COMMENTARY

Understanding environmentally significant consumption

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Consumer choices can have major impacts on the environment. For example, the United States could reduce its total greenhouse gas emissions by 7% through modest policies to encourage more efficient household energy consumption (1). This "behavioral wedge" would make a substantial and low-cost contribution to climate-change mitigation (2, 3). Shifts in water and food consumption would also be environmentally significant but we lack robust estimates of the impact. To realize the potential of consumer action, we need policies based on a sound understanding of environmental decision making.

Attari's analysis of beliefs about water consumption identifies a major obstacle to effective policy (4). On average, her respondents tend to underestimate the amount of water used by particular household appliances and activities by a factor of 1.6–2. The underestimate was greatest for the activities that use the most water. Thus, even if consumers are motivated to reduce their consumption, they will not do so effectively.

Earlier, Attari et al. found that consumers also misunderstood household energy use (5, 6). Respondents underestimated the amount of energy used by the most energy-intensive appliances and activities and overestimated the energy used by the least intensive. Perceptions of energy use were even less accurate than those for water use: on average, true energy use was underestimated by a factor of 2.8.

Taken together, these two studies show that motivating consumers will not be sufficient to realize environmental gains. Motivation will have to be accompanied by effective communication about what actions will have the biggest pay-offs. Furthermore, financial obstacles will have to be addressed. Attari finds that her respondents are reluctant to shift to more water-efficient appliances, probably because these actions require some upfront investment. However, those are the actions that will have the greatest benefits.

Resource-efficient technologies have substantial potential to reduce human stress on the environment. However, the "if we build it they will come" approach will not realize this potential. Rather, efficiency policy must be grounded in an understanding of decision making, including problems of motivation, inaccurate information, and financial and time constraints (7, 8). To design effective policies, we need an integrative theory of consumer decision making.

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Understanding Environmental Decision Making

The earliest attempts to understand environmental decision making assumed consumers were rational actors promoting their individual self-interest using perfect information about the costs and benefits that would follow from their actions (9, 10). Under this model, if a product or a change in behavior would save money while providing the same utility to the consumer, it would be adopted. The assumption of self-interested behavior raised the specter of the tragedy of the commons (11). How could a group of self-interested actors sustainably manage a common pool resource, such as a fishery, a ground water supply, or the climate? Narrow self-interest would predict collapse of the resource as a result of overexploitation. However, some commons have been maintained sustainably for decades or even centuries, whereas others have collapsed. This conundrum has inspired a rich and sophisticated literature (12, 13). It has become clear that self-interest is only one of several values that underpin environmental decision making, and that altruism also may be a major motivation in human decision making (14). Recent studies also show that political ideology, which is substantially grounded in individual values, has an influence on consumer decisions. For example, Gromet et al. found that highlighting the environmental benefits of consumer products made self-identified conservatives less likely to adopt them (15, 16).

Cognitive psychology has demonstrated that humans use shortcuts to simplify the information available, an approach labeled "heuristics and biases" (17, 18). These shortcuts have undoubtedly been useful across our evolutionary history and serve us well in most day-to-day decisions. However, the shortcuts can be problematic when making decisions about complex coupled human and natural systems. A sophisticated literature has applied these insights to understand public perceptions of environmental and technological risks (19). Attari's work (4) moves a step further, showing how our perceptions of consumption impacts can be systematically inaccurate. Although a few studies precede hers, we are only beginning to understand how consumers think about the environmental consequences of their actions (20–24).

We are now at a time when these two threads—one grounded in values and one grounded in cognitive process—need to be joined. To design policies that encourage more efficient consumption, we must understand both what motivates consumers in their choices and how they understand the environmental and other consequences of their decisions. What would such a synthetic theory entail, and why would it be of use?

Toward an Integrative Theory

We are learning how values interact with situational cues that emphasize or de-emphasize different implications of a behavior (25), and how beliefs and norms complement values in shaping a variety of proenvironmental behaviors (14, 26, 27). However, these

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theories of proenvironmental behavior share with the rational actor model a tendency to ignore the physicality of our resource use. There have been calls to take account of both psychological processes and practical constraints in the study of proenvironmental decisions (26, 28). The importance of categorizing resource consumption by types of behaviors required in consuming and reducing consumption (habits, equipment purchases, maintenance, and so forth) rather than by technology has been noted (1). However, the heuristics and biases tradition is not yet integrated with theories of what motivates environmentally significant decisions.

Attari's work (4) shows that we cannot assume that consumers will accurately assess the environmental impacts of their actions. She also shows the mis-perceptions are systematically biased. It appears that some of the systematic variation has to do with the resource itself. Perceptions of water use were much more accurate than perceptions of energy use. Attari offers two hypotheses to explain the difference. First, the typical measurement units for water—gallons—are very familiar to most of us, because most of us routinely purchase liquids (gasoline, milk) in gallon quantities. In contrast, we have almost no routine engagement with kilowatt hours or other units of energy measurement. Second, the services provided by water are directly visible: we wash ourselves, our clothes, and our dishes with water, and we drink and prepare food with water. However, electricity is invisible except through the services it provides. We see the services—warm air, cold air, the working of our many appliances—but not the electricity. In contrast, we usually see and hear water as it provides services. It follows that efforts to protect the environment will be most effective when they are directed toward the most tangible resource uses.

It also appears that perceptions of resource use are not randomly distributed across consumers. Attari finds important differences between water and energy in what factors influence the accuracy of perceptions. Age and sex influence perceptions of water use but not energy use. In contrast, perceptions about energy use but not water use are influenced by proenvironmental beliefs (a central element in many value-based theories). This interaction with beliefs may be related to the tangibility of water use versus energy use. For energy, those who are most concerned are most knowledgeable, whereas the familiarity of water consumption obviates that effect.

Next Steps

The agenda forward is obvious. Work on the influence of values and beliefs on decision making and work on consumer's cognitive shortcuts must converge. On the one hand, the ability of motivational theories to explain behavior will vary across types of consumption. Models using values and beliefs must be attentive to these differences. On the other hand, values and beliefs drive at least part of the variation in perceptions of resource. Models that examine both motivations and perceptions will not only be theoretically richer, they will also give better guidance to policy interventions.

What are the obstacles to such an integration? One is the familiar problem of disciplinary blinders. An integrative theory will require researchers to move across several traditions and create a unified approach. Another—and a rather crippling problem—is the lack of data that allows for integrative understanding. Relatively few studies grounded in either motivational or cognitive approaches are able to study actual behaviors rather than behavioral intentions. The studies that do examine behavior often have to focus on rather small-scale actions, such as the purchase of an energy-efficient light bulb. Even descriptive data on consumption are limited; Attari's data on the amount of water used by various appliances and activities is 14 y old.

It is clear that changes in consumer behavior can help reduce the stress we place on the environment. It is equally clear that an integrative theory of environmentally significant consumption can guide efficiency policy. However, generating the science to inform effective policy will require serious investment in interdisciplinary research.

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