Human Behavioral Contributions to Climate Change

Psychological and Contextual Drivers

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We are facing rapid changes in the global climate, and these changes are attributable to human behavior. Humans produce this global impact through our use of natural resources, multiplied by the vast increase in population seen in the past 50 to 100 years. Our goal in this article is to examine the underlying psychosocial causes of human impact, primarily through patterns of reproduction and consumption. We identify and distinguish individual, societal, and behavioral predictors of environmental impact. Relevant research in these areas (as well as areas that would be aided by greater attention by psychologists) are reviewed. We conclude by highlighting ethical issues that emerge when considering how to address human behavioral contributions to climate change.

Keywords: population, consumption, consumerism, climate change, social and cultural context

Current levels of human consumption, in combination with growing population, are having a significant negative impact on the natural environment and are contributing to climate change (Dietz & Rosa, 1994; Dietz, Rosa, & York, 2007; Myers & Kent, 2003; National Research Council, 1997). Continuing the current rate of greenhouse gas emissions is expected to yield a great variety of undesirable consequences that increase over time (Intergovernmental Panel on Climate Change, 2007). Even if per capita emissions are held constant, population increases expected in the next half century would increase the global emissions rate by about half. A much larger increase would result if per capita emissions from energy consumption in developing countries (2.2 metric tons of CO_2 in 2005) increased to the U.S. level of 19.5 metric tons (International Energy Agency, 2007). Psychology can help explain what drives population growth and consumption while also clarifying the links from population and consumption to climate change and attending to global and regional inequities.

We first present quantitative models that link population and consumption to climate change. After establishing this link, we examine characteristics and predictors of population growth. Much of this research has been done outside of psychology, for example, by demographers. We suggest ways in which psychology could contribute more to this discussion. The link between population and climate change flows through the collective impact of environmentally significant patterns of consumption. Therefore, we provide a psychological analysis of consumption via a model that includes predictors and consequences of environmental consumption. We then elaborate on the model by first disaggregating consumption behaviors into those that have direct (environmental consumption) and indirect (economic consumption) impacts on climate change. Then we illustrate what psychology can contribute to the understanding of psychological and cultural predictors of consumption while recognizing structural, economic, and physical constraints on consumption decisions. Last, we reflect on the ethical implications of considering constraints and changes in population and consumption.

Quantitative Models

Various quantitative models describe and predict the impact of population and consumption on the environment. A widely known formula from the 1970s is $I = P \times A \times T$, or IPAT, where I = impact, P = population, A = affluence per capita, and T = technology (Commoner, 1972; Ehrlich & Holdren, 1971; Holdren & Ehrlich, 1974). Although T has been used to refer to technology, in practice it served as an error term, representing all sources of impact not captured by P and A. Other details have been included in other versions of the formula. For instance, population has been disaggregated into both number of individuals and number of households (Dietz & Rosa, 1997; Liu, Daily, Ehrlich, & Luck, 2003), and the Intergovernmental Panel on Climate Change version of the formula makes specific reference to greenhouse gas (GHG) emissions: $Population \times Per\ Capita\ Gross\ Domestic\ Product \times Intensity_{GHG} = Emissions_{GHG}$ (Blodgett & Parker, 2008). A particularly noteworthy new formula is known as STIRPAT (stochastic impacts by regression on population, affluence, and technology; Dietz et al., 2007). It employs advanced

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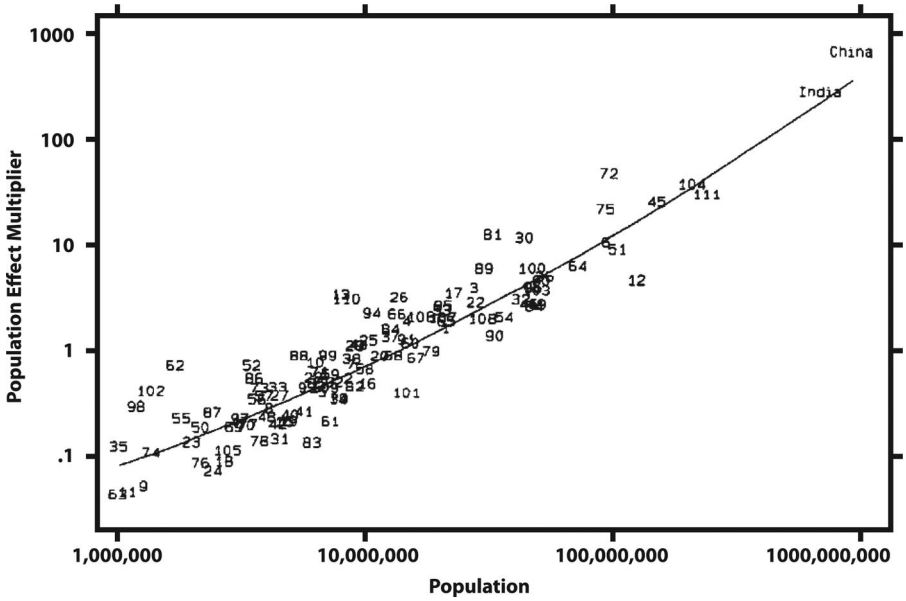
statistical methods that can take into account the probabilistic nature of the variables in the equation.

Across the different models, a consistent finding is that growing population and consumption are major contributors to the impact of humans on the environment and on CO_2 levels in particular. For example, STIRPAT analyses illustrate that countries with larger populations (see Figure 1) and greater per capita consumption (see Figure 2) have greater CO_2 emissions (Dietz & Rosa, 1997). The relations with affluence are important to consider in more detail. Figure 2 illustrates a commonly found, albeit sometimes debated, pattern (Carson, 2010) in which increasing affluence is associated with environmental outcomes except at the highest levels, where the association levels off and starts to become negative (Hanley, 2008). This pattern has been used as evidence for a delinking of CO_2 emissions and economic growth at higher levels of income. Proposed explanations for this pattern include the possibility that in places with greater per capita gross national product (GNP), people spend more on services than goods, are invested more in energy efficiency, live in more energy-efficient urban areas and use more efficient technologies, relocate their contribution to emissions to other parts of the world via trade that decreases industrialization in their own countries, and have governments that have more effective regulations (Carson, 2010; Dietz & Rosa, 1997; Hanley, 2008). The array of possible explanations illustrates the need to better understand the relation between affluence and CO_2 emissions. Further, individual-level analysis is necessary to determine why there is a relation between consumption and emissions. Psychology can help clarify mechanisms by which population and affluence effect cli-

Figure 1
The Relation Between Population and CO_2 Emissions, Controlling for GDP



Note. Numbers in the graph represent countries used in the analyses (Dietz & Rosa, 1997). Number 104 represents the United States. GDP = gross domestic product. Reprinted from "Effects of Population and Affluence on CO_2 Emissions" by T. Dietz & E. A. Rosa, 1997, *Proceedings of the National Academy of Sciences, USA, 94,* p. 178. Copyright 1997 by the National Academy of Sciences of the United States of America.

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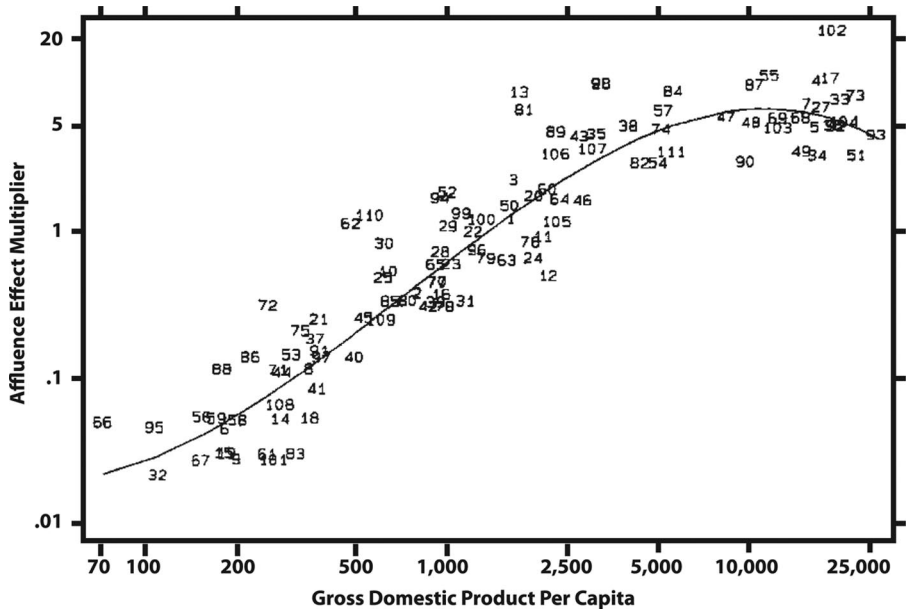
mate change by examining the psychological and social predictors of population growth and consumption and by providing a behavioral analysis of different types of consumption behaviors.

Population

Concerns about population include considerations of population size, distribution, and density. Here we consider population size because of its demonstrated relation with GHG emissions, as noted above. Population distribution and density are also relevant to environmental impact, but the relationships are more complicated. The size of the human population has grown exponentially over the last 100 years (see Figure 3). There are now approximately 6.6 billion humans on the planet. The growth rate is projected to be less than 1% by 2020, but this rate still indicates continued overall growth (U.S. Census Bureau, 2008). Population change is not consistent across regions. Fertility rates are currently lowest in Europe, East Asia, and the Pacific, with about 2.1 children or fewer per woman, and highest in Sub-Saharan Africa, with about 5.2 children per woman (Lule, Singh, & Chowdhury, 2007). However, population size and per capita emissions must be examined together.

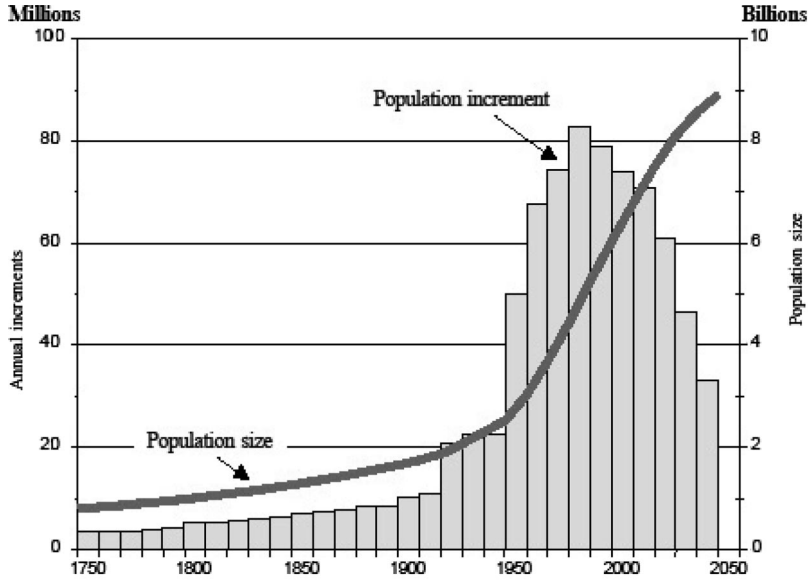
The potential impact of population growth on climate change is much greater in countries with high per capita emissions (International Energy Agency, 2007). For example, projected increases in energy use in Africa in the next 25 years are expected to result in much smaller total emissions than in other regions because this continent has the lowest regional per capita GHG emissions. In contrast, the United States now produces seven times more CO_2 emissions than Africa and in the next 25 years is projected to contribute about five to six times more emissions than

Figure 2
The Relation Between Per Capita Affluence and CO_2 Emissions, Controlling for Population



Note. Numbers in the graph represent countries used in the analyses (Dietz & Rosa, 1997). Number 104 represents the United States. Reprinted from "Effects of Population and Affluence on CO_2 Emissions" by T. Dietz & E. A. Rosa, 1997, *Proceedings of the National Academy of Sciences, USA, 94,* p. 178. Copyright 1997 by the National Academy of Sciences of the United States of America.

Figure 3
World Population Size and Annual Increments: 1750 to 2050



World Population Reached:	4 billion in 1974 (14 years later)
1 billion in 1804	5 billion in 1987 (13 years later)
2 billion in 1927 (123 years later)	6 billion in 1999 (12 years later)
3 billion in 1960 (33 years later)	7 billion in 2011 (12 years later)

Note. Projections are based on an assumption of medium fertility (United Nations, 1999). The population estimate for 2011 is from the U.S. Census Bureau (2011). Except for the 2011 population estimate, the figure is reprinted from *The World at Six Billion* (pp. 7, 8) by the Population Division, Department of Economic and Social Affairs, United Nations Secretariat, 1999, New York, NY: United Nations. Copyright 1999 by the United Nations.

Africa. Although most of the world's projected increase in energy demand over the next 25 years comes from developing countries, led by China and India, the United States is projected to continue to contribute the most per capita, at about two to three times more per person than China. Many argue that increases in per capita energy consumption are necessary for economic development in places such as Africa, China, and India.

Decreasing population or population growth does not address climate change in a straightforward way. Some have argued that there is a logical fallacy in concluding that an increase in population is associated with an increase in GHG emissions because the countries with the greatest increase in population are contributing the least to climate change (Carr, Suter, & Barbieri, 2006). Decreasing population growth in regions that have high per capita GHG emissions could have a much greater effect on climate change than decreases in population in other areas. Yet even in regions with high per capita GHG emissions, a population decrease does not guarantee decreases in emissions. In the United States, average household sizes are decreasing, but households are living in larger homes, which use more energy (Steele, 2010; Whipps, 2006). Also, change in number of households (rather than in number of individuals) is a better unit of analysis for understanding energy consumption and, as a result, GHG emissions (Carr et al., 2006). Most direct energy consumption is related to transportation, heating and cooling of buildings, and appliances. These contributors are shared by household members, with larger households using less energy per capita than smaller households. Considerations such as these have led some to argue that it is more important to focus on decreasing consumption rather than decreasing population (Diamond, 2008).

Yet stabilizing or reducing population size can be an important element of climate change mitigation because of the strong, though indirect, impact of population on GHG emissions. Further, reducing the number of households can also be critical because of the link to population size and efficiency. It is interesting to note that perceived links between one's own behavior and specific environmental problems can encourage contraceptive use. For example, in a rural agricultural setting in Nepal, those who perceived that environmental destruction had influenced their agricul-

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tural productivity were more likely to use contraceptives (Ghimire & Mohai, 2005).

Psychologists can identify psychological predictors of individual procreation decisions, policy support, and living arrangements while attending to links between these predictors and social and cultural forces and justice issues (e.g., Sen, 2003; Trommsdorff & Nauck, 2010). For instance, procreation decisions are influenced by perceptions of the economic and emotional value of children, and these perceptions can vary intergenerationally (Trommsdorff & Nauck, 2010). Although we are not aware of any studies specifically about the perceived desirability of different population sizes, there may be implicit or explicit beliefs that a growing population is desirable because increasing population implies that a society has access to food and adequate health care (Livi-Bacci, 2007) and because of concerns about inverted pyramidal distributions in which older adults outnumber youths (Booth & Crouter, 2005). These beliefs may counter support for policies aimed at decreasing population growth. Social patterns such as the nuclearization of families, increased divorce, and longer life spans are likely to encourage formation of a greater number of households. Psychological models that support family structures that help counter the impact of these patterns on numbers of households may be useful. Individual and culturally supported restrictive gender roles can also influence procreation decisions. Gender roles that define women's status by the number of children they have, limit women's access to alternative roles, give others control over women's decisions to have children, and devalue female children (creating greater demand for more children in order to ensure having male children) have been implicated as causes of population growth in India (Bhan, 2001; Sen, 2003). Psychological research into beliefs about sexuality, the acceptance of birth control, and masculinity and male dominance and psychologists' expertise on the increasing sexualization of girls, the effects of abortion on women's well-being, and various types of subtle and implicit sexist beliefs are relevant to discussions about population. Finally, because population growth has been described as a type of commons dilemma (Hardin, 1968), psychology can help by applying what has been learned about cultural and psychological factors that counter commons dilemmas (e.g., Gifford, 2008; National Research Council, 2002).

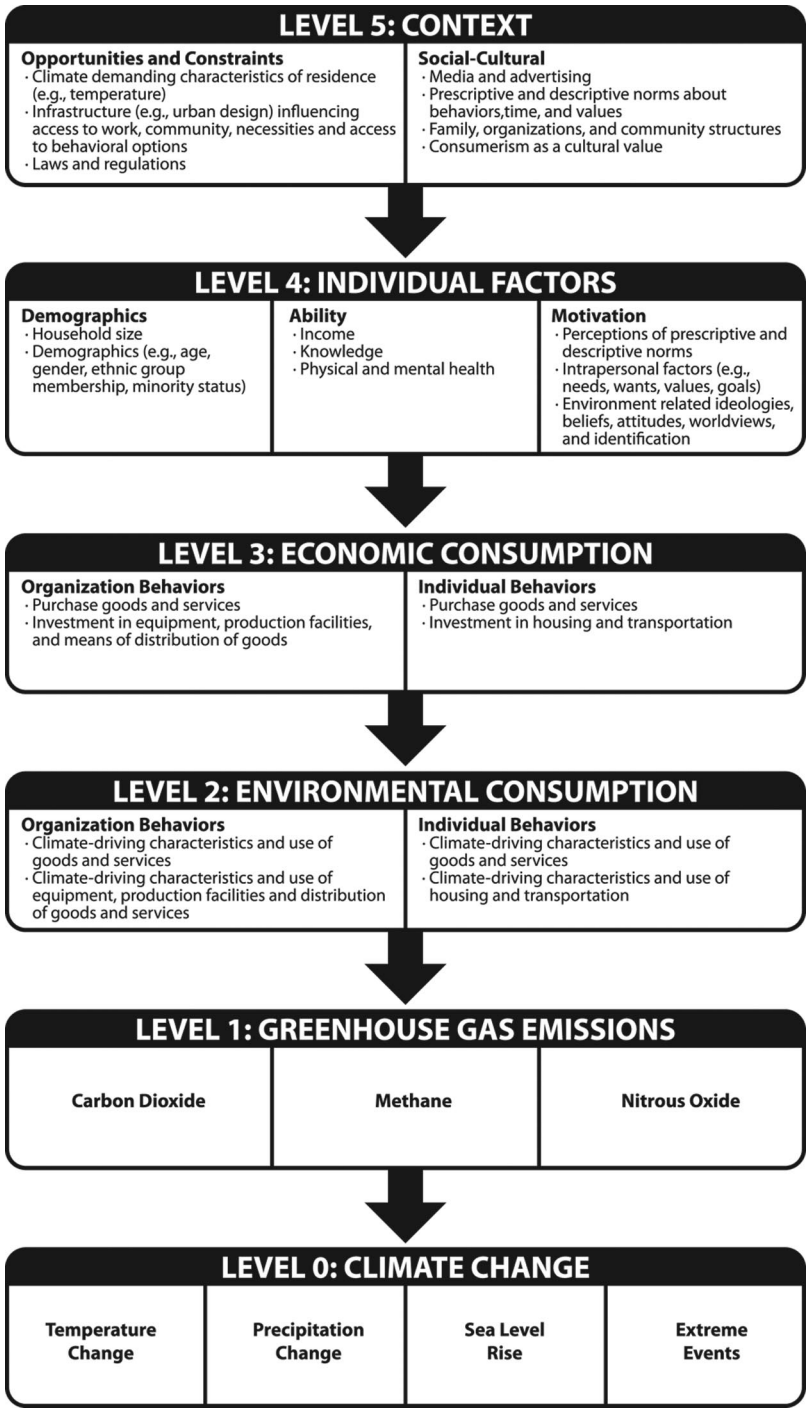
Consumption

The term *consumption* has multiple meanings in different disciplines and intellectual communities. The IPAT and STIRPAT formulations operationalize it in monetary terms, with a measure of aggregate economic activity or aggregate consumer purchases. However, a full understanding of how consumption contributes to climate change requires a more detailed model. Figure 4 presents a conceptual model that helps illuminate predictors of consumption, differentiates between consumption defined in terms of money spent versus consumption defined in terms of environmental impact, and identifies the mechanisms by which consumption influences climate change.

Variables at each level illustrated in Figure 4 can affect variables at the other levels, either directly or indirectly, but it is important to recognize the distinctions among them. Level 5 sets the context for individual behaviors and decisions, sometimes encouraging and directing behaviors and at other times constraining behaviors. Level 4 includes characteristics of individuals that influence their ability and motivation to engage in consumption, including many psychological constructs related to environmental consciousness, such as attitudes and values, which have been the focus of much research on predictors of environmentally responsible behaviors. Contexts (Level 5) can influence individual drivers of consumption (Level 4). Cultural practices influence psychological factors, for instance, by defining what are considered needs versus mere desires and by making particular behavioral options possible, feasible, and desirable. Individual consumption decisions can be made alone or within groups (e.g., families or boards of directors representing particular contexts for decisions, Level 5).

Levels 3 and 2 represent two different aspects of consumption. Economic consumption, Level 3, involves the money individuals and organizations spend; it is represented by per capita GNP used in the quantitative models described earlier. Level 2 represents environmental consumption—"human and human-induced transformations of materials and energy" (National Research Council, 1997, p. 20). Economic and environmental consumption are correlated but separable. For example, a person might buy a famous painting that cost a lot more than the gas paid to drive to the point of purchase, but the latter will have more of an environmental impact. Choices about how to spend money—for instance, the choice to spend money on a low-mileage rather than a high-mileage car (economic consumption)—also influence environmental

Figure 4
Examples of Predictors and Climate Change–Relevant Consequences of Environmental Consumption



Note. Adapted from *Psychology and Global Climate Change: Addressing a Multifaceted Phenomenon and Set of Challenges* (p. 34) by the American Psychological Association Task Force on the Interface Between Psychology and Global Climate Change, 2009, Washington, DC: American Psychological Association. Copyright 2009 by the American Psychological Association.

consumption. However, environmental consumption is also affected by other factors, such as driving distances.

Much of the psychological research agenda on consumption concerns the links between levels and the moderating and mediating processes involved. Psychology can help (a) explain the relationships among and between contextual (Level 5) and individual drivers of consumption (Level 4); (b) explain the links from individual drivers (Level 4) to economic and environmental consumption (Levels 3 and 2); (c) explain how interventions (incentives, information, persuasion, etc.) directly affect consumption (Levels 2 and 3); and (d) test whether interventions alter individual drivers and/or individual drivers moderate relations between interventions and consumption (Levels 2 and 3). These links are also important psychologically because consumption choices may reflect people's knowledge or concern about links between consumption (Levels 2 and 3) and GHG emissions (Level 1), as shown, for example, by whether they try to buy products that use less energy or use their products in more energy-efficient ways.

Psychologists can help by providing behavioral analyses of economic and environmental consumption (Levels 2 and 3). Evidence of the impact of consumption on the environment, and specifically on GHG emissions, is typically assessed with national-level data on the GDP of individual countries. A problem for a behavioral analysis is that GDP aggregates a wide variety of different types of consumption behaviors and focuses on economic rather than environmental consumption. Disaggregation of these behaviors into specific types of behaviors can help clarify which behaviors contribute the most to climate change and which behaviors can therefore be most effectively targeted for reduction of emissions. Great effort can be put into engaging in behaviors that have little effect on emissions (Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009). Moreover, individuals who lack knowledge about the relative contribution of behaviors to emissions may prioritize a relatively ineffective behavior over a more effective one (Attari, DeKay, Davidson, & De Bruien, 2010). Bin and Dowlatabadi (2005) argued that consumer behaviors that directly produce emissions (e.g., driving a car) account for about 40% of U.S. emissions and that about 60% of U.S. emissions come from consumer purchasing behaviors that indirectly impact emissions via commercial and industrial processes. Dietz et al. (2009) argued that by targeting particular behaviors such as buying fuel-efficient cars and weatherizing homes it is possible to realistically expect households to reduce their direct contributions to emissions by 20%, which would reduce U.S. emissions by 7.4% annually. Disaggregation of behaviors can help elucidate factors that encourage or discourage particular behaviors. Different functional units of behaviors, such as recreation and leisure (e.g., entertainment, holiday travel) versus subsistence activities (e.g., space heating, food preparation and production), suggest different contextual and individual drivers of consumption behaviors (Druckman & Jackson, 2009; Jackson, Papathanasopoulou, Bradley, & Druckman, 2007). Further disaggregation of behaviors into specific behaviors that serve these functions may also be important. Some behaviors may be motivated by hedonic reasons, and others, by social norms (Lindenberg & Steg, 2007). Some behaviors may require specialized skills, may cost a great deal of money, or may be unavailable.

Yet behavioral analyses need to consider more than individual actions. First, actions can be interdependent. Engaging in one type of environmentally friendly behavior can predispose one to engage in similar behaviors, inhibit other behaviors, or even increase environmentally harmful behaviors (e.g., switching to hybrid cars may encourage people to drive farther, neutralizing emissions reductions; Crompton & Thøgerson, 2009; York, 2006). Second, individual behaviors that have little effect may add up to a large effect across behaviors and across individuals (e.g., putting electronics on standby power mode saves minuscule amounts of energy, but the total energy saved across devices and households can be considerable; Dietz et al., 2009). Third, behaviors can influence not just GHG emissions but their absorption and the direct reflectivity of Earth (e.g., changes in land use, such as through deforestation, can decrease absorption of GHGs; Millennium Ecosystem Assessment, 2005). Increases in population, number of households, and housing size potentially impact climate change not just through direct and indirect energy use but also through deforestation and biodiversity more generally. For instance, nearly half of the earth's surface is devoted to agriculture, and over three quarters of the earth's surface is subject to some degree of anthropogenic influence (Carr et al., 2006). This analysis points to the need to understand individuals' choices among behaviors and their overall patterns of consumption, especially the total effects of these choices and patterns in climate terms. We start by examining types of consumption behaviors (Levels 2 and 3), then consider individual drivers of consumption (Level 4), and end with a consideration of broader influences (Level 5) on consumption decisions.

Types of Consumption (Levels 2 and 3)

Researchers have proposed different classifications of consumption and consumption-reducing behaviors (e.g., Jackson et al., 2006). One classification distinguishes investment in equipment and technology, management of the equipment and technology, and their use (cf. Kempton, Darley, & Stern, 1992; Kempton, Harris, Keith, & Weihl, 1985). The first of these categories represents economic consumption that drives energy use, whereas the latter two represent more direct environmental consumption. Orthogonal to these categories are specific domains of energy use such as transportation, space heating and cooling, and household appliances and electronics (see Table 1 for examples). We pick these three domains because they represent major sources of household emissions, and the table illustrates three ways that households can directly influence their personal GHG emissions through their behaviors (Bin & Dowlatabadi, 2005; Dietz et al., 2009). As noted above, we could consider other behaviors as well. For instance, recycling and reusing materials reduce emissions because they reduce the need to extract, process, and transport virgin materials. However, these effects are not entirely within

Table 1
Types of Consumption Behaviors and Examples in Different Domains of Energy Use

Domain of energy use	Type of consumption behavior: Investment in equipment and technology	Management of equipment and technology	Intensity of equipment and technology use
Transportation	Number and fuel efficiency of personal and public transportation vehicles	Number of people in vehicles, engine maintenance	Miles traveled in vehicles
Heating and cooling of buildings	Size of buildings, efficiency of furnaces and air conditioners, amount of insulation	Maintenance of furnaces, caulking of windows	Temperature settings
Household appliances and electronics	Energy efficiency of water heaters, televisions, refrigerators	Cleaning freezer coils, reducing standby power use	Amount of hot water used, time spent with television on

the consumer's control because the choice to replace virgin materials with recycled goods is made by manufacturers.

A considerable body of psychological literature on predictors of consumption either focuses implicitly or explicitly on economic consumption, usually without regard to its environmental consequences, or addresses environmental consumption but does not attend to its consequences for GHG emissions. Research on economic consumption is relevant to understanding human contributions to climate change because of the general association between economic consumption and GHG emissions (as illustrated above with research on GDP) and because nonenvironmental product attributes are important to consumption decisions that affect GHG emissions. Further, information learned from research on environmentally responsible behavior may be transferable to the study of behaviors that contribute to greenhouse gases. However, efforts to address climate change are likely better served if attention is given more directly to the extent to which particular behaviors have environmental impacts and whether they contribute to climate change. For instance, Gatersleben, Steg, and Vlek (2002) distinguished environmentally sensitive choices for waste management and food from environmentally sensitive choices for household energy use. Household energy use is more directly related to the production of GHG, is negatively related or unrelated to waste management and food choices, and has some unique predictors. With this caveat in mind, we turn to predictors of consumption, noting that some of the studies consider economic consumption, some consider environmental consumption, and some consider specific behaviors of relevance to climate change.

Individual Drivers of Consumption (Level 4)

Variation in consumption behaviors is due, in part, to variation in individuals' actual and perceived abilities (Level 4). Ability can be influenced by income available for affording different consumption behaviors, knowledge about how to act to change the climate impacts of consumer behavior, and physical and mental health. Low-emission behavioral choices that require only very infrequent actions (e.g., insulating one's home) are often affected by financial and other barriers that do not exist for management and use actions. However, such choices generally save more energy than changes in management or use of equipment, which usually require repeated efforts (Dietz et al., 2009). Demographic variables, such as household size, family life cycle, and age, are likely related, at least in part, to environmental consumption because of the relation between demographic variables and individual and household needs and/or abilities to choose alternative behaviors (Gatersleben et al., 2002). Response efficacy and self-efficacy can also be important drivers of consumption. Response efficacy, or perceptions of the effectiveness of different behaviors for reducing emissions, may be important even when perceptions do not match the research data (Attari et al., 2010; Kempton et al., 1985). Self-efficacy, or individuals' perceptions of their ability to engage in the behaviors, also influences whether people engage in these behaviors (Sia, Hungerford, & Tomera, 1985–1986).

Motivations also play an important role in directing behaviors. Some motivations inhibit behaviors, including those that require little ability (e.g., desires for comfort discouraging thermostat setbacks). Other motivations encourage individuals to overcome ability barriers. For example, financial incentives, as an external motivator, can be used to address financial barriers to investment in energy-efficient equipment and technology and can influence choices about the use of products and services that contribute either more or less to GHG emissions.

Motivations can be behavior specific, such as those produced by incentives to buy particular products. Research in Europe over several years has examined behavior-specific predictors of low-emission behaviors such as car use and travel mode choices, purchasing of environmentally friendly cars, sustainable holiday travel, use of solar energy, and collective decisions about energy use (Matthies, 2008). For instance, Van Vugt, Van Lange, Meertens, and Joireman (1996) examined the role of travel costs and flexibility in preferences for using carpool lanes in Europe. After carpool lanes were made available, those who drove alone, not using the carpool lane, increased the

importance they placed on flexibility and decreased the importance they placed on travel costs, apparently increasing their justification for not carpooling. In addition to personal cost–benefit considerations, motivations can include ethical considerations with regard to the consequences of specific behaviors (Swim & Becker, in press).

Motivations can be more general, directing patterns of consumption. For example, greater engagement in sets of environmentally responsible behaviors is positively associated with (a) the importance of preserving or utilizing nature (Milfont, Duckitt, & Cameron, 2006); (b) self-transcendent universal values (e.g., a preference for a world of beauty and unity with nature; Schwartz, 1994); (c) concerns about the impact of environmental problems on marine life, plants, and nonhuman animals (Schultz et al., 2005; Swim & Becker, in press); and (d) beliefs about the vulnerability of nature and environmental systems (Poortinga, Steg, & Vlek, 2002). Another potentially important predictor is environmental identity or connections to the nonhuman natural environment (Clayton, 2003).

Materialism—prioritizing the acquisition and possession of material objects—is a general motivator particularly relevant for studying consumption behaviors. Many advertisements promise various personal and social rewards for purchasing products, including self-satisfaction, fun, and praise from others. Thus, individuals may seek happiness via consumption. Yet the presumed relation between consumption and happiness is not well supported by data, particularly in wealthier countries, where consumption is already high. Subjective well-being is higher in wealthier countries, but within countries, there is little relation between increasing GDP over time and subjective well-being (Diener & Biswas-Diener, 2002). In economically developed countries, there is only a small positive correlation between individual income and self-reported subjective well-being (Diener & Biswas-Diener, 2002), and income is only weakly related to daily mood (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2006). Relative income is more strongly associated with self-reported happiness than is actual income (Clark, Frijters, & Shields, 2008), and the relation between income and well-being is stronger in poorer countries. These findings suggest that once basic needs are satisfied, increasing income and associated increases in economic consumption are less relevant for happiness.

Research indicates that rather than promoting well-being, materialism hinders well-being and is more detrimental to the environment than alternative aspirations. Those who endorse materialistic aspirations (such as believing that financial success is an important personal life goal) are more likely to score poorly on measures of subjective well-being, including global adjustment, social productivity, and behavioral disorders (Kasser & Ryan, 1993; Kasser, Ryan, Couchman, & Sheldon, 2004). Further, U.S. adults and adolescents who do not endorse materialistic values consume less energy by some measures, such as riding bicycles, using both sides of paper, and turning off lights in unused rooms (Kasser, 2005; Richins & Dawson; 1992).

Core psychological needs may also drive consumption (Deci & Ryan, 2000; Ryan & Deci, 2000). Products may provide a sense of belonging and connection to others. The clothes we wear, the cars we drive, the way we decorate our homes, and the gifts we give others allow us to fit in with social trends, raise our status, carve out our own unique subcultures and individual identity, and display our group membership. The need to belong can explain the power of conforming to descriptive social norms for energy use (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Consumption can also be promoted as a way to satisfy a need for autonomy or competence and to reach one's individual potential (i.e., become self-actualized; Berger, 2006; Curtis, 2002; Lavine, 2006). Yet it is possible that even if these core needs and goals predict consumption, environmental consumption may not satisfy these needs, in the same way that meeting extrinsically oriented goals does not satisfy needs for subjective well-being (Kasser et al., 2004; Kasser & Ryan, 1993). Research like that examining the relation between happiness and materialism is needed to more fully illuminate relations between core psychological needs and consumption.

From the standpoint of the need to reduce environmental consumption in countries such as the United States, it is important to consider how psychological needs can be satisfied with less than current levels of such consumption. Rather than pursuing materialistic goals and passive forms of entertainment (e.g., watching television), people would be better served by working on tasks that require greater engagement (Csikszentmihalyi, 2004). Further, engaging in ecologically responsible behavior is associated with higher subjective well-being and with endorsing more intrinsic and less extrinsic values (Brown & Kasser, 2005). Thus, although psychological needs drive consumption, there may be alternative ways to satisfy those needs that are both more effective and less environmentally taxing. More research exploring these possibilities is needed.

Context and Consumption (Level 5)

As noted in Figure 4, a number of contextual features (Level 5) influence individual drivers of consumption (Level 4). Some contextual features influence consumption decisions by influencing needs (whether individuals live in temperate vs. very hot or very cold environments) and abilities (the physical infrastructure that affects the options for travel or the energy efficiency of homes; the service providers' and producers' choices of which goods and services to make available; and various laws and regulations that affect what options and behaviors are permitted). Other contextual features influence motivations, such as when cultures influence perceptions of needs, desire for consumer goods, and perceptions of time. We elaborate on these three motivational ways that cultures can influence consumption.

First, cultures can affect consumption by influencing perceptions of what is a necessity versus a luxury. Culture can create real needs. For instance, products that were once luxuries, such as cars, have become necessities for many people because human settlements have developed in ways

that make it very difficult to engage in necessary activities, such as obtaining food and employment, without a car. Yet shifts over time and subgroups reveal the plasticity of these perceptions. In 1996, 32% of people in the United States thought that a microwave oven was a necessity, whereas in 2006, 68% believed this was true (Pew Research Center, 2006). Further, in that same survey, the more income a person had, the more likely he or she was to view the items examined in the survey (clothes dryers, home and car air conditioning, microwave ovens, television sets, etc.) as necessities. Although we know of no specific research on cultural factors that influence these perceptions, it seems likely that culturally defined reference points are important. For instance, if a certain level of consumption is seen as normal, consumption levels below it may be perceived as insufficient. Reductions in this norm would be seen as losses, rather than as gains from a state of no possessions, and losses have greater psychological impact than gains (Kahneman & Tversky, 1979). Further, upward social comparisons with those who consume a great deal ("the rich and the famous") likely encourage people to consume more because of a perception of their current state as relatively deprived (cf. relative deprivation theory; Crosby, 1976).

Second, cultures can influence the relative importance of consumerism, a cultural foundation for the materialistic tendencies described above. Consumerism is "a belief and value system in which consumption and acquisition rituals (e.g., shopping) are naturalized as sources of self-identity and meaning in life, goods are avidly desired for non-utilitarian reasons such as envy provocation and status seeking, and consuming replaces producing as a key determinant of social relations" (Zhao & Belk, 2008, p. 231). Consumerism can be transmitted to members of a society via media. Frequent television viewing is associated with less concern for the environment, and materialism mediates this association (Good, 2007). The particular importance of advertising for environmental consumption is illustrated by the positive relationship between money spent on advertising from 1900 to 2000 and (a) the purchasing of household appliances and supplies and (b) the purchasing and operation of automobiles (but not food consumption and the purchasing of clothes; Brulle & Young, 2007). Consumerism in the United States needs to be understood as occurring within a wealthy, individualistic, and capitalistic culture (Kasser, Cohn, Kanner, & Ryan, 2007). The importance of this connection is suggested by correlates of endorsement of free-market ideology (Heath & Gifford, 2006). Endorsement of this ideology is associated with a variety of beliefs related to lack of concern about the environment and lack of attention to addressing negative effects of global climate change. However, although consumerism is widely associated with the United States, it is becoming global. It has become a part of Chinese culture, with some arguing that it is overpowering communism (Zhao & Belk, 2008).

Third, cultures can influence consumption through their perceptions of time and their valuation of it. A future time perspective, a perspective often held in Western cultures, is associated with endorsing the need for environmental preservation (Milfont & Gouveia, 2006). Yet Western culture is built to a great extent on treating time as a resource that is maximized at the expense of natural resources. Energy is used to improve efficiency (e.g., to decrease time on any particular task and increase our ability to multitask) and expand time so that we can have activities occurring around the clock (Stephens, 2002). The cost to one's time can influence environmentally significant consumption. Preferences for public transportation decrease when public transportation is perceived to take longer and be more unpredictable than traveling by car (Van Vugt, Van Lange, & Meertens, 1996). Increases in personal investment of time may be required to reduce our use of natural resources. These changes can be impractical for individuals to make on their own and may require a more general cultural shift in perceptions of the value of time and how we use it (Kasser & Brown, 2003; Kasser & Sheldon, 2009).

Other cultural variables likely influence consumption behaviors. For instance, cultural values of aspiring toward mastery and hierarchy (which include specific values relevant to consumerism) are correlated with greater environmental destruction and specifically with higher levels of CO_2 emissions in a country, even after GDP is statistically controlled (Bloodhart & Swim, 2010; Kasser, 2011). Further, residents' environmental concerns and subsequent evaluations of their behaviors help explain country differences in environmental consumption (Swim & Becker, in press). Given these and the above considerations about culture, it is likely that identification with particular social groups (e.g., ethnic groups) and internalization of cultural worldviews also have an impact on consumerism and patterns of consumption.

Counter-Consumerism Movements

Individuals and groups of people have made efforts to alter their lifestyles to reject what they see as the problems with consumerism and a culture that they perceive supports it. For instance, some people join voluntary simplicity movements, promote efforts to allow people to "take back their time," join community-supported agricultural groups, and participate in "freecycling" groups (Bekin, Carrigan, & Szmigin, 2005; Craig-Lees & Hill, 2002). When undertaken voluntarily, these activities may contribute to well-being, which they may not do if they are experienced as asceticism or self-deprivation or are done for involuntary reasons (Lavine, 2006). The extent to which these movements ultimately influence climate change will depend on how widespread they become and the extent to which their altered patterns of consumption reduce GHG and other climate drivers.

Yet these movements are phenomena worth exploring in more depth because of their relationship to patterns of consumption. Many individuals who have become "downshifters" (estimated in 1998 to be 19% of the U.S. population [Schor, 1998] and in 2003 to be about 25% of the population in Great Britain [Hamilton, 2003]) are simplifying their lifestyles by repairing, reusing, sharing, and making their own goods and by changing their focus to fulfill civic engagement roles, including using the consumer culture to fight the consumer culture with boycotts

and "buycotts" (Elgin, 2000). Many of their behavioral choices involve less environmentally taxing patterns of consumption that include behaviors that produce fewer GHG emissions. It is argued that individuals joining these movements have found ways to satisfy their needs for esteem, autonomy, and belongingness. Brown and Kasser (2005) provided evidence of this. They found that, relative to a matched group of mainstream people in the United States, self-identified voluntary simplifiers were not only living a more ecologically sustainable lifestyle but were also significantly happier. The benefits may extend farther when such movements become social movements (such as transition town initiatives) in which individuals work together to build communities' resilience and to mitigate climate change impacts (see http://www.transitionnetwork.org). People who live such an alternative lifestyle may serve as a sort of "minority opinion," encouraging others to consider the possibility of deviating from mainstream societal norms, like the deviants in Asch's (1956) famous conformity experiments.

Conclusions

Human behaviors, through activities that lead to the emission of GHGs such as carbon dioxide and methane, are largely responsible for current trends in global climate change. Although media coverage and advertising campaigns often attribute environmentally taxing behavior to ignorance and/or lack of concern for the environment, decades of psychological research provide a much more nuanced understanding of the multiple, interdependent, and often seemingly irrational behavioral decisions involved. Taking into account variations in abilities and motivations for engaging in behavior and directing consumers toward alternative behaviors that satisfy psychological needs and aspirations can increase the short- and long-term effectiveness of behavioral change efforts.

Explicit and implicit decisions are a gateway between cultural contexts and behaviors that ultimately contribute to climate change. Cultural and social contexts that encourage or discourage population- and consumption-relevant decisions are on one side of this behavioral decision gateway. Taking into account these contexts can be critical when designing culturally sensitive interventions and policies. On the other side of this gateway are the behaviors that contribute to climate change. Attending to differences in types of behaviors (e.g., economic vs. environmental consumption, behaviors with different degrees of direct and indirect environmental impact, different functions of behaviors) and the relations among behaviors can be critical when designing interventions (see Stern, 2011, this issue, for more discussion about interventions). Yet to fully provide recommendations for interventions and policies, more psychological research is needed on such topics as

- predictors of reproductive behavior, number of households, household size, and support for population policies;
- predictors of environmental (not just economic) consumption that influences GHG emissions, and comparisons across cultures and subcultures;
- the impact of consumption on satisfaction of a variety of core psychological needs and non-consumer-driven means to achieve core psychological needs;
- cultural norms and worldviews (e.g., concerning time, personal space, and consumerism) and how these relate to environmental consumption; and
- consumer and community movements that have the goal of reducing emissions.

We encourage psychologists to engage with these issues in order to bring the skills of our profession to bear on the environmental challenges we are facing. Our argument is not only that psychological research is relevant to these challenges but that psychologists have an obligation to apply their knowledge to address a threat with the potential to significantly affect individual and societal well-being.

A Cautionary Note: Ethical Concerns

A number of ethical concerns emerge when discussing population and consumption. With respect to population, these include concerns about reproductive rights and choices (how many children to have, whether to use contraceptives, and whether to have abortions), a fetus's/unborn child's right to life, and an elderly individual's right to die. Moreover, concerns are raised when solutions to population growth target poor countries that are producing few GHG emissions and when solutions fuel anti-immigration rhetoric (Hartmann & Barajas-Roman, 2009). Other ethical concerns surrounding population growth and distribution involve the rights of human and ecological communities that are detrimentally affected by the increasing size and spread of human populations. Dilemmas emerge when these rights are framed as being in competition with each other.

With regard to consumption levels, ethical concerns arise from inequities across the globe and within regions of the world associated with different levels of energy consumption. Efforts to curb consumption can maintain or exacerbate existing inequalities depending on how the reductions are distributed. Many low-income countries and regions want—and some say should have the right—to develop economically in ways that rely on emission-intense industries that have allowed other countries to develop. Technological solutions that provide energy's services without using fossil fuel may provide a means to maintain affluent lifestyles and raise well-being for poor people while simultaneously decreasing GHG emissions. However, perfect technological solutions are not yet available because of variation in the ability to afford the solutions and possible environmental and social problems inherent in the production of the solutions.

Such issues mean that encouraging changes in population and consumption presents ethical considerations. It is imperative that we understand the values and assumptions

underlying the behavioral choices and policy support that influence population and consumption. Increasing population size and increasing consumption represent classes of behaviors that explain the ways that human behavior contributes to climate change. These classes of behaviors are embedded in larger contexts, framed by cultural and societal differences, in which not everyone has access to the same opportunities and choices. In order to address the links from population and consumption to climate change, we must recognize that both the predictors and the consequences of these behavioral patterns vary across cultural contexts and that a "one size fits all" approach is likely to be both unjust and ineffective.

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