confident that they could have a positive effect on the environment, but even fewer respondents reported taking any action to reduce their impact on the planet (The Home Depot 2010).

In this article, we consider the evolutionary bases for why people sometimes act in destructive and ecologically damaging ways. In doing so, we present insights into how our evolutionary past can inform strategies used by marketers, policy makers, and social entrepreneurs to help change socially problematic behaviors (Bloom 2009). For example, we discuss how one small social entrepreneur firm called OPOWER harnessed an ancestral tendency to dramatically reduce home energy use, leading President Obama to hail it as a model for how to effectively motivate proenvironmental behavior (Cuddy and Doherty 2010).

We begin with a brief review of what it means to examine behavior from an evolutionary perspective. We then discuss the evolutionary bases for why people sometimes act in destructive ways. We propose that many modern environmental and social problems are caused or exacerbated by five evolutionary tendencies: (1) propensity for genetic self-interest, (2) motivation for relative rather than absolute status, (3) proclivity to unconsciously copy others, (4) predisposition

to be shortsighted, and (5) proneness to disregard impalpable concerns. We next examine the evolutionary processes that produced each tendency by drawing on theory from the natural sciences, including kin selection, reciprocal altruism, costly signaling, and life history theory. By considering how and why deep ancestral forces continue to shape modern behaviors, we suggest that evolutionary tendencies can be harnessed by marketers, policy makers, and social entrepreneurs to mitigate or eliminate social problems. Although we focus on sustainability and conservation, many of the ideas herein apply to helping solve a multitude of modern social problems, including obesity, overpopulation, poverty, and many types of risky behavior.

Evolution and Modern Behavior

Humans are living fossils—collections of mechanisms produced by prior selection pressures operating on a long and unbroken line of ancestors.

—David Buss (1995, p. 10)

An evolutionary approach to behavior is based on the seminal work of Charles Darwin (1859, 1871). In the past few decades, evolutionary considerations of human behavior have produced an immense amount of theoretical and empirical insights into psychology, anthropology, and economics (Buss 2005; Dunbar and Barrett 2007; Gandolfi, Gandolfi, and Barash 2002; Saad 2007). Evolutionary approaches are increasingly influencing marketing (Durante et al. 2011; Griskevicius, Goldstein, et al. 2009; Griskevicius, Shiota, and Nowlis 2010; Miller 2009; Saad and Vongas 2009; Van den Bergh, Dewitte, and Warlop 2008), as well as medicine, law, and business (Colarelli 2003; Jones and Goldsmith 2005; Nesse and Stearns 2008; Saad 2011; Van Vugt and Ahuja 2011).

An evolutionary approach suggests that just as the forces of natural selection can shape morphological features, such as the shape of our hands, those forces also shape behavioral and psychological tendencies. This approach maintains that humans inherit brains and bodies equipped to behave in ways that are *adaptive*—that is, fit to the demands of the environments within which their ancestors evolved (Buss 2005; Kenrick et al. 2010; Tooby and Cosmides 1992). However, as we discuss subsequently, people are not always aware of the evolutionary reasons for their behavior, and the behavioral tendencies that were adaptive in ancestral environments are not always adaptive today.

Distinguishing Proximate and Ultimate Causes of Behavior

An evolutionary approach pertains to the adaptive function of behavior. It asks: How might a given behavior have helped our ancestors survive or reproduce? This approach focuses on a particular type of “why” question. When asking *why* children prefer doughnuts over spinach, for example, one answer is that doughnuts taste better and elicit more pleasure than spinach. An evolutionary approach, however, would also ask why sweetened, fatty foods taste good and elicit more pleasure in the first place. In this case, the reason is that humans have inherited a tendency to crave

fatty and sweet foods, such as meat and ripe fruit (Rozin 2005). These types of foods provided our ancestors with much-needed calories in a food-scarce environment and did so more effectively than foods low in fat or sugar (e.g., roots, leaves, unripe fruit). In the modern world of supermarkets and convenience stores, although people know that they should resist Ben & Jerry’s latest combination of ice cream, cookies, and brownies, their evolved mechanisms continue to signal the adaptive benefits of fatty and sweet foods. This evolutionary explanation for food preferences is known as an ultimate explanation or cause.

An evolutionary perspective draws an important distinction between *ultimate* and *proximate* explanations for behavior (Kenrick et al. 2010; Tinbergen 1963). Behavioral scientists have typically been concerned only with proximate explanations, which focus on relatively immediate triggers for behavior. When asking why people behave in a certain way, proximate explanations include culture, incentives, preferences, learning, utility, pleasure, happiness, values, emotions, and personality. However, an evolutionary perspective contends that it is useful and important to consider the ultimate, evolutionary reasons for behavior—to ask why humans evolved to behave in a certain way.

It is important to note that proximate and ultimate explanations are not competing. Instead, they are complementary, explaining behavior at different levels of analyses. Because human behavior is the product of brain activity and the brain is an evolved organ, all behaviors have *both* ultimate and proximate explanations. For example, children like sweet foods because such treats elicit pleasure (proximate reason) *and* because humans have evolved to crave sweet and fatty foods (ultimate reason). Both explanations are simultaneously correct; each one provides insight into the same behavior at a different level of analysis.

Although all behavior is driven by both proximate and ultimate motives, people are not always aware of the ultimate motives for their behavior. A large body of literature shows that evolutionary motives often guide behavior in an automatic, nonconscious manner (Barrett and Kurzban 2006; Kenrick et al. 2010). An important insight from this work is that people are often unaware of the evolutionary reasons behind their behavior, but because behavior has both proximate and ultimate motives, people often have multiple motives for a given behavior. For example, a proenvironmental act can be driven by altruistic motives at the proximate level (e.g., “I want to be nice and help the environment”) but also by nonconscious selfish motives at the ultimate level (e.g., “Being nice helps my reproductive fitness by enhancing my reputation”). Although our genes are selfish at the ultimate level, selfish genes can and do build organisms that are capable of behaving in ways that are kind, charitable, and sustainable (Dawkins 1976).

Mismatches Between Current and Ancestral Environments

An evolutionary perspective asserts that people interact with their present-day world using brains that evolved to confront ancestral problems. However, although our Stone Age brains are designed to produce adaptive behaviors in the ancestral environment, this does not mean that they will

always produce adaptive behaviors today. For example, the evolved desire for sexual gratification can lead to modern behavior with no evolutionary benefits, such as watching pornography, which is sexually arousing but does little to help people's reproductive fitness. An evolutionary approach emphasizes that there is often a mismatch between what our brains were designed to confront and what we confront in the modern world (Ornstein and Ehrlich 1989; Penn 2003). This is because brain evolution takes many thousands of years, but the environment (e.g., technology) has changed much more rapidly. For example, our brains have not evolved to respond adaptively to the ready availability of calorie-dense foods in supermarkets and convenience stores, which is an evolutionarily novel phenomenon.

An important insight from an evolutionary perspective is that strategies aimed to change behaviors might be fighting an uphill battle when those strategies are mismatched with the ancestral motives driving the problematic behavior. If so, this implies that influence strategies might be more effective when they are matched to the evolutionary mechanism driving the problematic behavior. For example, consider the common strategies used in the hope of reducing consumption of unhealthy foods. Some strategies use guilt to persuade people that eating junk food is bad, other strategies urge eaters to exercise self-control and restraint, and still others inform people about the high number of calories in their food. Although such strategies may be somewhat successful, an evolutionary perspective argues that they may be suboptimal because each strategy works directly against our evolved tendencies. As mentioned, our bodies evolved to respond to the taste of fat and sugar by feeling immense pleasure; we evolved to quickly devour all available sweet or fatty foods because such foods were perpetually scarce and perishable; our ancestors did not count calories, nor did they know the number of calories in different foods or how many calories they should be consuming.

An evolutionary approach argues that strategies to change eating behavior may be more effective if they are directly matched to the evolutionary mechanism driving the problem. In the case of food, humans have evolved to crave the *taste* of sweet and fatty foods because this taste signals adaptive benefits to the brain. Thus, as long as unhealthy food tastes good and remains affordable, persuading people to substitute healthful snacks for sugary treats will be difficult. However, people might have more healthful diets if healthful foods were better at persuading their senses that such foods taste good. For example, people might eat more celery, broccoli, and Brussels sprouts if these foods tasted adaptively valuable—that is, if the taste of these foods was augmented to provide cues of sweetness and fattiness. Although this strategy might seem strange, it is already being used with great success with several types of foods. For example, people commonly put salad dressing on their vegetables, effectively changing the taste of green vegetables to be fattier and tangier. The same type of strategy has also been used successfully by U.S. pharmacies in getting unwilling children to take essential but putrid-tasting medications, by flavoring these medications with the taste of fruity sugars.

The takeaway message is that consideration of the evolutionary mechanism driving a problematic behavior can provide insights into strategies for changing that behavior. By matching influence strategies to work with, rather than against, evolved tendencies, marketers, policy makers, and social entrepreneurs may be more effective at mitigating or eliminating socially problematic behaviors.

Evolutionary Reasons for Modern Ecological Problems

The suggestion that our evolved human nature is a source of environmental exploitation and degradation is not a claim that nothing can be done, but a warning that effective conservation strategies will have to incorporate an understanding of relevant evolved psychological processes in order to modify human action.

—Wilson, Daly, and Gordon (1998, p. 517)

According to popular belief, humans are inherently good and naturally inclined to restrain themselves from depleting environmental resources. This idea of an ecological “noble savage” dates back to the writings of the eighteenth-century French philosopher Jean-Jacques Rousseau, and it suggests that many contemporary social problems and poor environmental practices are a product of modern, wasteful Western culture. However, traditional societies are not the peace-loving conservationists they were once thought to be (Smith and Wishnie 2000). Although many traditional societies believe in the sacredness of nature, for example, holding such beliefs does not actually result in having a low ecological impact (Low 1996). Instead, current evidence suggests that the low ecological impact of many traditional societies is more strongly associated with low population densities and lack of technology. In our evolutionary past, our nomadic hunter-gatherer ancestors moved their camp to new locations when resources in current locations became scarce or waste accumulated. This nomadic past suggests that human nature has been designed to extract and consume resources from the environment, rather than to preserve and conserve them. Rather than being noble savages, our species has a long history of producing ecological and social calamities (Diamond 2005; Penn 2003).

Why do humans continue to degrade the environment and experience social problems? We propose that a large portion of human-inflicted ecological damage is caused or exacerbated by five ancestral tendencies: (1) propensity for self-interest, (2) motivation for relative rather than absolute status, (3) proclivity to unconsciously copy others, (4) predisposition to be shortsighted, and (5) proneness to disregard impalpable concerns (see Table 1). These tendencies are not mutually exclusive, in which the most ecologically damaging behaviors often involve a combination of several tendencies. Although all these tendencies were adaptive in the ancestral environment, they can have devastating consequences in the modern world—in the same way that people's adaptive tendency for craving sweet and fatty foods can lead to obesity in the modern world of caloric abundance.

Several of the tendencies we describe are well documented in scientific literature. However, merely documenting that humans possess these tendencies does not provide

Table 1. Ancestral Tendencies and Strategies for Influencing Behavior

Ancestral Tendency	Key Theoretical Principles	Examples of Strategies Mismatched with Ancestral Tendencies	Examples of Strategies Matched with Ancestral Tendencies
Self-interest <i>People prioritize self-interest over group welfare</i>	Kin selection Reciprocal altruism Indirect reciprocity	<ul style="list-style-type: none"> • Imploring people to value the group above themselves • Urging self-restraint for the sake of other people or for the sake of the environment • Offering donation to green cause only if people first purchase a product 	<ul style="list-style-type: none"> • Highlight benefits to a person's genetic self-interest • Create small, dense, and interdependent social networks resembling ancestral groups • Threaten reputations and foster group identities • Donate to green cause to create obligation and then ask people to reciprocate in return
Relative status <i>People are more motivated by relative rather than absolute status</i>	Costly signaling Competitive altruism	<ul style="list-style-type: none"> • Urging people to be content with their current level of status • Asking people to behave in ways that lower their status • Emphasizing that some people have more goods than people in distant places 	<ul style="list-style-type: none"> • Encourage competitions on prosocial outcomes (e.g., the most sustainable) • Publicize lists that rank the most prosocial companies, celebrities, or ordinary citizens • Make people who engage in self-sacrificing behaviors easy to identify
Social imitation <i>People copy unconsciously what others are doing</i>	Mimicry Cultural evolution Social norms	<ul style="list-style-type: none"> • Depicting undesirable behaviors as regrettably frequent • Informing people of what the average person is doing 	<ul style="list-style-type: none"> • Depict the high prevalence, or perceived prevalence, of the desired behavior • Use social approval to encourage those above average to continue their behavior (OPOWER strategy)
Future discounting <i>People value the present more than the future</i>	Life history theory Sexual selection Parental investment	<ul style="list-style-type: none"> • Calling on people to value needs of future generations as much as those of present generations • Depicting the world as fast paced and ever changing 	<ul style="list-style-type: none"> • Emphasize consequences of unsustainable behavior for present, not for future, generations • Highlight the stability, predictability, and safety of the world in which people live • Depict that women prefer men who engage in prosocial and sustainable behavior
Impalpable concerns <i>People disregard problems they cannot see or feel</i>	Sensory mechanisms Environmental mismatch Biophilia	<ul style="list-style-type: none"> • Presenting distant environmental problems by showing statistics • Depicting environmental problems by appealing to evolutionarily recent cognitive abilities 	<ul style="list-style-type: none"> • Present local environmental problems to elicit visceral responses • Create visible links between behavior and its immediate environmental consequences

insight into how or why they evolved to possess them. The usefulness of an evolutionary perspective comes from using appropriate theories to identify why these tendencies exist, which can shed light on how to work with them to change human behavior.

In the next section, we discuss each evolutionary tendency by drawing on theories from the natural sciences, including kin selection, reciprocal altruism, costly signaling, and life history theory. For each tendency, we highlight potential marketing and policy mistakes that can result from not taking the evolutionary power of each tendency into account. By considering in more detail the evolutionary roots of these tendencies, we also suggest how each tendency can be potentially harnessed to promote social change. Although some of the implications and applications we suggest need further testing, many have already been tried and tested.

1: Propensity for Self-Interest

Humans evolved to be tempted by opportunities to reap more rewards for themselves while forcing costs on others (Hawkes 1992). Natural selection does not care about the survival of the species; what matters is the replication of one's genes, which often comes at the expense of the survival of others' genes (Dawkins 1976). Although people vary in the extent to which they exploit others (Van Lange et al. 1997), they are disposed to make selfish choices in social dilemmas, especially when interacting with strangers in large groups (Komorita and Parks 1994; Van Vugt 2009).

Many environmental problems result from this inherent conflict between personal and collective interests, in which narrow self-interests often prevail against the common good of the group. This tension is famously captured by the tragedy of the commons metaphor (Hardin 1968), in which

a small pasture is shared by multiple herders. Although the herders all want everyone's grazing to be limited, each herder realizes that if he adds just a few extra cattle to the pasture, he will gain a net personal benefit, while the costs are shared among all the herders. The result is an unintended tragedy: Most people increase their grazing, thereby destroying the commons (Dawes 1980; Dietz, Ostrom, and Stern 2003).

Because humans evolved to be self-interested, influence strategies urging people to value the group above themselves tend to be suboptimal (Penn 2003). For example, trying to persuade people to engage in self-restraint purely for environmental reasons is rarely effective (Gardner and Stern 2002). Even if such strategies appear to work at the outset, voluntary restraint is likely to be only a temporary solution because the mere possibility of free-riders (cheaters) breeds paranoia and temptation (Van Vugt 2009). For example, a campaign urging people to use restraint in water use actually increased water use because people feared that others would be unwilling to restrain themselves (Van Vugt 2001).

Although eradicating the evolved proclivity for self-interest will be difficult, an evolutionary perspective suggests that people are more likely to behave prosocially when such behavior is grounded in evolutionarily selfish reasoning. In the following subsections, we discuss several theories from evolutionary biology that point to the origin of human selfishness and cooperation. Each theory suggests ways that people's selfish tendencies could be harnessed to generate self-sacrificial and proenvironmental behavior.

Kin Selection and Psychological Kinship

An evolutionary perspective highlights that self-interest does not equate to the interest of an individual person. The theory of kin selection (or inclusive fitness theory) notes that people have evolved to ensure the survival and replication of their genes—genes that are shared with family and kin (Hamilton 1964). Kin selection has important implications for self-sacrifice and cooperation in environmental social dilemmas. From an evolutionary perspective, benefiting an unrelated stranger at one's expense is critically different than benefiting a genetic relative, because helping a kin member is akin to benefiting oneself (Kenrick, Sundie, and Kurzban 2008). Indeed, across cultures and species, people are much more likely to share resources with kin than nonkin and with close kin more than distant kin (Burnstein, Crandall, and Kitayama 1994; Dunbar and Barrett 2007).

According to the theory of kin selection, appeals may be more influential if they emphasize the interests of kin. A message urging people to conserve water, for example, may be more effective if it emphasizes that there might not be enough water left for their children, grandchildren, nephews, nieces, and cousins. Consistent with this idea, recent research shows that messages emphasizing conserving the environment for one's kin are more effective at spurring environmental volunteerism than nonkin appeals (Neufeld et al. 2011). Another implication of kin selection is that prosocial behavior might be more powerfully motivated by the use of fictitious kin labels. This means that messages emphasizing that unrelated groups are like fami-

lies (e.g., sisterhood, brotherhood) might elicit greater self-sacrifice by activating a psychological sense of kinship.

Reciprocal Altruism and Social Obligation

Humans have also evolved to cooperate with people outside their family, and evolutionary theorists explain this type of nonkin cooperation in light of the theory of reciprocal altruism (Trivers 1971). Cooperation with nonkin can evolve if the helpers can benefit by being helped in return. Conditions in human ancestral groups were well suited for the evolution of reciprocal altruism because hunter-gatherer groups formed small and stable social networks (Foley 1997). Research shows that modern small communities with dense and interdependent social networks—much like those found in hunter-gatherer bands that resemble the environments of our ancestors—are better at preserving communal resources (Ostrom 1990; Van Vugt 2009). For example, fishery communities with stronger networks have more sustainable fishing practices (Palmer 1991), and dense community networks speed up the adoption of green technologies through word of mouth (Gardner and Stern 2002).

Consideration of reciprocal altruism suggests that proenvironmental behavior could be fostered more easily by the creation of small and interdependent social networks. Consistent with much previous research, people should be more willing to self-sacrifice for a group of nonrelatives if they perceive themselves as interdependent with those other members. Although modern cities of millions of anonymous people are a stark contrast to the world of our ancestors, online social networking tools, such as Facebook and Twitter, could be used to turn large, anonymous masses into small, dense, and interconnected virtual communities that psychologically resemble ancestral bands.

Reciprocal altruism is related to another popular tit-for-tat influence strategy: offering a donation to a prosocial cause in return for a specific purchase, a strategy that falls under the rubric of cause-related marketing (Varadarajan and Menon 1988). For example, for every Samsung Reclaim phone purchased, Samsung donated \$2 to the Nature Conservancy. Similarly, hotels sometimes offer a donation to an environmental cause if guests reuse their towels. Cause-related marketing is believed to be so effective that it is the fastest-growing area of corporate sponsorship, outpacing sports sponsorships (Watson 2006).

Although cause-related marketing approaches can be effective, there is reason to believe that they may be suboptimal (Goldstein, Griskevicius, and Cialdini 2012; Newman and Shen 2011). This is because most types of cause-related marketing do not actually harness reciprocal altruism. For example, the agent asking people to engage in a proenvironmental act does not provide any initial benefit that allows the recipients to reciprocate. Instead, cause-related marketing simply provides an indirect incentive for people to purchase a product. Consideration of reciprocal altruism suggests a small but theoretically crucial alteration to the practice of cause-related marketing: switching the order of giving. If the company were to first donate resources to a prosocial cause on behalf of its customers (rather than first asking customers to purchase a product), it might elicit the tendency to reciprocate. Consistent with this idea, recent research shows that a message in hotel rooms

informing guests that the hotel had already donated to an environmental cause on behalf of its guests increased towel reuse by 26% (Goldstein, Griskevicius, and Cialdini 2012). Taken together, small changes in the sequence of a message can produce large changes in behavior if the strategy harnesses an evolutionary tendency, such as reciprocal altruism.

Indirect Reciprocity, Reputation, and Group Identity

Humans have also evolved to cooperate with people who cannot directly return favors. The evolution of this kind of helping is usually explained in light of theories of indirect reciprocity (Nowak and Sigmund 2005). Indirect reciprocity posits that organisms can evolve the ability to cooperate with nonreciprocating strangers because doing so can establish a reputation as a good cooperater. The ultimate reason helping strangers evolved is that gaining a reputation for being cooperative is associated with increased status in a social hierarchy and more opportunities for alliances (Hardy and Van Vugt 2006).

Indirect reciprocity posits that people might be particularly responsive to influence strategies that target reputation. For example, people are less likely to deplete resources when their reputation is at stake (Hardy and Van Vugt 2006; Milinski et al. 2006). Reputational concerns can also induce people to buy proenvironmental products even when they perceive such products as inferior (Griskevicius, Tybur, and Van den Bergh 2010). Similarly, reputation is a powerful tool for inducing firms to adopt sustainable practices. For example, a consumer-led “name and shame” campaign forced McDonald’s to abandon plastic packaging in favor of more sustainable materials (Gardner and Stern 2002). Research shows that reputational concerns can be activated by something as simple as a picture of eyes on a poster, which has been shown to decrease free-riding in a social dilemma (Bateson, Nettle, and Roberts 2006). This implies that signs, stickers, or even computer monitors with eyes might spur prosocial behavior.

Concerns about reputation are especially powerful when people strongly identify with a group and its members. For example, the strength of people’s community identification predicts their willingness to help solve social dilemmas (Van Vugt 2001), and high community identifiers are more willing to punish cheaters and compensate for undesirable behavior of other community members (Brewer and Kramer 1986). Recent neuroscience findings reveal that similar brain regions are activated when people help strangers with whom they strongly identify as when they help kin (Harbaugh, Mayr, and Burghart 2007), suggesting that people can perceive members of their community as kin. Thus, sustainable behavior might be increased by fostering stronger community identities. For example, a local group identity can be strengthened by emphasizing a common threat, such as the collapse of the local tourist economy when a shared resource, such as a rain forest, is being destroyed (Van Vugt 2009). In summary, whether by strengthening community identity, activating reputational concerns, or eliciting the obligation to reciprocate, an evolutionary perspective suggests that people will be more willing to self-sacrifice and behave proenvironmentally if they foresee a material gain

for themselves, their kin, or their tribe.

2: Desire for Relative Status

A second evolutionary factor contributing to modern environmental problems is the universal human desire for status. This desire produces excessive consumption, especially of extravagant, showy goods that have no immediate survival value. Such consumption contributes significantly to the depletion of natural resources, pollution, and waste (Frank 2007; Penn 2003). According to Miller (2000, 2009), wasteful consumption is evolutionarily rooted in people’s innate desire for status that improves reproductive opportunities. Because success in evolution is always relative (a gene must do better than alternative alleles to spread), in general, people should be more concerned with relative status than absolute status. For example, people are not so much motivated to have a large house than to have a house larger than their neighbor’s house (Frank 1985). Similarly, an increase in relative wealth makes people happier than an increase in their absolute wealth (Diener and Suh 2000).

The desire to “keep up with the Joneses” is often presented as an invention of modern Western culture. For example, Thorstein Veblen’s (1899) classic treatise on *Theory of the Leisure Class* is widely regarded as a critique of frivolous consumer behavior in capitalist society. Yet Veblen himself observed that conspicuous consumption had occurred throughout human history (Sundie et al. 2011). Egyptian pharaohs displayed their wealth with golden thrones, elaborate artworks, and giant pyramids, and Indian maharajahs built extravagant and ostentatious villas while keeping collections of rare and exotic animals on their expansive estates. Such showy displays of wealth have been documented in cultures as diverse as feudal Europe and Japan and among Polynesian Islanders, Icelandic communities, Amazonian foraging tribes, and Melanesian people of Australia (Bird and Smith 2005; Godoy et al. 2007; Van Vugt and Hardy 2010).

Strategies for reducing overconsumption that do not account for the importance of relative status are often fighting an uphill battle. For example, it is misguided to blame advertising for creating a thirst for status. Rather than being the root of the problem, savvy marketers are simply exploiting people’s innate desires. It will also be difficult to persuade people to be content with their current status or behave in ways that lowers their status. For example, imploring Westerners to consume less because they are wealthier than most people in the world is likely to do little to slow consumption. In the following subsections, we discuss several theories from evolutionary biology that point to the origin of the human thirst for status. Rather than trying to eradicate the drive for status, each theory suggests how this tendency can be harnessed to motivate people to behave in self-sacrificing and proenvironmental ways.

Costly Signaling and Competitive Altruism

The evolutionary root of people’s desire for relative status is usually explained by costly signaling theory (Zahavi and Zahavi 1997). This theory posits that natural selection favors people who engage in activities that are increasingly

costly—involving significant resources, energy, risk, or time—as a way to signal their ability to incur costs, which is associated with status (Bird and Smith 2005; Miller 2009). With this perspective, people who buy second homes, for example, effectively convey to their peers that they can incur the cost of spending large sums of money on nonessential goods, thereby increasing their relative status (Van Vugt and Hardy 2010).

Because costly behaviors may have evolved to signal the ability to incur costs, competitions for relative status should not be limited to consumption. For example, the media mogul Ted Turner can signal his ability to incur costs by building another mansion or by donating the same million dollars to proenvironmental causes. People who are considered wealthy *and* helpful tend to be perceived as more trustworthy, as more desirable friends and romantic partners, and as better leaders (Barclay 2004; Cottrell, Neuberg, and Li 2007; Griskevicius et al. 2007; Hardy and Van Vugt 2006; Iredale, Van Vugt, and Dunbar 2008).

People throughout history have been known to compete for status through self-sacrifice, a concept known as “competitive altruism” (Roberts 1998; Van Vugt, Roberts, and Hardy 2007). In the Native American Kwakiutl practice of potlatching, for example, tribal chiefs compete to give away their possessions. The person who is able to give away the most resources gains status (Cole and Chaikin 1990). Anthropologists have observed competitive altruism behaviors in numerous societies, including the Ache of Paraguay, the Meriam of Australia, and the Shuar of the Amazon (Price 2003; Smith and Bird 2000).

Status and Competitive Environmentalism

Consideration of competitive altruism suggests that people are particularly motivated to compete for status through proenvironmental behaviors that can signal self-sacrifice. A key component of harnessing the desire for status to benefit the environment is that environmental acts need to be visible to others (Hardy and Van Vugt 2006). For example, status desires motivate people to buy green products, particularly when someone is around to see it (Griskevicius, Tybur, and Van den Bergh 2010). This suggests that firms or organizations that have an explicitly proenvironmental option should provide people with visible signs or tags for choosing the green option, so that people can clearly display their self-sacrificing green acts.

Competitive environmentalism also suggests that a particularly effective strategy would be publicizing a “green list” that ranks the top greenest companies, celebrities, or ordinary citizens. The media mogul Ted Turner, for example, once bemoaned the influence of the *Forbes* 400 list of richest Americans, pointing out that this publicized list discouraged the wealthy from donating to charity for fear of slipping down in the rankings. Perhaps it was not a coincidence that a public list of top philanthropists—the *Slate* 60—was established the very same year that Turner publicly pledged one billion dollars to humanitarian relief. Similar types of publicized lists of “least polluting companies” in India have been remarkably effective at motivating firms to voluntarily reduce pollution (Powers et al. 2008), suggesting that people worldwide are willing to engage in self-sacrificing behavior to avoid appearing at the bottom of a status hierarchy.

Finally, consideration of competitive environmentalism also has implications for the pricing of green products. This perspective suggests that sometimes increasing the price of a green product can cause that product to become *more* desirable because it signals that purchasers are prepared to incur costs. For example, after U.S. tax credits for the proenvironmental Toyota Prius expired, sales increased by 68.9% (Toyota 2008). Although this increase might have been even larger had the tax incentive remained, pundits were similarly bewildered by Lexus’s decision to begin selling a hybrid sedan priced at more than \$120,000. Yet again, sales of the proenvironmental and ultraexpensive Lexus LS600h exceeded projections by more than 300% (Ramsey 2007). When green products are cheaper than their nongreen counterparts, their desirability can decrease because such products might convey to peers that their owners cannot afford more expensive alternatives (Griskevicius, Tybur, and Van den Bergh 2010). An implication of costly signaling theory is that making some green products cheaper, easier to buy, and more time saving might undercut their utility as a signal of environmentalist dedication. For example, electric cars might be viewed as more prestigious and more desirable if recharging stations are more difficult to find and batteries take longer to recharge. Further research is necessary to determine when behaviors are more likely to be adopted when they are difficult to do. In summary, whereas competition for status has often been viewed as an unsavory endeavor, the same thirst for status can be channeled to facilitate socially beneficial rather than wasteful behavior. For example, encouraging competition on proenvironmental outcomes might motivate people and firms to voluntarily adopt more sustainable practices.

3: Unconsciously Copying the Behavior of Others

Humans have evolved to instinctively copy and mimic the behavior of others. Psychologists have long recognized that humans exhibit this tendency (Asch 1956), which is believed to have evolutionary benefits (Griskevicius et al. 2006; Simon 1990; Van Vugt and Ahuja 2011). Imitating others and following the majority are adaptive strategies for learning in social species, in which the costs of individual trial-and-error learning are substantial (Gigerenzer and Todd 1999; Richerson and Boyd 2006). In ancestral environments, people who swiftly followed what others were doing had an adaptive advantage, especially in uncertain situations (Cialdini and Goldstein 2004; Kameda, Takezawa, and Hastie 2003). Imitating others is often an unconscious process, automatically triggered by specific neurons in the brain (Chartrand and Van Baaren 2009).

Imitation is an underappreciated contributor to environmental problems because many such problems result from a conflict between what people believe they ought to do versus what they actually see others doing (Cialdini, Reno, and Kallgren 1990). For example, although home residents say that the behavior of their neighbors has the *least* effect on their own conservation behaviors, studies show that the behavior of neighbors is often the strongest predictor of actual energy conservation (Nolan et al. 2008). Furthermore, neighbors’ behaviors are often a substantially

stronger predictor of conservation behavior than personal environmental attitudes or even financial incentives (Nolan et al. 2008). When people learn that their neighbors are not conserving, they *increase* their own energy consumption, even when they had been conserving energy in the past (Schultz et al. 2007).

Because of the mimicry instinct, strategies urging consumers that they “should” behave environmentally are often doomed if people are not convinced that many others are behaving in this manner. Paradoxically, a common approach in the hope of spurring environmental behaviors is to depict a problem as regrettably frequent. Messages such as “83% of people are not recycling!” or “300 million plastic bottles discarded every day!” are well intended, but the communicators have missed something critically important: Within the statement “*Look* at all the people who are doing this undesirable thing” lurks the powerful and undercutting message “*Look* at all the people who *are* doing it.” For example, a sign at the Petrified National Forest in Arizona attempts to prevent theft of petrified wood by informing visitors about the regrettably high number of thefts each year. Field experiments show that this antitheft sign depicting the prevalence of theft *increases* theft by almost 300% (Cialdini 2003). In the following subsections, we discuss how the automatic tendency to copy others can be harnessed and redirected. Rather than trying to stop people from paying attention to the bad behavior of others, ancestral tendency provides an opportunity to use social incentives to motivate proenvironmental action.

Cost-Effective Social Incentives

Two types of appeals are commonly used to persuade people to go green. One involves informing people about the plight of the environment, and the other involves appealing to monetary benefits. For example, most hotels place cards in rooms urging guests to reuse their towels by appealing to the environment (e.g., “The environment needs our help!”) or to money (e.g., “Please reuse towels to help keep your costs low”). Although such messages may intuitively seem persuasive, field experiments show that either type of message is no more effective than simply asking people to “Please reuse your towels” (Goldstein, Cialdini, and Griskevicius 2008). Much research demonstrates that merely informing people about the plight of the environment does little to motivate proenvironmental behavior (Gardner and Stern 2002). Furthermore, although financial incentives can motivate conservation, such incentives often need to be substantial (e.g., a \$5 hotel discount for reusing towels), making such programs prohibitively expensive. Moreover, financial incentives may crowd out any intrinsic motivation to do good for the environment (Tenbrunsel and Messick 1999).

The ancestral tendency to imitate others implies that a method for spurring proenvironmental behavior might be to use social rather than financial incentives. For example, hotel cards imploring guests to reuse towels could indicate the prevalence of this behavior, which might trigger others to do likewise. Compared with standard messages, when guests are informed that the majority of other guests reuse their towels at least once during a stay, towel reuse goes up by 34% (Goldstein, Cialdini, and Griskevicius 2008). The

tendency to automatically copy others has been used with great success to increase recycling (Schultz 1999), reduce littering (Cialdini, Reno, and Kalgren 1990), and decrease home energy use (Nolan et al. 2008).

An impediment to using imitation-based strategies is that often only a small minority of people are engaging in the desired behavior. For example, to promote carpooling, it is ill-advised to inform people that only 5% of the three million city residents carpool (such a strategy is likely to decrease carpooling even further). The critical part of effective messages that harness imitation is the *perception* that many people are engaging in a behavior. This means that reframing the carpooling statistic from relative numbers (“5% of city residents carpool each week”) to absolute numbers (“more than 250,000 city residents carpool each week!”) might successfully convey the perception that many others are engaging in this behavior. Thus, imitation-based strategies might be effective even if the majority of people are not yet engaging in the desired behavior.

Social Imitation and Large-Scale Behavioral Change

The ancestral tendency to imitate leads people to copy behavior regardless of whether it helps or hurts the environment. When residents learn that they are using less energy than their neighbors, for example, they increase energy consumption (Schultz et al. 2007). Fortunately, this detrimental effect can be reversed by providing people with social approval. When residents are informed that they are using less energy than their neighbors *and* they receive a smiley face to indicate social approval for this action, such information motivates conservationists to continue their energy-efficient ways (Schultz et al. 2007).

A U.S.-based social entrepreneur company named OPOWER provides a case study of how the unconscious tendency to imitate can be harnessed to foster large-scale behavioral change (Cuddy and Doherty 2010). Directly applying the research of Schultz et al. (2007), this small software company provides home residents with information on their monthly energy bill regarding how much energy they are using compared with their neighbors, including drawing a smiley face on the bills of the residents who are energy efficient. Despite reaching only a small percentage of homes, by the end of 2010, the amount of energy use reduced by OPOWER was equivalent to removing 150,000 homes from the electricity grid. Not only is this approach extremely cost-effective, but it also has been effective at reducing energy consumption across all demographic categories and continues to work more than two years after implementation. This impressive result has served as the basis for a case at Harvard Business School (Cuddy and Doherty 2010), and President Obama recently held a public press conference at OPOWER’s headquarters heralding this approach as the model for creating sustainable lifestyles.

Following the Ancestral Leader

Although people are wired to follow the masses, they also tend to copy certain types of people more than others. Humans are disposed to imitate those who are perceived as

prestigious or successful (Van Vugt, Hogan, and Kaiser 2008). The evolved tendency to follow people who are perceived as leaders has important implications for environmental behavior. For example, Toyota believes that its sales of the Prius were boosted dramatically when it was revealed that celebrities, such as Cameron Diaz, Leonardo DiCaprio, and Harrison Ford, were driving the Prius (Taylor 2006).

An evolutionary perspective highlights that people are especially inclined to imitate those who have the *ancestral* features of leaders (Van Vugt and Ahuja 2011). For example, humans are more likely to follow the eye gaze of people with physically dominant faces, and those who are taller and have lower-pitched voices attract more followers (Van Vugt, Hogan, and Kaiser 2008). Although these types of physical features may no longer help people become leaders in the modern world, their Stone Age brains unconsciously process these features as signals of status, power, and leadership. In summary, humans are more likely to voluntarily engage in self-sacrificing behavior when they perceive either that people with ancestral features of leadership are engaging in such behavior or that many others are doing likewise.

4: Valuing the Present over the Future

Natural selection is not a forward-looking process. It does not anticipate what might happen in future generations, let alone a few years in the future. Instead, natural selection has shaped our psychology to maximize the here and now. The evolutionarily recent transition from being hunter-gatherers to farmers had important consequences for temporal discounting. Whereas hunter-gatherers' labor is often rewarded the same day, farmers need to wait several months until harvest. However, because the human shift from foraging to food production is very recent on an evolutionary timescale, our deep ancestral preferences were not eradicated. Although there are individual differences in the ability to delay gratification, people in modern societies still overwhelmingly weigh immediate outcomes more heavily than distant ones (e.g., Frederick, Loewenstein, and O'Donoghue 2002; Green and Myerson 2004), while underestimating the probability and severity of future outcomes, such as ecological threats (Hardin 1995; Slovic 1987).

Many social and environmental problems result from valuing immediate over delayed rewards, in which today's desires often prevail against tomorrow's needs. This proclivity to discount the future is sometimes assumed to be a pathology of Western civilization (Penn 2003); yet this tendency had enormous benefits in ancestral environments (Wilson and Daly 2005). If our ancestors had spent too much effort on future needs rather than on satisfying immediate needs, they would have been less likely to survive and reproduce (Kacelnik 1997).

Because people have evolved to value the present over the future, influence strategies that fail to take this into account usually fight an uphill battle. Calls for people to value the needs of future generations as much as their own needs are unrealistic. For example, field studies show that appeals to consider the consequences of wasteful behavior on future generations are ineffective at motivating environmental behavior (Gardner and Stern 2002; Nolan et al. 2008). In the following subsections, we discuss several theories from evo-

lutionary biology that address the origin of the tendency to discount the future. Although zero discounting is unrealistic, an evolutionary perspective points to strategies that can increase people's valuation of the future.

Life History Theory and Predictable Environments

Evolutionary theorists believe that the extent to which people weigh the present versus the future is linked to life history theory (Kaplan and Gangestad 2005). According to life history theory, individual differences in future discounting develop in part as a response to specific environmental factors, especially in childhood. People grow up to value the present and discount the future more steeply in environments that are dangerous or unpredictable (Ellis et al. 2009). For example, mortality rates are strongly related to steeper discounting of the future and to earlier age of reproduction (Low 1996; Wilson and Daly 1997). Even when socioeconomic status is controlled for, higher violent crime rates predict an earlier age of having children (Griskevicius, Delton, et al. 2011). This means that in environments perceived as unpredictable or dangerous, people tend to become more impulsive in their decision making and to care less about events in the distant future.

An important implication of life history theory is that it is a mistake to emphasize the unpredictability of the environment when trying to motivate people to care about the environment and the future. For example, asking people to conserve for the future because no one can predict when natural resources might run out leads most people to do the opposite of the desired response, causing them to increase their valuation of the present and engage in behavior for short-term payoffs (Griskevicius, Tybur, et al. 2012). Instead, life history theory suggests that less discounting of the future should occur when environments are, or are merely perceived as, more stable and predictable. This means that influence strategies emphasizing that life today shares many commonalities with life in the past (and likely with life in the future) are more likely to lead people to perceive that they live in a predictable world (Ellis et al. 2009). When people believe that they live in a predictable world and will be around to see the future, they have more incentive to care about what that future looks like.

Gender Differences and the Power of Female Choice

An evolutionary perspective predicts that men should discount the future more steeply than women. This prediction is derived from the theories of parental investment and sexual selection (Darwin 1871; Trivers 1972), which posit that the sex in a species with *lower* obligatory investment in offspring (e.g., gestation, birthing, lactation, parenting) will be *more* competitive. Because in the vast majority of mammals, including in humans, the male counterparts have lower obligatory parental investment, much research documents that men across cultures are more competitive, risk taking, and aggressive and have a shorter life expectancy than women (Daly and Wilson 1988; Griskevicius, Tybur, et al. 2009). Accordingly, on average, men have steeper future discount rates than women (Wilson, Daly, and Gordon 2007). An implication of this gender difference is that

men are more willing to deplete environmental resources and engage in wasteful consumption for present gains. This is borne out by studies showing that men are less concerned about environmental degradation and are more willing to conspicuously waste environmental resources (Low 1996; Sundie et al. 2011; Wilson, Daly, and Gordon 1998, 2007).

Because many gender differences are rooted in the ancestral past, an evolutionary perspective suggests that specific types of environmental cues could be powerful at mitigating such gender differences. For example, men's impulsivity is related to local mating ecology, such as the availability of and competition for sexual mates (Van den Bergh, Dewitte, and Warlop 2008). Men's preferences become less impulsive and more future oriented when they perceive that there is less competition for mates (Griskevicius, Tybur, et al. 2012). An evolutionary perspective also suggests that men's behaviors tend to be strongly influenced by women's mate preferences. If women desire men who are pro-environmental, men may change their behavior to accommodate women's preferences. Recent research shows that women find men who behave sustainably (Gotts and Van Vugt 2011) and who engage in heroic acts of kindness (Griskevicius et al. 2007) as sexually more attractive. This implies that a powerful lever in shaping men's behavior may be information conveying that women desire men who are proenvironmental and value sustainability.

5: Disregarding Impalpable Concerns

Many environmental and social problems are exacerbated by a general lack of strong concern about such issues. Some people are simply not alarmed by the current ecological situation. Although apathy and skepticism are sometimes presented as callous or ignorant, such dispassionate responses are rooted in our evolutionary past. Because our ancestors evolved to value the present rather than the future (see previous section), we do not possess evolutionary mechanisms for reacting to large-scale but slow-moving environmental problems, such as climate change (Penn 2003). Our brain has simply not evolved to ring the alarm when confronted with novel dangers rarely faced in our past, such as pollution. Not surprisingly, people tend to be poor at comprehending environmental risks, underestimating the severity of many environmental issues (Hardin 1995).

An important reason people often fail to respond to environmental hazards is due to their evolved sensory and cognitive mechanisms (Ornstein and Ehrlich 1989). People's minds evolved in an ancestral world in which there was a tangible and visceral link between behavior and the environment. If group members hunted all the game and gathered all the food in an area, they became hungry; if they defecated in their cave, it became uninhabitable; and if they ate something poisonous, they got sick and possibly died. A critical difference between the modern world and the ancestral environment is that today people rarely see, feel, touch, hear, or smell how their behaviors affect the environment. When buying food, people do not see how food is grown; if they buy all the food at the store, more will arrive tomorrow. When purchasing a manufactured product, they do not see the factory by the river that is poisoning the water downstream. When tangible and visceral links between

behavior and the environment are disconnected, it is less surprising that many people today question what all the fuss is about.

Tangible Links and Visceral Cues

Consideration of the evolved sensory mechanism suggests that people may be more responsive to environmental threats that they can feel, hear, smell, touch, or see. Consider an instructive example from the gas company. How do you know if your home is filling up with poisonous gas? You know because your house begins to smell funny. Natural gas has no odor, so gas companies intentionally scent gas with a noxious smell to ensure that people *feel* that they are being poisoned, which motivates them to take immediate action.

Now consider a similar question: How do you know if your environment is being poisoned? Almost everyone "cognitively knows" that resources are being depleted at unprecedented rates, water is becoming increasingly polluted, and entire ecosystems are being destroyed. But our house smells just fine, our neighborhood has trees, our water tastes fine, and our food supply at the store is plentiful. Our minds are not designed to respond to environmental problems when such problems are distant or are presented in cognitive terms.

People may be more responsive to environmental problems when there are tangible and visceral cues indicating a problem. As in the poisonous gas example, people may be more responsive to air quality concerns when invisible but harmful emissions have been intentionally colored to show the level of pollutants in the air. Similarly, people may be more likely to do something about water pollution if the taste and smell of public drinking water has been altered according to the level of pollutants in the water. In summary, whereas people tend to be relatively unresponsive to cognitively based messages highlighting statistics about environmental degradation, they may be more likely to be responsive to messages and incentives that reach their ancestral sensory mechanisms.

Harnessing Dormant Biophilia

Although human nature has been shaped to extract and consume resources, our ancestors did live in natural settings for many hundreds of thousands of years. An increasing body of research suggests that our evolution in nature (rather than in cement boxes in concrete cities) may have endowed us with biophilia, or an innate appreciation and desire for the natural world (Wilson 2006). Studies have found that humans around the world are attracted to natural landscapes, and people in modern cities go out of their way to convert their living spaces to be more like ancestral environments (Kaplan and Kaplan 1989). Exposure to such natural environments even grants positive benefits, such as increasing recovery from stressful experiences (e.g., surgery) (Ulrich 1984). Consumers similarly spend significant amounts of money to be surrounded by nature, with American and European zoos attracting more annual visitors than professional sports (Wilson 2006).

Although our modern concrete cities hardly resemble our natural ancestral dwellings, our latent ancestral ability to

love and cherish nature might be awakened to promote more sustainable behavior. Recent research shows that when urban dwellers see short video clips of natural scenery, they show more restraint in social dilemmas and donate more money to environmental causes (Steentjes and Van Vugt 2011). Because much of the world's population lives in massive cities largely devoid of nature, it might be useful to find creative ways to tap and unleash human biophilia. For example, for children growing up in urban environments, early-life exposure to trees, animals, and enjoyable outdoor experiences might promote a lifelong environmental commitment (Van Vugt 2009).

Conclusion

In this article, we examine the evolutionary bases for sustainability. We suggest that many ecological problems are caused or exacerbated by five ancestral tendencies (see Table 1). Although these tendencies were adaptive in the environment of our ancestors, they can have devastating consequences in the modern world. Although an evolutionary perspective points to the ultimate reasons humans degrade the environment, it does not imply that such problems are inevitable. By considering the evolutionary roots of each tendency through the lens of specific theories from the natural sciences, we suggest ways that marketers, social entrepreneurs, and policy makers can harness and redirect people's evolutionary tendencies to lessen or even eradicate environmental problems (see Table 1). We contend that for influence strategies to be optimally effective, they must work with, rather than against, evolved tendencies. We present research documenting the effectiveness of some of these strategies, but many implications of an evolutionary approach to sustainability await further testing.

Although we focus on sustainability and conservation, an evolutionary perspective can be useful for understanding and potentially helping solve a multitude of modern social problems, including obesity, overpopulation, poverty, and many types of risky behavior. The evolutionary tendencies that lead people to degrade the environment are often the same ones that lead people to behave in other types of anti-social or destructive ways. Although an evolutionary perspective suggests that ancestral human nature has contributed to creating modern social problems, human nature is also poised to help solve them.

References

- Asch, Solomon (1956), "Studies of Independence and Conformity," *Psychological Monographs: General and Applied*, 70 (9), 1–70.
- Barclay, Pat (2004), "Trustworthiness and Competitive Altruism Can Also Solve the 'Tragedy of the Commons,'" *Evolution and Human Behavior*, 25 (4), 209–220.
- Barrett, H. Clark and Robert Kurzban (2006), "Modularity in Cognition: Framing the Debate," *Psychological Review*, 113 (3), 628–47.
- Bateson, Melissa, Daniel Nettle, and Gilbert Roberts (2006), "Cues of Being Watched Enhance Cooperation in a Real-World Setting," *Biology Letters*, 2 (3), 412–14.
- Bird, Rebecca B. and Eric A. Smith (2005), "Signaling Theory, Strategic Interaction, and Symbolic Capital," *Current Anthropology*, 46 (2), 221–48.
- Bloom, Paul N. (2009), "Overcoming Consumption Constraints Through Social Entrepreneurship," *Journal of Public Policy & Marketing*, 28 (1), 128–34.
- Brewer, Marilyn B. and Roderick M. Kramer (1986), "Choice Behavior in Social Dilemmas: Effects of Social Identity, Group Size and Decision Framing," *Journal of Personality and Social Psychology*, 50 (3), 543–49.
- Burnstein, Eugene, Christian Crandall, and Shinobu Kitayama (1994), "Some Neo-Darwinian Decision Rules for Altruism: Weighing the Cues for Inclusive Fitness as a Function of the Biological Importance of the Decision," *Journal of Personality and Social Psychology*, 67 (5), 773–89.
- Buss, David M. (1995), "Evolutionary Psychology: A New Paradigm for Psychological Science," *Psychological Inquiry*, 6 (1), 1–49.
- (2005), *Handbook of Evolutionary Psychology*. New York: John Wiley & Sons.
- Chartrand, Tanya L. and Rick Van Baaren (2009), "Human Mimicry," in *Advances in Experimental Social Psychology*, Vol. 41, Mark P. Zanna, ed. London: Academic Press, 219–74.
- Cialdini, Robert B. (2003), "Crafting Normative Messages to Protect the Environment," *Current Directions in Psychological Science*, 12 (4), 105–109.
- and Noah J. Goldstein (2004), "Social Influence: Compliance and Conformity," *Annual Review of Psychology*, 55, 591–621.
- , Raymond R. Reno, and Carl A. Kallgren (1990), "A Focus Theory of Normative Conduct: Recycling the Concept of Norms to Reduce Littering in Public Places," *Journal of Personality and Social Psychology*, 58 (6), 1015–1026.
- Colarelli, Stephen M. (2003), *No Best Way: An Evolutionary Perspective on Human Resource Management*. New York: Praeger.
- Cole, Douglas and Ira Chaikin (1990), *An Iron Hand upon the People: The Law Against the Potlatch on the Northwest Coast*. Seattle: University of Washington Press.
- Cottrell, Catherine A., Steven L. Neuberg, and Norman P. Li (2007), "What Do People Desire in Others? A Sociofunctional Perspective on the Importance of Different Valued Characteristics," *Journal of Personality and Social Psychology*, 92 (2), 208–231.
- Cuddy, Amy J.C. and Kyle T. Doherty (2010), "OPOWER: Increasing Energy Efficiency Through Normative Influence," Harvard Business School Case N9-911-16.
- Daly, Martin and Margo Wilson (1988), *Homicide*. New York: Aldine de Gruyter.
- Darwin, Charles (1859), *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. London: Appleton & Co.
- (1871), *The Descent of Man and Selection in Relation to Sex*. London: Appleton & Co.
- Dawes, Robyn M. (1980), "Social Dilemmas," *Annual Review of Psychology*, 31, 169–93.
- Dawkins, Richard (1976), *The Selfish Gene*. New York: Oxford University Press.
- Diamond, Jared (2005), *Collapse: How Societies Choose to Fail or Succeed*. London: Allen Lane.

- Diener, Ed and Eunkook M. Suh (2000), *Culture and Subjective Well-Being*. Boston: MIT Press.
- Dietz, Thomas, Elinor Ostrom, and Paul C. Stern (2003), "The Struggle to Govern the Commons," *Science*, 302 (5652), 1907–1912.
- Dunbar, Robin I.M. and Louise Barrett (2007), *Oxford Handbook of Evolutionary Psychology*. Oxford: Oxford University Press.
- Durante, Kristina M., Vladas Griskevicius, Sarah E. Hill, Carin Perilloux, and Norman P. Li (2011), "Ovulation, Female Competition, and Product Choice: Hormonal Influences on Consumer Behavior," *Journal of Consumer Research*, 37 (6), 921–34.
- Ellis, Bruce J., Aurelio J. Figueredo, Barbara H. Brumbach, and Gabriel L. Schlomer (2009), "Fundamental Dimensions of Environmental Risk: The Impact of Harsh Versus Unpredictable Environments on the Evolution and Development of Life History Strategies," *Human Nature*, 20 (2), 204–268.
- Foley, Robert A. (1997), "The Adaptive Legacy of Human Evolution: A Search for the Environment of Evolutionary Adaptedness," *Evolutionary Anthropology*, 4 (6), 194–203.
- Frank, Robert H. (1985), *Choosing the Right Pond: Human Behaviour and the Quest for Status*. New York: Oxford University Press.
- (2007), *Falling Behind: How Rising Inequality Harms the Middle Class*. Berkeley: University of California Press.
- Frederick, Shane, George Loewenstein, and Ted O'Donoghue (2002), "Time Discounting and Time Preference: A Critical Review," *Journal of Economic Literature*, 40 (June), 351–401.
- Gandolfi, Arthur, Anna Gandolfi, and David P. Barash (2002), *Economics as an Evolutionary Science: From Utility to Fitness*. New Brunswick, NJ: Transaction Publishers.
- Gardner, Gerald T. and Paul C. Stern (2002), *Environmental Problems and Human Behaviour*. London: Pearson.
- Gigerenzer, Gerd and Peter M. Todd (1999), *Simple Heuristics That Make Us Smart*. Oxford: Oxford University Press.
- Godoy, Ricardo, Victoria Reyes-García, Tomás Huanca, William R. Leonard, Thomas McDade, Susan Tanner, Vincent Vadez, and Craig Seyfried (2007), "Signaling by Consumption in a Native Amazonian Society," *Evolution and Human Behavior*, 28 (2), 124–34.
- Goldstein, Noah J., Robert B. Cialdini, and Vladas Griskevicius (2008), "A Room with a Viewpoint: Using Social Norms to Motivate Environmental Conservation in Hotels," *Journal of Consumer Research*, 35 (October), 472–82.
- , Vladas Griskevicius, and Robert B. Cialdini (2012), "Reciprocity by Proxy: Harnessing the Power of Obligation to Foster Cooperation," *Administrative Science Quarterly*, forthcoming.
- Gotts, Joe and M. van Vugt (2011), "Environmental Behavior as a Mate Quality Signal," working paper, Department of Social and Organisational Psychology, VU Amsterdam.
- Green, Leonard and Joel Myerson (2004), "A Discounting Framework for Choice with Delayed and Probabilistic Rewards," *Psychological Bulletin*, 130 (5), 769–92.
- Griskevicius, Vladas, A.W. Delton, T.E. Robertson, and J.M. Tybur (2011), "The Influence of Mortality and Socioeconomic Status on Risk and Delayed Rewards: A Life History Theory Approach," *Journal of Personality and Social Psychology*, 100 (6), 241–54.
- , Noah J. Goldstein, Chad R. Mortensen, Robert B. Cialdini, and Douglas T. Kenrick (2006), "Going Along Versus Going Alone: When Fundamental Motives Facilitate Strategic (Non)Conformity," *Journal of Personality and Social Psychology*, 91 (2), 281–94.
- , ———, ———, Jill M. Sundie, Robert B. Cialdini, and Douglas T. Kenrick (2009), "Fear and Loving in Las Vegas: Evolution, Emotion, and Persuasion," *Journal of Marketing Research*, 46 (June), 385–95.
- , Michelle N. Shiota, and Stephen M. Nowlis (2010), "The Many Shades of Rose-Colored Glasses: An Evolutionary Approach to the Influence of Different Positive Emotions," *Journal of Consumer Research*, 37 (August), 238–50.
- , Joshua M. Tybur, Joshua M. Ackerman, Andrew W. Delton, Theresa E. Robertson, and Andrew E. White (2012), "The Financial Consequences of Too Many Men: Sex Ratio Effects on Saving, Borrowing, and Spending," *Journal of Personality and Social Psychology*, 102 (1), 69–80.
- , ———, Steven W. Gangestad, Elaine F. Perea, Jenessa R. Shapiro, and Douglas T. Kenrick (2009), "Aggress to Impress: Hostility as an Evolved Context-Dependent Strategy," *Journal of Personality and Social Psychology*, 96 (5), 980–94.
- , ———, Jill M. Sundie, Robert B. Cialdini, Geoffrey F. Miller, and D.T. Kenrick (2007), "Blatant Benevolence and Conspicuous Consumption: When Romantic Motives Elicit Strategic Costly Signals," *Journal of Personality and Social Psychology*, 93 (1), 85–102.
- , ———, and Bram Van den Bergh (2010), "Going Green to Be Seen: Status, Reputation, and Conspicuous Conservation," *Journal of Personality and Social Psychology*, 98 (3), 392–404.
- Hamilton, W.D. (1964), "The Genetical Evolution of Social Behavior, I, II," *Journal of Theoretical Biology*, 7 (1), 1–52.
- Harbaugh, William, Ulrich Mayr, and Dan Burghart (2007), "Neural Responses to Taxation and Voluntary Giving Reveal Motives for Charitable Donations," *Science*, 316 (5831), 1622–25.
- Hardin, Garrett (1968), "Tragedy of the Commons," *Science*, 162 (1243), 1243–48.
- (1995), *Living with Limits: Ecology, Economics, and Population Taboos*. Oxford: Oxford University Press.
- Hardy, Charlie L. and Mark van Vugt (2006), "Nice Guys Finish First: The Competitive Altruism Hypothesis," *Personality and Social Psychology Bulletin*, 32 (10), 1402–13.
- Hawkes, Kristen (1992), "Sharing and Collective Action," in *Evolutionary Ecology and Human Behavior*, Eric A. Smith and Bruce Winterhalder, eds. New York: Aldine de Gruyter, 269–300.
- Heinen, Joel T. and Bobbi S. Low (1992), "Human Behavioral Ecology and Environmental Conservation," *Environmental Conservation*, 19 (2), 105–116.
- The Home Depot (2009), "First Ever 'Canadian Green Home Index' Reveals Room for Improvement in Homes Across Canada," (April 14), (accessed April 18, 2011), [available at http://www.homedepot.ca/wcsstore/HomeDepotCanada/pdf/canadian_press/green_home_index_2009.pdf].
- (2010), "Second Annual Canadian Green Home Index Reveals Reduced Environmental Efforts at Home," (April 7), (accessed April 18, 2011), [available at http://www.homedepot.ca/wcsstore/HomeDepotCanada/pdf/canadian_press/green_home_index.pdf].

- Iredale, Wendy, Mark van Vugt, and Robin I.M. Dunbar (2008), "Showing Off in Humans: Male Generosity as a Mating Signal," *Evolutionary Psychology*, 6 (3), 386–92.
- Jones, Owen D. and Timothy H. Goldsmith (2005), "Law and Behavioral Biology," *Columbia Law Review*, 105 (March), 405–502.
- Kacelnik, Alex (1997), "Normative and Descriptive Models of Decision Making: Time Discounting and Risk Sensitivity," in *Characterizing Human Psychological Adaptations*, Gregory R. Bock and Gail Cardew, eds. Chichester, UK: John Wiley & Sons.
- Kameda, Tatsuya, Masanori Takezawa, and Reid Hastie (2003), "The Logic of Social Sharing: An Evolutionary Game Analysis of Adaptive Norm Development," *Personality and Social Psychology Review*, 7 (1), 2–19.
- Kaplan, Hillard S. and Steven W. Gangestad (2005), "Life History and Evolutionary Psychology," in *Handbook of Evolutionary Psychology*, David M. Buss, ed. New York: John Wiley & Sons, 68–95.
- Kaplan, Rachel and Stephen Kaplan (1989), *The Experience of Nature: A Psychological Perspective*. Cambridge, MA: Cambridge University Press.
- Kenrick, Douglas T., Vladas Griskevicius, Steven L. Neuberg, and Mark Schaller (2010), "Renovating the Pyramid of Needs: Contemporary Extensions Built upon Ancient Foundations," *Perspectives on Psychological Science*, 5 (3), 292–314.
- , Jill M. Sundie, and Robert Kurzban (2008), "Cooperation and Conflict Between Kith, Kin, and Strangers: Game Theory by Domains," in *Foundations of Evolutionary Psychology*, Charles Crawford and Dennis Krebs, eds. Mahwah, NJ: Lawrence Erlbaum Associates.
- Komorita, Samuel S. and Craig D. Parks (1994), *Social Dilemmas*. Madison, WI: Brown & Benchmark.
- Low, Bobbi S. (1996), "Behavioral Ecology of Conservation in Traditional Societies," *Human Nature*, 7 (4), 353–79.
- Milinski, Manfred, Dirk Semmann, Hans-Jürgen Krambeck, and Jochem Marotzke (2006), "Stabilizing the Earth's Climate Is Not a Losing Game: Supporting Evidence from Public Goods Experiments," *Proceeding of the National Academy of Sciences*, 103 (11), 3994–98.
- Miller, Geoffrey F. (2000), *The Mating Mind: How Sexual Choice Shaped the Evolution of Human Nature*. New York: Doubleday.
- (2009), *Spent: Sex, Evolution, and Consumer Behavior*. New York: Viking.
- Nesse, Randolph M. and Stephen C. Stearns (2008), "The Great Opportunity: Evolutionary Applications in Medicine," *Evolutionary Applications*, 1 (1), 28–48.
- Neufeld, Samantha L., Vladas Griskevicius, Susan E. Ledlow, Yexin J. Li, R. Neel, et al. (2011), "Going Green to Help Your Genes: The Use of Kin-Based Appeals in Conservation Messaging," working paper, Global Institute for Sustainability, Arizona State University.
- Newman, George E. and Y. Jeremy Shen (2011), "The Counterintuitive Effects of Thank-You Gifts on Charitable Giving," working paper, Yale School of Management.
- Nolan, Jessica M., P. Wesley Schultz, Robert B. Cialdini, Noah J. Goldstein, and Vladas Griskevicius (2008), "Normative Social Influence Is Underdetected," *Personality and Social Psychology Bulletin*, 34 (7), 913–23.
- Nowak, Martin A. and Karl Sigmund (2005), "Evolution of Indirect Reciprocity," *Nature*, 437 (October), 1291–98.
- Ornstein, Robert and Paul Ehrlich (1989), *New World, New Mind: Moving Toward Conscious Evolution*. New York: Touchstone Books.
- Ostrom, Elinor (1990), *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge, UK: Cambridge University Press.
- Palmer, Craig T. (1991), "Kin-Selection, Reciprocal Altruism, and Information Sharing Among Maine Lobstermen," *Ethology and Sociobiology*, 12 (3), 221–35.
- Penn, Dustin J. (2003), "The Evolutionary Roots of Our Environmental Problems: Toward a Darwinian Ecology," *Quarterly Review of Biology*, 78 (3), 275–301.
- Powers, Nicholas, Allen Blackman, Thomas P. Lyon, and Urvashi Narain (2008), "Does Disclosure Reduce Pollution? Evidence from India's Green Rating Project," Discussion Paper, Resources for the Future, RFF 08-38, (accessed October 24, 2010), [available at <http://www.rff.org/RFF/Documents/RFF-DP-08-38.pdf>].
- Price, Michael E. (2003), "Pro-Community Altruism and Social Status in a Shuar Village," *Human Nature*, 14 (2), 191–208.
- Ramsey, Jonathon (2007), "Lexus Exceeds LS600h Sales Target by Three Hundred Percent," (January 4), [available at <http://www.autoblog.com/2007/12/04/lexus-exceeds-ls600h-sales-target-by-three-hundred-percent/>].
- Richerson, Peter J. and Robert Boyd (2006), *Not by Genes Alone: How Culture Transformed Human Evolution*. Chicago: Chicago University Press.
- Roberts, Gilbert (1998), "Competitive Altruism: From Reciprocity to the Handicap Principle," *Proceedings of the Royal Society, London, B*, 265 (1394), 427–31.
- Rozin, Paul (2005), "The Meaning of Food in Our Lives: A Cross-Cultural Perspective on Eating and Well-Being," *Journal of Nutrition Education and Behavior*, 37 (2), S107–S112.
- Saad, Gad (2007), *The Evolutionary Bases of Consumption*. New York: Lawrence Erlbaum Associates.
- (2011), *Evolutionary Psychology in the Business Sciences*. Heidelberg, Germany: Springer.
- and John G. Vongas (2009), "The Effect of Conspicuous Consumption on Men's Testosterone Levels," *Organizational Behavior and Human Decision Processes*, 110 (2), 80–92.
- Schultz, P. Wesley (1999), "Changing Behavior with Normative Feedback Interventions: A Field Experiment of Curbside Recycling," *Basic and Applied Social Psychology*, 21 (1), 25–36.
- , Jessica M. Nolan, Robert B. Cialdini, Noah J. Goldstein, and Vladas Griskevicius (2007), "The Constructive, Destructive, and Reconstructive Power of Social Norms," *Psychological Science*, 18 (5), 429–34.
- Simon, Herbert A. (1990), "A Mechanism for Social Selection and Successful Altruism," *Science*, 250 (4988), 1665–68.
- Slovic, Paul (1987), "Perception of Risk," *Science*, 236 (4799), 280–85.
- Smith, Eric A. and Rebecca B. Bird (2000), "Turtle Hunting and Tombstone Opening: Public Generosity as Costly Signaling," *Evolution and Human Behavior*, 21 (4), 245–61.
- and Mark Wishnie (2000), "Conservation and Subsistence in Small Scale Societies," *Annual Review of Anthropology*, 29, 493–524.
- Steenjens, D. and M. van Vugt (2011), "Exposure to Nature Promotes Cooperation in Social Dilemmas," working paper,

- Department of Social and Organisational Psychology, VU Amsterdam.
- Sundie, Jill M., Douglas T. Kenrick, Vidas Griskevicius, Joshua M. Tybur, Kathleen D. Vohs, and Daniel J. Beal (2011), "Peacocks, Porsches, and Thorstein Veblen: Conspicuous Consumption as a Sexual Signaling System," *Journal of Personality and Social Psychology*, 100 (4), 664–80.
- Taylor, Alex (2006), "The Birth of the Prius," *Fortune*, (February 24), [available at http://money.cnn.com/magazines/fortune/fortune_archive/2006/03/06/8370702/].
- Tenbrunsel, Ann E. and David M. Messick (1999), "Sanctioning Systems, Decision Frames and Cooperation," *Administrative Science Quarterly*, 44 (4), 684–707.
- Tinbergen, Nikolaas (1963), "On the Aims and Methods of Ethology," *Zeitschrift für Tierpsychologie*, 20, 410–33.
- Tooby, John and Leda Cosmides (1992), "The Psychological Foundations of Culture," in *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, John Barkow, Leda Cosmides, and John Tooby, eds. New York: Oxford University Press, 19–136.
- Toyota (2008), "Toyota Reports 2007 and December Sales," (January 3), [available at <http://www.toyota.com/about/news/corporate/2008/01/03-1-sales.html>].
- Trivers, Robert L. (1971), "The Evolution of Reciprocal Altruism," *Quarterly Review of Biology*, 46 (1), 35–57.
- (1972), "Parental Investment and Sexual Selection," in *Sexual Selection and the Descent of Man: 1871–1971*, Bernard Campbell, ed. Chicago: Aldine, 136–79.
- Ulrich, Roger S. (1984), "View Through a Window May Influence Recovery from Surgery," *Science*, 224 (4647), 420–21.
- Van den Bergh, Bram, Siegfried Dewitte, and Luk Warlop (2008), "Bikinis Instigate Generalized Impatience in Intertemporal Choice," *Journal of Consumer Research*, 35 (June), 85–97.
- Van Lange, Paul A.M., Ellen M. De Bruin, Wilma Otten, and Jeffrey A. Joireman (1997), "Development of Prosocial, Individualistic, and Competitive Orientations: Theory and Preliminary Evidence," *Journal of Personality and Social Psychology*, 73 (4), 733–46.
- Van Vugt, Mark (2001), "Community Identification Moderating the Impact of Financial Incentives in a Natural Social Dilemma: Water Conservation," *Personality and Social Psychology Bulletin*, 27 (11), 731–45.
- (2009), "Averting the Tragedy of the Commons: Using Social Psychological Science to Protect the Environment," *Current Directions in Psychological Science*, 18 (3), 169–73.
- and Anjana Ahuja (2011), *Naturally Selected: The Evolutionary Science of Leadership*. New York: Harper.
- and Charlotte L. Hardy (2010), "Cooperation for Reputation: Wasteful Contributions as Costly Signals in Public Goods," *Group Processes and Intergroup Relations*, 13 (1), 1–11.
- , Robert Hogan, and Robert B. Kaiser (2008), "Leadership, Followership, and Evolution: Some Lessons from the Past," *American Psychologist*, 63 (3), 182–96.
- , Gilbert Roberts, and Charlie Hardy (2007), "Competitive Altruism: Development of Reputation-Based Cooperation in Groups," in *Handbook of Evolutionary Psychology*, Robin Dunbar and Louise Barrett, eds. Oxford: Oxford University Press, 531–40.
- Varadarajan, P. Rajan and Anil Menon (1988), "Cause-Related Marketing: A Coalignment of Marketing Strategy and Corporate Philanthropy," *Journal of Marketing*, 52 (July), 58–74.
- Veblen, Thorstein (1899), *Theory of the Leisure Class*. New York: A.M. Kelley.
- Watson, Tom (2006), "Consumer Philanthropy: Nonprofits Spend Billions to Reach Consumers: Changing Our World Pegs Marketing Spending at \$7.6 Billion Annually," *On Philanthropy*, (December 13), (accessed October 23, 2010), [available at <http://onphilanthropy.com/2006/special-report-consumer-philanthropy/>].
- Wilson, Edward O. (2006), *The Creation: An Appeal to Save Life on Earth*. New York: Norton.
- Wilson, Margo and Martin Daly (1997), "Life Expectancy, Economic Inequality, Homicide, and Reproductive Timing in Chicago Neighborhoods," *British Medical Journal*, 314 (April), 1271–74.
- and ——— (2005), "Carpe Diem: Adaptation and Devaluing the Future," *Quarterly Review of Biology*, 80 (1), 55–60.
- , ———, and Stephen Gordon (1998), "The Evolved Psychological Apparatus of Human Decision-Making Is One Source of Environmental Problems," in *Behavioral Ecology and Conservation Biology*, Tim Caro, ed. Oxford: Oxford University Press.
- , ———, and ——— (2007), "The Evolved Psychological Apparatus of Human Decision-Making Is One Source of Environmental Problems," in *Evolutionary Perspectives on Environmental Problems*, Dustin Penn and Iver Myrsetrud, eds. New Brunswick, NJ: Transaction Publishers.
- Zahavi, Amotz and Avishag Zahavi (1997), *The Handicap Principle: A Missing Piece of Darwin's Puzzle*. New York: Oxford University Press.

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