TOPIC 2:

Climate Mitigation

Chapter 2 of 5 from:

The Science of Changing Behavior for Environmental Outcomes:

A Literature Review

STAP SCIENTIFIC AND TECHNICAL ADVISORY PANEL
An independent group of scientists that advises the Global Environment Facility

gef UN environment programme

rare CENTER FOR BEHAVIOR & THE ENVIRONMENT

Authors:

Philipe M. Bujold
Senior Associate, Center for Behavior & the Environment, Rare

Katie Williamson
Senior Associate, Center for Behavior & the Environment, Rare

Erik Thulin
Behavioral Science Lead, Center for Behavior & the Environment, Rare

Recommended citation:

Bujold, P. M., Williamson, K., & Thulin, E. (2020). *The Science of Changing Behavior for Environmental Outcomes: A Literature Review*. Rare Center for Behavior & the Environment and the Scientific and Technical Advisory Panel to the Global Environment Facility.

Acknowledgments:

We would like to acknowledge the valuable review and comments on this report from Edward Carr (STAP), Graciela Metternicht (STAP), Mark Stafford Smith (STAP), Guadalupe Duron (STAP secretariat), Christopher Whaley (STAP secretariat), and Kevin Green (Rare BE.Center); research by Milan Urbanik (London School of Economics), Ganga Shreedhar (London School of Economics), Madhuri Karak (Rare BE.Center) and Kate Heller (Rare BE.Center) in study identification and analysis; and Corinn Weiler (Rare) and Kyla Timberlake (Rare) for graphic development and document design. Cover photo by Jason Houston.

This report was commissioned and funded by the Scientific and Technical Advisory Panel to the Global Environment Facility.

Introduction

Introduction

The environmental challenges facing us are striking. Whether it is the threat of the sixth mass extinction or global climate change, these challenges can seem fundamentally intractable. What links nearly all present environmental problems is their root cause: human behavior (Foley et al., 2005; IPCC, 2018). Yet this cause also presents a solution: to address these challenges, humans must act differently (Schultz, 2011). In other words, environmental problems are behavioral problems, and environmental solutions must also be behavioral solutions. Whenever one approaches developing an environmental program, what they are doing is developing a behavior change program (Cowling, 2014).

Behavior Change Levers for the Environment

Even when not explicitly identified, changing behaviors have long been at the core of delivering environmental programs. Historically, there have been three main levers pulled for changing behavior: shifting material incentives, promulgating rules and regulations, and providing information to actors.

Shifting material incentives involves increasing or decreasing the costs, time, or effort for doing a behavior. This lever has its roots in neoclassical economics, where an actor is assumed to respond to only the material incentives for engaging or not engaging in a specific behavior. Standard methods for shifting incentives include enforcing penalties for non-compliance with rules, providing rewards for positive behavior, or making a target behavior materially easier, such as removing time friction or promoting substitute actions.

Passing rules and regulations that promote or restrict a behavior is perhaps the most commonly used strategy for achieving environmental outcomes. Rules and material incentives often work together, but each can exist without the other. For example, a seller might offer an incentive to purchase a product without any legal requirement. Similarly, laws and rules can be passed without their enforcement shifting the material incentives. Even without enforcement, rules can shift behavior due to people having a general preference to conform to rules even without positive or negative sanctions (Funk, 2007) or where rules convey factual or social information (Sunstein, 1996).

Figure 1. Rare's Levers of Behavior Change Framework (Rare, 2020)

Providing actors with information has also been a common tactic in traditional environmental programming, including explaining what the desired behavior is, why it is important, and how to engage in it. Informational programs implicitly assume something similar to the information deficit model; the lack of change in someone's behavior is assumed to be because they do not know key information, rather than psychological or socio-contextual factors (Burgess et al., 1998).

While these levers can be successful at changing behavior, they have also been well-documented as generally insufficient for changing behavior on their own (Cinner, 2018). Environmental behavior change program designers have recently expanded their toolkit to include a more comprehensive set of levers for shifting behavior and achieving environmental outcomes. These levers are choice architecture, emotional appeals, and social influences. These three novel levers, along with the three traditional levers, represent the Behavioral Lever Framework for categorizing behavioral interventions in the environmental field (Rare, 2020).

Using choice architecture means constructing an actor's choice environment without changing the value of said actor's underlying options. This lever deviates from the more traditional levers by not assuming that actors are solely

influenced by their rational deliberation, but also how a choice is presented to them. There are many ways in which a designer might construct the choice environment. These include prominent strategies such as directing attention by increasing salient features or changing what outcome occurs by default, using timely moments to prompt action, and providing decision aids that encourage short- or long-term decision making.

Emotional appeals function differently by changing how an actor feels about a set of options. Humans like to believe that they deliberate over all of their decisions, yet emotions often drive our decisions. Emotional appeals can include messaging that makes the behavior feel consistent with the target actor's core identities and values or encourage the actor to experience a particular emotion known to result in a particular behavioral pattern.

Finally, leveraging an actor's social networks and influences is an effective behavior change strategy. Social influence strategies involve understanding how an actor relates to others in their social system, including those with power and prestige, and leveraging these dynamics to support changes in the actor's behavior. Changing behavior in this way often includes social learning, making behavior more observable, or shifting social norms by changing an actor's expectations for what others in their reference network are doing or think is right or wrong.

These novel strategies complete the six levers of the Behavior Levers framework. These levers provide a typology for categorizing the majority of existing behavior change interventions, often delivered in combination rather than isolation.[1]

The logic, ethics, and effectiveness of behavior change programming across these levers have been an intense subject of research. This work has mainly been conducted from the behavioral science perspective, which focuses on the cognitive processes affecting how individuals make decisions, and the social science perspective, which focuses on how social structures shape an actor's capacity and interest in adopting a behavior.

The Behavioral Science Perspective

While there are many different definitions of behavioral science, we focus on the systematic study of human judgment and decision making. This research has been conducted by those working in several fields but is most commonly associated with psychology and behavioral economics. This perspective tends to take the individual actor as the central unit for analysis and understanding behavior.

The roots of what is now commonly known as behavioral science can be traced to rational choice models in neoclassical economics and the inability of those models to account for the decisions people often make. These systematic deviations from rational choice models are known as biases, which result from people applying cognitive heuristics to solve real-world decision problems (Tversky & Kahneman, 1974).

Research in this field focuses on the decision processes that affect how an actor is making a particular decision. These processes are often described as falling into two broad and simplified categories. The first mode is quick and automatic and is more likely to be driven by an emotional reaction. The second mode of thinking more closely approximates rational choice models. This way of thinking is often slow and deliberate, and the decision-maker is generally conscious of this mode. These two groups of processes are often labeled as System 1 and System 2 (Stanovich & West, 2000). Research in the behavioral sciences primarily focuses on documenting the mechanisms underpinning System 1.

Researchers have documented a host of deviations from rational choice models in decision making and the cognitive processes underpinning them. The most extensive set of this work has been conducted in contexts where people face some risky decision, where an outcome could end up going better or worse than their current state.

1 For a more exhaustive list of the strategies in each of lever category, refer to Rare, 2020.

One pattern is loss aversion, where people feel a loss more strongly than a similarly sized gain. Another is risk aversion, where people prefer a sure thing over a risky proposition, even when the risky proposition is likely to return even more. A third is ambiguity aversion, where people prefer to choose options where they know the likelihood of the different outcomes, even when they are guaranteed to do worse. Many of these findings have been replicated frequently and cross-culturally (Ruggeri et al., 2020).

This research has also documented an effect called status quo bias, a general tendency for people to keep doing what they have previously done, even when not in their best interest (Kahneman et al., 1991). This bias describes how habitual behaviors persist but also why it is difficult to form new habits that are inconsistent with one's previous status-quo.

While behavioral science researchers generally take the individual as their unit of analysis, this does not mean researchers ignore social influences. A large body of work on social preferences has documented how people—unlike what would be predicted by a selfish economic model—care deeply about what those in their social network do, believe, and receive. While early research attempted to identify universal social preferences (Fehr & Schmidt, 1999), these social influences differ dramatically across cultural contexts (Henrich et al., 2005). Behavioral scientists now primarily focus on the cognitive mechanisms that result in a particular pattern of behavior within a social context. For example, social norms describe where an individual's actions are influenced by their beliefs of what others are doing and what others think they should be doing (Bicchieri, 2016). The fact that these expectations may be different for different social groups, and different for individuals having different reference networks within a social group, allows for the varied social preferences we see among people of different social groups.

Behavioral science insights have recently been deliberately incorporated into behavior change program design, including at the bilateral, national, and regional levels of government and non-government entities (Whitehead et al., 2019). Many applications of behavioral science have been to design a choice environment to nudge people to perform behaviors in their interest (Thaler & Sunstein, 2009). Nudges are intended to be consistent with libertarian paternalism, where each person's actual choices are not restricted, but their environment is designed to encourage a particular behavior. Nudges are often subtle changes, such as shifting the default offering or making one choice more salient. However, nudges represent only one area of the application of behavioral science to behavior change. Other applications of behavioral science incorporate rich insights from the program's target actors. They also often involve shifting entrenched social norms, such as encouraging the adoption of toilets (Ashraf et al., 2020), reducing female genital cutting (Evans et al., 2019), or encouraging treatment adherence to painful drug regimens like those used to treat tuberculosis (Yoeli et al., 2019). This latter set of interventions differs from traditional uses of nudges by addressing actors as members of a community rather than narrowly as individuals, being more overt about the intervention itself, and often targeting socially constructed practices.

In summary, the behavioral science perspective has studied how individuals make decisions, concentrating on the ways human behavior deviates from the predictions of rational choice models. The field has documented various biases that result from people relying on cognitive heuristics for making decisions, many of which are the result of quick, implicit, and sometimes emotional processes rather than slow deliberation. While this work analyzes decisions from the perspective of the individual, it also investigates social influences, showing how people process their social environment and then apply it to their choices. This work has recently been adopted into behavior change program design across various institutions and levels of decision-makers, sometimes within the framework of nudges and larger-scale behavior change campaigns that often target more entrenched behaviors.

The Social Science Perspective

While there is no single definition of social science, in this review, we take it to be the study of the relationship between social structure and decision making. The fields most associated with this research include anthropology, sociology, political science, and human geography.

This perspective recognizes that individuals do not make their decisions in a vacuum. Instead, social science puts social structure into primary focus. This includes how that social structure defines an individual's social identities and social roles, as well as how an individual's actions can feedback into shaping the social structure for themselves and the network in which they are embedded. From this perspective, this feedback system of socially defined identities and roles create the foundation for individuals to make choices (Popitz, 1972). While identity is often thought of as how individuals see *themselves*, the social sciences point to an even more critical component: the bidirectional relationship between how others perceive an individual and how that individual behaves. Common identities and accompanying roles addressed in the social sciences include gender, race, ethnicity, socio-economic status, and various culturally specific positions of power through prestige and authority. Both formal rules, such as laws, and informal rules, such as social norms, can dictate directly and indirectly how individuals of certain identities can or must behave, with that behavior then feeding back into socially defining those same rules (Hechter et al., 1990).

It is important to note that an individual can rarely, if ever, be reduced down to a single identity. For example, an individual might be both a woman and of a particular ethnicity. Their sum identity is reflected in the intersection of these various identities (Crenshaw, 1989). Understanding what intersections an individual inhabits is critical for understanding their behavior, as the social rules governing their actions apply differently for different intersections. For example, while women might generally be given minimal autonomy to make farming decisions, older women might have significantly more independence, pointing to the possible importance of the intersection of age and gender in understanding an individual's ability to act (Carr & Owusu-Daaku, 2016). There are various combinations of identities, and researchers have cautioned against the essentialization of an individual through a particular identity.

Much of the research in the social sciences has focused on how these various instances of social difference affect how a social group may restrict or enable agency through different forms of rules, and how those rules are socially constructed. Agency can be defined as the ability to make decisions to achieve one's current and future goals (Petesch et al., 2018). Indeed, agency is not distributed equally across populations; marginalized and lower-status groups experience less agency and decision-making power in society. This further results in groups having different abilities to make changes in their own lives or affect broader social systems. Some of these effects may be obvious on first observation, such as only men allowed in a particular space. Others may be far more subtle but can have major implications for behavior change. For example, female farmers in South Africa have less autonomy in setting their schedules, meaning they cannot make time to listen to scheduled radio broadcasts for agricultural forecasts (Archer, 2003). While research into the relations between different identity groups often focuses on where they "result in contradictory interests, imperatives and expectations" (O'Shaughnessy & Krogman, 2011), differing social groups may also mutually reinforce each other in complementary ways. For example, in eastern African bushmeat hunting, women reinforce hunting by men through encouragement and praise, plus benefit from their successes (Lowassa et al., 2012).

Scientists across the social and environmental sciences have been expanding the models we use that incorporate agency by going beyond individual actions to include strategic, political, and collective agency. This also aligns with shifts away from purely rational-actor models or Integrated Assessment Models that rely on narrow assumptions about human behavior. Such concepts help researchers explain and operationalize the influences humans can have on transforming systems, such as those required for global environmental change. For example, groups with greater agency tend to be those with greater wealth and those contributing more greenhouse gas emissions in daily activities. This has implications for how designers and scientists perceive leverage points within a system to change existing structures (Otto et al., 2020).

While different forms of relations exist, social scientists have found power between individuals of different social roles to be a particularly strong explanatory force for understanding human behavior. While analyzing these power dynamics within a community can be a fruitful lens, social scientists have also frequently applied this lens to the wider social system outside a given community. This often includes power dynamics between the behavior change implementer, such as a government agency, and those impacted by it. A social science lens can shed light

on phenomena such as why communities surrounding natural reserves area may refuse to comply with hunting regulations (Strong & Silva, 2020), or why someone might comply with an intervention designed to preserve free choice, even when the individual would not otherwise wish to comply (White, 2013).

Social scientists recognize that individuals are not just subject to social structures, but that they *constitute* those social structures as well. This creates feedback loops where one actor's behavior makes up another's social context. This can result in systems-level emergent properties, where the behavior of each individual can fundamentally only be understood by taking into account the behavior of the other actors in the system. This includes social tipping points, where changes among a minority can result in rapid group-wide changes in beliefs or behavior (Granovetter, 1978; Schelling, 1978). This work has been extended to understand how behavior adoption diffuses through social networks, in which each individual adopts a behavior only when a sufficient set of surrounding connected others do the same (Centola & Macy, 2007).

Taking this social-systems viewpoint often highlights the unintended consequences of a behavior change intervention that an individual-focused standpoint might miss. For example, interventions might have achieved their intended behavioral and environmental impacts but had negative impacts as well. Social scientists have pointed to unintended effects of strengthening bureaucracies (Ferguson, 1994), creating informal lines of employment such as interpreters and fixers (Jeffrey, 2010), or even undermining traditional authority structures (Beall, 2010). Understanding the totality of consequences has implications for how social scientists approach program assessment. They focus not only on the behavioral and environmental outputs but also on assessing any social impacts, intended or not, positive or negative, that may result.

The social sciences present a unique opportunity to evaluate the ethics of behavior change programming. One common but ethically questionable element of behavior change programming is its often top-down nature, where local stakeholders have no input into the programs they experience. As a result, programs can fail to recognize local communities' rights or simply be ineffective. A designer's lack of local knowledge results in a program being ill-suited for its target actors (Hansen, 2018). Because of their rich focus on the various identities among target actors, the social sciences have raised ethical concerns over the equitable distribution of a program's costs and benefits. While programs are often evaluated by estimating the average treatment effect for the entire population, the social sciences have focused on disaggregating these results to reveal disparate impacts.

Social scientists have further found justification to criticize the ethical nature of "nudge" style behavioral interventions, which are often invisible to target actors. Designers of this style of intervention often argue that their solutions preserve free choice and are not coercive. However, social scientists have pointed out that those subject to these interventions find a lack of disclosure to violate their autonomy, whether or not the designer finds it free-choice-preserving (White, 2013). Social scientists have also identified that these interventions rarely change the root structures of systems and problems they seek to address, even when they account for the social system in which they are deployed (Feitsma, 2018).

In summary, the social science perspective focuses on the actor as both the product and creator of their social context, rather than as an individual. This view recognizes the importance of the various social identities that an actor might have and how those identities dictate their position in the social system that defines their ability to adopt a behavior. By analyzing this system as a whole, a social science perspective can identify various ways in which actors might influence each other. These include power, allowing some to restrict the choices of others, or reinforcement, where some support others' ability to act. In the context of behavior change programming, this view can provide a critical lens on how powerful organizations, such as governments or NGOs, may, sometimes inadvertently, coerce target actors into compliance, which is ethically dubious. By looking at the total social system, this view recognizes the commonly inequitable distribution of costs and benefits from behavior change programming, often tying those inequalities to existing inequalities in the social system.

Review Focus and Scope

Presented this way, behavioral science and social science may appear quite different. However, both disciplines aim to explain human behavior and interaction. Instead of seeing them as fundamentally different, we argue that behavioral science and social science are best understood as two levels of analysis that exist on a spectrum (See Figure 2). This spectrum ranges from the most cognitive explanations of decisions existing entirely within the individual to the most abstract descriptions of social interaction focused solely on the system in which those individuals are embedded. Many sub-disciplines exist closer to the middle of this spectrum, blending these two perspectives, such as social psychology, cultural psychology, cognitive anthropology, and network analysis. By embracing this entire spectrum of behavioral and social science, we better understand human behavior as a whole.

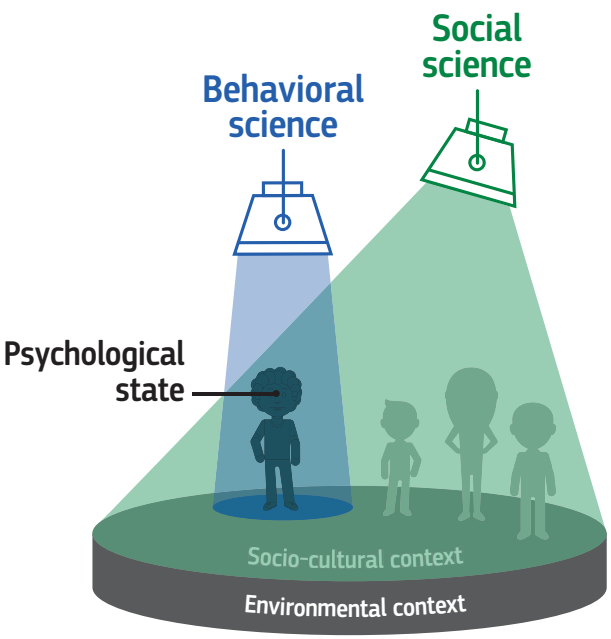

Figure 2. The interaction of behavioral and social science in understanding human behavior. Behavioral science focuses on understanding an actor's psychological state, whereas social science focuses on understanding the socio-cultural context for that actor. Both are necessary for understanding an actor's behavior within a given environmental context. Changes to the socio-cultural context, environmental context, or actor's behavior create feedback loops with one another.

In this review, we aim to identify how these perspectives can be applied to understand existing behavior change interventions designed to address biodiversity conservation, climate mitigation, water management and conservation, waste management, and land management. For each of these topic areas, we review empirical evidence for behavior change programs targeting behaviors in each of these areas. We include evidence that provides empirical analysis on the effect of interventions designed to change these behaviors, as well as evidence for the psychological, material, and socio-cultural barriers and motivations for their adoption. This includes evidence from the behavioral and social sciences, as well as non-disciplinary evaluations, and consists of both qualitative and quantitative analysis across a variety of measurement paradigms.

We then provide an analysis of that evidence in three areas. First, we review the evidence's strength for changes in the target behavior, including the internal validity, external validity, and geographic spread of the interventions. Then, we identify behavioral science insights demonstrated in the interventions or gaps in the intervention logic that behavioral science may elucidate. Last, we similarly identify social science insights in the interventions, including insights to help identify opportunities and gaps. After conducting this analysis for the five topic areas, we provide an overall summary of these analyses to identify trends across the environmental field. We conclude by proposing a framework for understanding how behavioral and social sciences can most effectively integrate into behavior change programming to improve environmental outcomes further.

References

Archer, E. R. M. (2003). Identifying underserved end-user groups in the provision of climate information. Bulletin of the American Meteorological Society, 84(11), 1525–1532. https://doi.org/10.1175/BAMS-84-11-1525

Ashraf, S., Bicchieri, C., Delea, M. G., Das, U., Chauhan, K., Kuang, J., Shpenev, A., McNally, P. K., & Thulin, E. (2020). Design and rationale of the Longitudinal Evaluation of Norms and Networks Study (LENNS): A cluster-randomized trial assessing the impact of a norms-centric intervention on exclusive toilet use and maintenance in peri-urban communities of Tamil Nadu. MedRxiv, 2020.06.26.20140830. https://doi.org/10.1101/2020.06.26.20140830

Beall, J. (2010). Traditional leadership and developmental coalitions: Lessons from Durban, South Africa.

Bicchieri, C. (2016). Norms in the wild: How to diagnose, measure, and change social norms. Oxford University Press.

Burgess, J., Harrison, C. M., & Filius, P. (1998). Environmental communication and the cultural politics of environmental citizenship. Environment and Planning A: Economy and Space, 30(8), 1445–1460. https://doi.org/10.1068/a301445

Carr, E. R., & Owusu-Daaku, K. N. (2016). The shifting epistemologies of vulnerability in climate services for development: The case of Mali's agrometeorological advisory programme: Shifting epistemologies of vulnerability in climate services for development. Area, 48(1), 7–17. https://doi.org/10.1111/area.12179

Centola, D., & Macy, M. (2007). Complex contagions and the weakness of long ties. American Journal of Sociology, 113(3), 702–734. https://doi.org/10.1086/521848

Cinner, J. (2018). How behavioral science can help conservation. Science, 362(6417), 889–890. https://doi.org/10.1126/science.aau6028

Cowling, R. M. (2014). Let's get serious about human behavior and conservation. Conservation Letters, 7(3), 147–148. https://doi.org/10.1111/conl.12106

Crenshaw, K. (1989). Demarginalizing the intersection of race and sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics. University of Chicago Legal Forum, 1989, 139.

Evans, W. D., Donahue, C., Snider, J., Bedri, N., Elhussein, T. A., & Elamin, S. A. (2019). The Saleema initiative in Sudan to abandon female genital mutilation: Outcomes and dose response effects. PLOS ONE, 14(3), e0213380. https://doi.org/10.1371/journal.pone.0213380

Fehr, E., & Schmidt, K. M. (1999). A theory of fairness, competition, and cooperation. The Quarterly Journal of Economics, 114(3), 817–868. https://doi.org/10.1162/003355399556151

Feitsma, J. N. P. (2018). The behavioural state: Critical observations on technocracy and psychocracy. Policy Sciences, 51(3), 387–410. https://doi.org/10.1007/s11077-018-9325-5

Ferguson, J. (1994). The Anti-politics Machine: "development," Depoliticization, and bureaucratic power in Lesotho. U of Minnesota Press.

Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R., Chapin, F. S., Coe, M. T., Daily, G. C., Gibbs, H. K., Helkowski, J. H., Holloway, T., Howard, E. A., Kucharik, C. J., Monfreda, C., Patz, J. A., Prentice, I. C., Ramankutty, N., & Snyder, P. K. (2005). Global consequences of land use. Science, 309(5734), 570–574. https://doi.org/10.1126/science.1111772

Funk, P. (2007). Is There An Expressive Function of Law? An empirical analysis of voting laws with symbolic fines. American Law and Economics Review, 9(1), 135–159. https://doi.org/10.1093/aler/ahm002

Granovetter, M. (1978). Threshold models of collective behavior. American Journal of Sociology, 83(6), 1420–1443. https://doi.org/10.1086/226707

Hansen, P. G. (2018). What are we forgetting? Behavioural Public Policy, 2(2), 190–197. https://doi.org/10.1017/bpp.2018.13

Hechter, M., Opp, K.-D., Wippler, R., Werner-Reimers-Stiftung, American Sociological Association, & National Science Foundation (U.S.) (Eds.). (1990). Social institutions: Their emergence, maintenance and effects. A. Gruyter.

Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., Gintis, H., McElreath, R., Alvard, M., Barr, A., Ensminger, J., Henrich, N. S., Hill, K., Gil-White, F., Gurven, M., Marlowe, F. W., Patton, J. Q., & Tracer, D. (2005). "Economic man" in cross-cultural perspective: Behavioral experiments in 15 small-scale societies. Behavioral and Brain Sciences, 28(6), 795–815. https://doi.org/10.1017/S0140525X05000142

IPCC. (2018). Summary for Policymakers. In V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P. R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, & T. Waterfield (Eds.), Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf

Jeffrey, C. (2010). Timepass: Youth, class, and the politics of waiting in India. Stanford University Press.

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1991). Anomalies: The endowment effect, loss aversion, and status quo bias. Journal of Economic Perspectives, 5(1), 193–206. https://doi.org/10.1257/jep.5.1.193

Lowassa, A., Tadie, D., & Fischer, A. (2012). On the role of women in bushmeat hunting—Insights from Tanzania and Ethiopia. Journal of Rural Studies, 28(4), 622–630. https://doi.org/10.1016/j.jrurstud.2012.06.002

O'Shaughnessy, S., & Krogman, N. T. (2011). Gender as contradiction: From dichotomies to diversity in natural resource extraction. Journal of Rural Studies, 27(2), 134–143. https://doi.org/10.1016/j.jrurstud.2011.01.001

Otto, I. M., Wiedermann, M., Cremades, R., Donges, J. F., Auer, C., & Lucht, W. (2020). Human agency in the anthropocene. Ecological Economics, 167, 106463.

Petesch, P, Badstue, L. & Prain, G. (2018). Gender norms, agency, and innovation in agriculture and natural resource management: The GENNOVATE methodology.

Popitz, H. (1972). The concept of social role as an element of sociological theory. In Role.

Rare. (2020). Levers of behavior change. behavior change for the environment—Rare. https://behavior.rare.org/behavioral-science-landing/

Ruggeri, K., Alí, S., Berge, M. L., Bertoldo, G., Bjørndal, L. D., Cortijos-Bernabeu, A., Davison, C., Demić, E., Esteban-Serna, C., Friedemann, M., Gibson, S. P., Jarke, H., Karakasheva, R., Khorrami, P. R., Kveder, J., Andersen, T. L., Lofthus, I. S., McGill, L., Nieto, A. E., … Folke, T. (2020). Replicating patterns of prospect theory for decision under risk. Nature Human Behaviour, 4(6), 622–633. https://doi.org/10.1038/s41562-020-0886-x

Schelling, T. C. (1978). Micromotives and macrobehavior. W. W. Norton & Company.

Schultz, P. W. (2011). Conservation means behavior. Conservation Biology, 25(6), 1080–1083.

Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate? Behavioral and Brain Sciences, 23(5), 645–665. https://doi.org/10.1017/S0140525X00003435

Strong, M., & Silva, J. A. (2020). Impacts of hunting prohibitions on multidimensional well-being. Biological Conservation, 243, 108451. https://doi.org/10.1016/j.biocon.2020.108451

Sunstein, C. R. (1996). On the expressive function of law. University of Pennsylvania Law Review, 144(5), 2021–2053. JSTOR. https://doi.org/10.2307/3312647

Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. Science, 185(4157), 1124–1131. https://doi.org/10.1126/science.185.4157.1124

White, M. (2013). The manipulation of choice: Ethics and libertarian paternalism. Springer.

Whitehead, M., Jones, R., & Pykett, J. (2019). Nudging around the world: A critical geography of the behaviour change agenda. Handbook of Behavioural Change and Public Policy. https://www.elgaronline.com/view/edcoll/9781785367847/9781785367847.00013.xml

Yoeli, E., Rathauser, J., Bhanot, S. P., Kimenye, M. K., Mailu, E., Masini, E., Owiti, P., & Rand, D. (2019). Digital health support in treatment for tuberculosis. New England Journal of Medicine, 381(10), 986–987. https://doi.org/10.1056/NEJMc1806550

Climate Mitigation

- Transportation
- Energy
- Food

Introduction

Climate change mitigation refers to human intervention to either reduce sources of greenhouse gas emissions (GHGs) or enhance sinks that absorb these emissions (IPCC, 2014). Numerous comprehensive assessments of the climate system conclude that increasing concentrations of anthropogenic GHGs have been the primary driver of global warming since the mid-20th century (IPCC, 2014; UNEP, 2017). Transportation, energy consumption, and food present some of the most significant opportunities to change human behavior to reduce carbon emissions (Williamson et al., 2018). As a result, this topic includes interventions that encourage shared or alternative transport methods, reduced and green energy usage, and low-carbon or plant-rich diet options.

Analysis Highlights

- Many target actors already value and intend to engage in climate mitigation behaviors, but their behavior does not follow. Interventions that employ choice architecture to draw attention and use saliency are particularly relevant and effective in this context. These solutions help actors to align their values, intentions, and actions.
- Climate mitigation interventions tend to neglect infrastructural constraints. While an actor may be motivated to pursue sustainable transportation or green energy solutions, the infrastructure and resources must also exist (e.g., available transit routes, restaurants that offer plant-rich dishes) for them to change their behavior.
- Differences within groups of target actors translate to variable effectiveness of behavioral interventions. This is clearest for social comparison and framing interventions where the motivations and responses to climate mitigation are different for different genders, value sets, or socioeconomic statuses. Designing for these differences is key to broad effectiveness.

Transportation

With growing urban populations and increased mobility, more people are relying on personal and public transport to get to their destinations. This creates significant opportunities for either many more vehicles on the road or increasingly efficient and low-carbon transport options. The behavior change interventions in this section target the adoption of these greener transport options.

Increasing carpooling and public transit: Planning, commitment, and timely moments

Highlighting transport information and encouraging the deliberate planning of car trips has been demonstrated to be quite effective in reducing car usage (Bamberg, 2002; Eriksson et al., 2008; Jakobsson et al., 2002). Pairing these commitments mechanisms with non-monetary incentives such as free public transportation has also been successful (Bachman & Katzev, 1982; Fujii & Taniguchi, 2006; Katzev & Bachman, 1982; Thøgersen, 2009). In Germany, a 2006 study found that by offering habitual drivers a free public transportation 'try-out' period, municipalities could effectively decrease car use, particularly when pairing this free 'try-out' with a personal commitment from users (Matthies et al., 2006). In Japan, a review of interventions that rely on travel feedback to encourage non-automotive travel found that these programs were particularly successful when participants had to make a personalized behavior plan (Fujii & Taniguchi, 2006). In fact, across the ten travel feedback programs that

Fujii and Taniguchi review, they found that such interventions reduced car use by 18%, increased public transport by 50%, reducing participants' overall CO_2 emissions by about 19%.

Another way of ensuring that intentions translate into action is to use personal commitments in conjunction with descriptive norms. In a Canadian field experiment, researchers paired a commitment to reduce vehicle use with norm information that informed research participants of others' successful efforts to reduce their vehicle use (Kormos et al., 2014). Compared to participants who received no such message, those who did receive a message reduced their vehicle use by approximately five times. Interestingly, norms messaging decreased private vehicle commutes, but not non-commuting trips—likely because, as others have suggested (Eriksson et al., 2008), normative interventions have a stronger pull on habitual choices (like people's daily commutes). Likewise, for many, the commuting trips were much easier to do via public transport than less habitual, non-commuting trips.

Unfortunately, not all interventions using personalized travel plans have been successful. For example, while the above studies do offer significant positive results, often these are small or limited to those drivers that already intend to reduce their car usage (e.g., Eriksson et al., 2008; Matthies et al., 2006). There is also some evidence that this approach may backfire, leading some drivers to reduce their environmental conscientiousness (Tertoolen et al., 1998). A series of interventions led by Kristal and Whillans (2020) found that neither sending letters, emails, offering a 1-week free bus trial, sending follow up letters, or emailing personalized travel plans to drivers had any effect in reducing car commutes. They also highlight the various barriers that planning and nudging may not have overcome. These include the relationship between driving and perceived autonomy in the United-States and the fact that drivers may simply not want to talk with employees they do not know. Most important, however, is that the target behavior may not have been consistent with individuals' self-interest—a core, yet often overlooked, principle of nudging.

It is important to consider both refinements and alternatives to the above interventions. One strategy has been to target participants in moments of transitions, such as moving homes (Verplanken & Roy, 2016). For example, a study on university employees in the UK found that if a person who is concerned about the environment moves house, they become less likely to use a car to commute than environmentally concerned non-movers (Verplanken et al., 2008). Designers have leveraged this insight for program development, finding interventions to be particularly effective right after the actor moves between towns (Bamberg, 2006). Receiving information on the new town's bus system, personalized travel plans to access shopping areas, and a free 1-day ticket to use the bus led to 47% uptake of public transpiration, as compared to 18% in the control (see also, Dai et al., 2014).

Studies of transportation patterns across demographics reveal how difficult it is to design a single intervention to address the needs of a diverse set us users. For carpooling behavior, for example, there are very different needs across age groups as well as gender. Older people are risk-averse and care more about nearby meeting points, vehicle condition, knowing other riders, and alternative backup transportation plans. Women are most concerned about safety and cost (Wilkowska et al., 2014). For personal car use, once again, gender trends prevail. Due to differing social roles, men tend to travel primarily for reasons related to work, where women travel according to their role as caretakers in the family. Men's trips are shorter and direct, where women's are longer and involve more stops, known as "trip chaining." As a result, both genders have quite different transportation needs, often requiring differing interventions to address (Root & Schintler, 2003).

Promoting alternative and efficient transport: Social norms and appealing to values

Instead of appealing to convenience and new habits, messaging campaigns that reframe transport options or leverage social influences are also effective at reducing car use. In 2007, Beale and Bonsall attempted to use marketing materials to address an overly negative public perception of the bus system in Leeds, UK. After their first campaign, they found that the marketing materials had encouraged bus use among those users who already took the bus: people who already liked taking the bus and women. Men, on the other hand, significantly *decreased*

their use of public transport, as did infrequent users and people who already disliked the bus. To address this, the researchers launched a second campaign where they reframed their message for those people who did not usually travel by bus. The second campaign acknowledged that the car was probably the first choice for some trips, but that the bus could also be more convenient for other trips. While the first campaign had seen a reduction of bus usage in men, the second led to a significant increase for men and recent bus users. This message aligned better with some people's perception of public transport and therefore was more successful in changing behavior for the target population (Beale & Bonsall, 2007).

In Malmo, Sweden, municipal officials also made behavior more personal in their campaign to encourage bike use (Hörlén et al., 2008). Building off its main slogan, "No ridiculous car trips," the campaign asked residents to submit written accounts of when that had driven unnecessarily to a location. The city also gave small gifts to cyclists as a thank you for choosing to bike and brought awareness to the convenience and speed of cycling by having cyclists time routes around the city. A year after the campaign, 75% of residents still reported they remembered the campaign's message, and 15% reported a change in their driving behavior. The city of Malmo saw an increase in the number of cyclists, and 12,000 residents made fewer short trips by car. The combination of strategies here was effective in reinforcing positive attitudes around biking.

Beyond decreasing car usage, interventions as simple as 'reframing' the metric used to measure a car's efficiency could be applied to encourage consumers to purchase more energy-efficient vehicles. In the United States, where the fuel-efficiency of a vehicle is conveyed via the 'miles per gallon' unit (MPG), a reasonable alternative would be to use gallons per 100 miles (GPM). Where MPG allows people to estimate the range of their vehicle on a full tank of gas, GPMs are better at conveying the quantity of gas used for a given trip (Larrick & Soll, 2008). Further, MPG does not offer a linear measure of fuel efficiency as it does for range, since the metric has to be converted. For example, replacing a car that gets 12 MPG with one that gets 14 MPG saves more fuel than replacing a car that gets 28 MPG for one that gets 40 MPG over the same distance (p.1593). Testing this directly, Larrick and Soll presented survey respondents with one of two scenarios: i) a choice between replacing 100 vehicles that get 15 MPG with vehicles that get 19 MPG, or replacing 100 vehicles that get 34 MPG with vehicles that get 44 MPG; or ii) replace 100 vehicles that get 6.67 GPM with vehicles that get 5.26 GPM, or replace 100 vehicles that get 2.94 GPM with vehicles that get 2.27 GPM. In the first scenario, only 25% of respondents chose the first option, which offers relatively lesser MPG gains but that reduces fuel consumption considerably. In the second scenario, 64% percent of respondents chose option one—an increase of 39%. GPM appears to make fuel-consumption easier to understand, explicit, and allows consumers to easily estimate cost-savings relative their gas usage.

Alternatively, rather than reframing the metric that leads to problem behaviors, practitioners can reframe problem behaviors themselves, such as encouraging more efficient use of the car. Bolderdijk et al. (2013), for example, found that marketing campaigns often promote energy conservation using economic rather than environmental arguments, but people much prefer to see themselves as 'green' rather than 'greedy' (Bolderdijk et al., 2013, p.2). Using this to inform a field experiment, the team tested four different sandwich-board messages to encourage US drivers to collect a free tire-check coupon while refueling: an environmental one, an economic one, a safety appeal, or a neutral, control message. Over the span of 22 observation days, Bolderdijk et al. found that drivers took significantly fewer coupons after seeing the economic message (0 percent) as compared to the environmental one (8.7 percent). In a similar study, Yeomans and Herberich (2014) conducted a field experiment at a US gas station where they looked at six different interventions to combat 'tire-pressure neglect' of drivers with low tire pressure. These interventions leveraged various combinations of information and social norms, paired with monetary incentives and social pressure. Out of these combinations, the study found that the impact of social norm messages (i.e., telling customers that 70% of people drove with under-pressurized tires) greatly depended on the accompanying incentive. When paired with social norms, monetary incentives (like waiving the pump fee) decreased the likelihood that someone would inflate their tires, but pairing the norm with an attendant's offer to help reliably increased this likelihood. While the perceived benefits of inflation may still have been too low for people to do it on their own, the added social pressure of a personal request was able to drive behavior change.

Encouraging the adoption of electric vehicles: Social norms and reducing uncertainty

In contexts where personal vehicle-use is necessary, entrenched, or required, encouraging consumers to adopt plug-in electric vehicles (EVs) allows drivers to maintain their autonomy while offering benefits to the wider community, such as reducing CO_2 emissions and air pollution. Still, many psychological and social barriers stand in the way of mass EV adoption. Around the world, high costs, range anxiety, and lack of vehicle choice are commonly associated with lower intentions to switch from internal combustion vehicles to electric ones (Egbue & Long, 2012; Kim et al., 2017; Park et al., 2018). There are also concerns as to the charging infrastructure and energy-efficiency of EVs, particularly when the electricity generated to power them still relies on fossil fuels (Degirmenci & Breitner, 2017; Egbue et al., 2017).

Regional and cultural differences determine how much target actors weigh the above concerns: in China, for example, consumers are less resistant to non-hybrid, plug-in EVs when compared to an American audience (Helveston et al., 2015). Chinese consumers are often first-time buyers and have no previous experiences with either type of vehicle; however, they do have experience with plug-in electric bikes. An inexpensive and far-reaching public train system also allows Chinese consumers to be less reliant on their personal vehicles when wanting to travel long distances. Air pollution is also an important difference between markets: the higher the particulate matter ($PM_{2.5}$) concentration in Chinese cities, the higher the sales volume of plug-in EVs (Guo et al., 2020).

While far from exhaustive, the above serve to highlight the concerns that policies seeking to increase EV adoption should target. Policy-makers have also found that providing benefits to EV drivers could encourage adoption: incentives like bus or transit lane access, toll-free parking or road access, as well as improving EV-relevant infrastructure all contribute to higher EV adoption rates (for review, see Hardman, 2019). Alternatively, behavior change practitioners may use behavioral levers to sway consumer decisions. In Italy's northeast region, most material barriers to EV adoption are low, yet uptake remains stagnant. Researchers have found that making future cost-savings more salient increases the likelihood of someone choosing an EV over an internal combustion alternative (DellaValle & Zubaryeva, 2019). They also found, however, that providing participants with a descriptive norm[3] relative to EV purchasing in their region did not significantly encourage EV choice—likely because the adoption rate was too low to meaningfully change people's perception of the norm. A similar study in Germany corroborates this result: descriptive norms about EV use in their region did not significantly influence EV acceptance, but injunctive norms did (Barth et al., 2016). When asked directly, participants responded that cost and environmental benefits were mostly driving their acceptance of EVs. Yet, survey results suggest that people are significantly influenced by both what they perceive others would approve of and what they perceive others would choose themselves (see also, Axsen et al., 2013; Cherchi, 2017; Thulin & Rakhimov, 2019). In a stated-choice experiment in Nepal, researchers chose to denote the air pollution impact of different kinds of motorcycles using injunctive messaging (i.e., smiley faces for electric motorcycles and sad faces for internal combustion ones). Compared to a group where such messaging was not used, 8.3% more participants said they would purchase an electric motorcycle over an internal combustion one (Filippini et al., 2020).

As with many 'green' decisions, social norms have the potential to be powerful tools for change for EV adoption. And while there remains little testing of behavioral interventions to increase EV adoption in low-income countries, evidence suggests such approaches are likely to be successful. Al Mamun et al. (2019), for example, reports that social norms are likely to be key in encouraging EV adoption in Malaysia. Researchers have made similar claims regarding the EV market in India (Khurana et al., 2020). If practitioners can identify and encourage early adopters to

3 Several nations and subnational governments distribute visually distinct license plates to EV owners: the United Kingdom, Norway, California in the US, and the provinces of Quebec and Ontario in Canada. No formal evaluation of their impact on consumer choice has been conducted, as they are mainly used for law-enforcement to identify those cars that get access to certain transportation benefits, but the increasing number of 'green' license plates is likely to make more salient the increasing number of EVs on our roads. In other words, green license plates serve as a dynamic norms message, particularly for 'hard-to-distinguish' vehicle models.

interact with non-adopters and serve as social proof, interventions utilizing social norms are likely to become a good strategy in developing markets (e.g., Seebauer, 2015).

Another encouraging area of investigation is in altering the point-of-purchase itself, such as factors that may reduce EV adoption when consumers interact with the seller. For example, researchers have found that even in Nordic countries where EV adoption is high relative to the rest of the world, car dealers were often dismissive of EVs, misinformed customers, or neglected EVs as options altogether (Zarazua de Rubens et al., 2018). This had a significant impact on buyers who rely on dealers' knowledge and recommendations to make 'informed' decisions about EVs. A similar study in Ontario, Canada, found that a lack of EVs on-site for consumers to test was a significant barrier to adoption (Matthews et al., 2017). The decision to purchase a vehicle is a significant one, and so the provision of reliable information and ability for consumers to validate this information (through a test drive) should be an important component of any behavior change strategy. The relevance of these findings is likely to extend beyond Europe or North America, yet there is yet no published evidence of interventions being deployed that target these barriers specifically.

Energy

In addition to transportation, energy use is one of the biggest contributors to greenhouse gases, both in the source and amount of energy we consume. This section offers evidence of interventions that have aimed to change behavior to increase green energy consumption and energy conservation.

Increasing green energy and energy efficiency: Defaults

One particularly effective way to increase energy conservation has been to leverage the 'default effect.' Put simply, the default effect refers to the phenomena whereby pre-selecting options for decision-makers makes them more likely to adopt and stick with that option. As a result, behavior change intervention designers have started using defaults to affect energy use: for example, by making energy conservation schemes the norm when selecting utility plans. An intervention seeking to increase green energy consumption for 40,000 German consumers did this by swapping the typical 'opting-in' policy on green energy contracts to one where consumers were automatically enrolled unless they 'opted-out' (Ebeling & Lotz, 2015). Though the green contracts were more expensive, the new 'opt-out' condition led to ten times more subscriptions: 7.2 percent in the opt-in condition and 69.1 percent in the opt-out condition. In the United-States, a similar approach was used to encourage the adoption of time-based utility pricing (Fowlie et al., 2017). While those who had to actively opt-in to the time-varying policy typically reduced energy by 25%, only 20% of customers actively chose to do so. By comparison, over 90% of customers in the opt-out condition remained in the time-based policy, although they only reduced their energy demand by 10% during peak periods. Due to the larger number of people affected by the opt-out condition, the impact and savings generated by the policy proved much greater, even with the smaller average amount of energy reduction.

Outside of households, researchers are also using defaults in buildings and offices. The OECD launched a randomized controlled trial at their offices and found that a 1˚C decrease in the default thermostat setting (from 20˚C to 19˚C) led to a reduction in the occupant-chosen settings by 0.38˚C on average (Brown et al., 2013). Importantly, this was not the case if the decrease was larger (from 20˚C to 17˚C), suggesting that if the change was large enough to be noticeable and/or uncomfortable, people would increase the temperature themselves. This raises concerns about ensuring a default setting meets people's needs and preferences.

Leveraging defaults in a way that truly preserves people's freedom of choice is a constant debate amongst social and behavioral scientists (Smith et al., 2013). While there are cases where defaults align with individuals' stated preferences (e.g., using energy-efficient lightbulbs; see Dinner et al., 2011), there are many cases where they do not. For example, in Ebeling and Lotz's study on green energy defaults, 100% of people who actively choose 'green' energy in the opt-in treatment were able to recall their decision. In the opt-out treatment, however, this number

dropped to 84.13%. Similarly, only 60% of respondents who did not swap out of the American time-based pricing policy could demonstrate that they effectively understood the electricity rates they were paying, as compared to 85% of those who actively opted-in (Fowlie et al., 2017).

Most recently, a study by Ghesla et al. (2020) found that defaults disproportionately affect lower-income relative to higher-income households. Four years after a Swiss utility company had implemented green contracts as defaults, residents with lower incomes, less education, and who did not own property were less likely than others to have opted-out of the green default policy. As a result, low-income households were paying more than they would prefer to for green energy, while high-income households were typically paying less than they were willing to for green energy. Even higher-income households who were interested and able to pay for greener contracts did not know enough about how to switch away from the default. Given the effectiveness and durability of defaults, 75 percent of these households still had the default green contract four years after the intervention, ensuring the durability of the unintended inequitable outcome.

Increasing energy conservation: Appealing to values

As we have seen previously, the use of defaults is one way of swaying consumer's decisions. Reframing or recontextualizing choices is another way. Where defaults rely on people passively going with the pre-selected choice, framing allows behavior change intervention designers to encourage active choices in situations where a default is less practical, or when the saliency of specific information could better inform consumer decisions. For example, a study by Asensio and Delmas (2016) found that reframing US households' energy conservation efforts relative to their impact on human health (for example, reducing the risk of asthma or lung cancer) engendered long-lasting energy savings of around 8-10%. For families with children, the health frame was even more effective (Omar I. Asensio & Delmas, 2015). A study by Permana et al. (2015) further nuances understandings of family energy use through gender differences. Regardless of a husband and wife's income, when women are in control of energy consumption, usage tends to be lower due to their greater concern with household expenses. Accounting for this, energy interventions might focus on increasing women's energy consumption decision making power, or by targeting men as inefficient consumers.

In Germany, a survey study highlights how framing energy-saving behaviors in terms of their CO_2 emissions may also spill over to other climate-friendly behaviors (Steinhorst et al., 2015). Presenting the impact of unique behaviors (like installing energy-efficient light bulbs, or reducing dryer use) as either cost-saving (in €) or CO_2 saving, Steinhorst et al. found that the environmental framing uniquely encouraged spillover behaviors by making people's pro-environmental goals salient, which then activated a general personal norm for climate-friendly behaviors (see also, Spence et al., 2014). Where both environmental and monetary framings had a positive impact on energy saving intentions, only the environmental framing—through its effects on people's personal norms and perceptions of self-efficacy - affected other climate-friendly intentions.

Similarly, affixing energy-efficiency labels to appliances in stores reminds consumers to think long-term when buying washers, dryers, dishwashers, etc. In the UK, labels with information on total lifetime running cost (in addition to the more 'ambiguous' EU labels and kWh per year) led to the sale of washer-dryer appliances that were 0.7% more efficient on average than those bought in control stores without the label (Behavioural Insights Team (BIT), 2014). There was no effect on washing machines or tumble dryers individually, though, likely because their lifetime energy consumption was far smaller and less salient than for a combined washer-dryer.

An important aspect to consider when framing messages like energy-labels is that not every label is created equal, and different people respond to these labels in different ways. For example, in European audiences, energy efficiency scales and labels that use letters rather than numbers are generally better understood and lead to more energy-efficient purchasing (London Economics, 2015). The evidence also suggests that the impact of a label's design is greatest for those who consider energy efficiency of low importance by making it simpler and more salient

for those who would otherwise not take on the effort. Successful framing interventions must consider the needs they are meeting (beyond just providing more information), the underlying motivations of their target actors, and how best to deliver a message to make it most salient and relevant (Banerjee & Solomon, 2003).

Increasing energy conservation: Social norms and comparison

Beyond changes to the decision-making context and framing, social comparison is also a powerful tool for changing energy behavior. For example, by comparing the energy use of one group of households to another, practitioners create the ideal setting in which social expectations encourage energy-saving behavior.

In collaboration with the software company Opower, Allcott and Rogers (2014) studied the effect of providing consumers with Home Energy Report where information about their energy usage was compared with their neighbors' energy usage. With a sample size of over six million customers, they found that those who received comparative information over many months reduced their energy use by 1-2% (Allcott, 2011) and that these effects persisted over four to five years, as long as the information was provided continuously on a monthly basis (Allcott & Rogers, 2014). A more recent study found that using Home Energy Reports in conjunction with timely, salient comparisons (e.g., when energy demands peak) could increase these energy savings even further from 2-4% to 7% (Brandon et al., 2019).

Giving Feedback, Getting Energy Savings

Beyond monthly home energy reports, smart meters have increasingly become a way that households can get real-time feedback about their energy usage. Several studies have found creative methods of delivering this information to people while also learning insights about maximizing user engagement (Buchanan et al., 2015). For example, home energy displays can pair personal energy use information with social comparative or normative information (Kaaukauskas et al., 2017). A two-year study of residential energy consumption found that normative feedback was effective at reducing household energy use (De Dominicis et al., 2019). Energy feedback can also be customized in the way that the amount of energy is conveyed, such as using numerical or visual, ambient feedback. A Dutch study compared whether giving the number of watts consumed was more or less effective than a lamp that would change color according to energy consumption. The lamp condition led to a 21% decrease in energy use and was also easier to understand than the numerical feedback (Maan et al., 2011). Overall, feedback interventions perform best when they also engage users in a compelling way.

Looking to social influences beyond just comparison, a team of researchers looked at how leveraging reputation could alter participation in energy demand response programs in California (Yoeli et al., 2013). They offered 1400 homeowners to opt-in to the program via a sign-up sheet with two randomized conditions. One required residents to write their name and address on the public sheet (i.e., making individual conservation choices observable), whereas in the other condition, participants used an anonymous code. After just a few days, the difference in participation was significant: participation was nearly three times higher if neighbors could identify who had opted-in rather than being anonymous. The researchers found that this effect was greatest for those whose reputation in

the community mattered most: residents of apartment buildings (compared to those in houses), and homeowners (compared to renters). This intervention was also much more effective than a monetary incentive of $25 to sign up for the program, with researchers estimating that they would have needed to offer the equivalent of $174 per resident to have the same effect. This study showed the importance of observable decisions that have real consequences for yourself and others (see also, Griskevicius et al., 2010).

The direct observability of green choices further makes an evolving norm more salient. For example, solar panels are observable features of buildings and their presence in a residential neighborhood can lead to more residents adopting solar as an energy source (Müller & Rode, 2013), as well as serving as a type of *social proof* for those individuals still unsure about the technology (Rai & Robinson, 2013). Solarize, a campaign to boost solar energy in the US, identified the importance of social proof and observability as key to solar adoption. The campaign used a multi-faceted approach with a foundation of community outreach in which local ambassadors would help to educate and encourage residents about solar energy (Gillingham & Bollinger, 2017). Solarize also tackled the high upfront cost of adopting solar energy as well as customer inertia by recruiting local government and solar contractors to support the community-led campaign. They bundled purchases between neighbors and received discounts from vetted suppliers. Solarize also mitigated the effect of status-quo bias through a time-bound discount campaign, making people feel that the time to act was limited and actively encouraging the choice to go solar.

As these examples demonstrate, most interventions that leverage descriptive norms to compare energy-users are from programs in high-income countries: the United States (e.g., Ayres et al., 2013; Brandon et al., 2017; D. L. Costa & Kahn, 2013; List et al., 2017), Europe (Behavioural Insights Team, 2011; Kandul et al., 2020; OECD, 2017), and Australia (Hurlstone et al., 2014). However, these programs have been expanded to South Africa and India as well. In Cape Town, for example, Ideas42 ran an intervention examining the use of inter-floor comparisons to reduce energy use in a large, non-residential office building (Klege et al., 2018, 2018). They found that by recording half-hourly meter readings from different floors and using this to create a weekly competition between them, energy use could be lowered by an average of 9% compared to floors with no competition. Adding 'floor advocates' who were directly responsible for turning off or asking others to turn off appliances increased savings to 14%, a remarkable finding given that most social comparison interventions see reductions of between 1% and 7%. Moreover, the effect remained durable over a period of 5 months—durability made all the more surprising after accounting for the fact that workers were not paying for their energy use (but see also, Bator et al., 2019).

In India, a randomized control trial found that peer comparisons were effective in reducing household energy use by 7% (Sudarshan, 2017). The intervention identified high-energy users as the individuals most influenced by the comparison but that pairing the comparison with monetary incentives (i.e., rewarding or punishing households depending on their ranking) eliminated rather than augmented the intervention's effectiveness. Given that participants already did not trust their government and utility providers, Sudarshan speculates that the monetary incentive may be interpreted as an attempt of the utility to benefit rather than to support consumers or the environment.

It is important to note that social comparison interventions are vulnerable to what researchers call 'the boomerang effect.' Schultz et al. also demonstrated this effect in a 2007 study where they found that although a social comparison intervention had decreased energy consumption on average, it had only truly worked for households that were above the average level of energy usage. In fact, not only did the intervention not work for households already using less energy, it actually *increased* their consumption to be more closely aligned with others' behavior.

Food

A third category of carbon-emitting behaviors relates to food consumption, particularly of meat, such as beef. Diet and food choices contribute a large portion of greenhouse gas emissions and are also a growing reason for deforestation and the production of monocultures. Interventions in this section focus on eating less meat and choosing more plant-rich options.

Promoting plant-rich diets: Increasing saliency and appealing to values

Behavioral interventions on food choices focus on encouraging the selection of lower-carbon food options—oftentimes by discouraging meat consumption and encouraging vegetarian alternatives. These interventions primarily encourage vegetarian choices via choice architecture efforts that increase the salience of vegetarian menu options by changing their order (Kurz, 2018), increase the relative quantity of these options versus non-vegetarian ones (Garnett et al., 2019), or make meatless options the default (Campbell-Arvai et al., 2014; Campbell-Arvai & Arvai, 2015).

A study by Bacon and Krpan (2018) looked at the ways in which changing the way that vegetarian options are presented on a menu could sway consumers purchasing of vegetarian meals. In an online experiment, Bacon and Krpan presented participants with four different menus: i) one where all dishes were presented the same way (the control), ii) one where the vegetarian dish came 'recommended by the chef,' iii) one where vegetarian dishes had more appealing descriptions, and iv) one where vegetarian dishes were shown separately in their own' section.' They found that those menus that 'recommended' or tastefully described vegetarian dishes increased the likelihood that these would be ordered by infrequent vegetarian eaters, but that they also decreased the likelihood of vegetarian orders for frequent vegetarian eaters by around 65.3%. Separating vegetarian dishes had no impact on infrequent vegetarian eaters, but it did decrease the likelihood of ordering for frequent vegetarian eaters by 57.8%.

Self-identity and past behaviors (i.e., the frequency with which one has vegetarian food) were important factors in the online menu experiment. As another form of the boomerang effect, describing or recommending vegetarian options backfired for those vegetarian eaters already doing the recommended behavior, even reducing their intentions to eat vegetarian again in the future (Bacon & Krpan, 2018). On the other hand, the menu changes were highly effective for non-vegetarians—the description and recommendation menus increased the likelihood by roughly 108% of these participants choosing a vegetarian dish. Additional studies by Bacon et al. (2018) and Vennard et al. (2018) on labels for vegetarian food demonstrated that describing plant-rich options with words about their cuisine or ingredients (e.g., 'field-grown,' 'Cuban black bean soup') signaled something more appetizing than descriptions that highlighted what the dishes lacked (e.g., 'meat-free,' 'low-fat').

Reframing meat dish options relative to their CO_2 emissions might also be an effective way of encouraging a more vegetarian diet. A lab experiment looked at the effect on sales of high-emissions foods (e.g., beef soup) of adding food labels that described the energy used to make the product in lightbulb minutes (Camilleri et al., 2019). Compared to participants who were shown no such label, those who did purchase 50% fewer high-emissions products. By making the environmental impact of meat (or milk, see Thøgersen et al., 2012) salient and simple to understand, the intervention reframes the choice of consumers in a way that makes decisions about more than just price and taste.

Social scientists examining food choices and decisions describe them as deeply tied to people's social, personal, and cultural values and less to feelings of urgency around climate change. Eating is further a pleasurable activity and often a social one, especially during major events and traditions. As a result, there may be a wide range of motivations and barriers to consider, some of which are outside of an individual's control (Macdiarmid et al., 2016). It is important to recognize that the barriers to reducing meat consumptions differ across social positions. Those experiencing these barriers most acutely include men, rural residents, and those with low education (Pohjolainen

et al., 2015). However, researchers also find that being exposed to non-meat consumption lowers the perception of the strength of these barriers. This suggests that interventions that encourage trial, such as offering vegetarian dishes in cafeterias, which is therefore expected to increase adoption in other settings. Being exposed to others eating non-meat meals is expected to have similar effects.

Promoting plant-rich diets: Social norms

Finally, as with the section on transportation and energy conservation, the use of social norms is likely to be a very effective tool in encouraging a healthier and more sustainable diet (Higgs et al., 2019). There is recent evidence that bringing attention to the way a norm is changing—rather than the current norm itself—might have a greater impact on people's food choices.

Sparkman and Walton (2017) ran an experiment where they compared the impact of providing information on a *dynamic norm*, i.e., the trend of how people's behavior is changing over time, versus a static one, i.e., people currently behave. When café customers were told that '30% of Americans make an effort to limit their meat consumption', 17% of customers chose the meatless option. In contrast, customers told that 'in the last five years, 30% of Americans have now *started* to make an effort to limit their meat consumption' led to 34% of people ordering a meatless lunch. Further work on the subject has identified that dynamic norms are particularly effective when consumers feel 'connected' with those consumers who form the norm (Sparkman et al., 2020). The use of dynamic norms is especially relevant for situations where only a minority of people doing the desired behavior, as simply disclosing the static norm that the behavior is rare is likely to lead to a boomerang effect (Mortensen et al., 2019; Sparkman & Walton, 2019).

Analysis

Climate scientists around the world are demanding immediate action on greenhouse gas emissions. Research into what can encourage climate mitigating behaviors is needed now more than ever. The behavior change literature focuses on situations where decisions are made at the individual level and could create a significant impact if realized at scale.

Review of the strength of the evidence

For transportation interventions, personal planning and goal setting appear to be the norm for promoting public transportation use or carpooling. These interventions are primarily correlational and exploratory with lower internal validity, but they have valuable insights for future campaigns and programs. For example, interventions appear to be most effective when people have to develop their own personalized travel plans (as opposed to someone else providing them) and when target actors are going through moments of transitions that offer opportunities for habit disruption and formation. For EV adoption or encouraging energy-efficient driving, we instead find the literature mainly evaluating the effect of social norms messaging.

For energy interventions, the use of choice architecture through defaults and social influences through social comparison and observability are consistently effective. In cases of social comparison, however, it is important to keep the *boomerang effect* in mind: salient norms can lead to different behavior for energy users above and below the norm. Message framings around health and environmental impacts of energy also appear to be effective. One particularly successful framing is making salient the environmental cost of appliances, products, or high-energy behaviors during use or at the time of purchase.

This was also true for interventions that are designed to encourage a more vegetarian, sustainable diet. Choice architecture has helped to increase the salience and availability of vegetarian options and highlight the ecological cost of meat through solutions like adding labels. While there has been some research on food choices and social

messaging, the evidence-base remains biased towards choice architecture and menu design. There is a need for more research on the impact of these interventions among their different actors, particularly those who already identify as vegetarian or vegan. For example, several studies showed that interventions were most effective for people who did not already have plant-rich diets but had a rebound effect for people already eating less meat (Bacon & Krpan, 2018).

Unlike transportation interventions, energy and food interventions have been tested and replicated through experiments that establish clear and consistent links between interventions and target behaviors. They vary in their ecological validity, with interventions taking place in naturalistic conditions, lab studies, and online experiments. Most of the research in this section can be thought of as trying to replicate or extend the findings of earlier interventions, although there is less diversity among food interventions. Their impact was thus directly tied to their ability to scale behavioral and social theories to new contexts and change people's norms and expectations.

Most studies lacked any measurement of durability beyond the intervention period, but social comparison interventions showed durable results up to five years into the future. There is also a lack of geographic spread in the interventions. Almost all interventions that encourage climate mitigation behavior have taken place in high-income countries in the United States, western Europe, or Japan. There is a clear lack of research in low and middle-income countries and contexts. The few studies that have explored these settings have provided particularly insightful results.

Review of the application of behavioral science

A recurring problem regarding climate mitigation efforts is that people's intentions, attitudes, or values do not always align with their actions. Behavioral scientists refer to this as the intention-action gap (or attitude-behavior gap or value action gap; see Blake, 1999). It is a phenomenon that is particularly rampant in the environmental field; people generally want to reduce their CO_2 emissions, but they take no action to do it (Flynn et al., 2009; Kollmuss & Agyeman, 2002; Lane & Potter, 2007).

There are several explanations for the intention-action gap. Studies often find that consumers blame their lack of knowledge regarding the actions they can and should take (Kennedy et al., 2009). Also, 'being green' necessitates more time, money, and space in our lives than what we perceive is generally available (Young et al., 2010). Interventions that make 'green' choices easier or those that cater to our cognitive biases are some of the most effective at encouraging climate mitigation behaviors. For example, interventions that rely on the default effect are effective because they leverage our tendency towards going with the current option (e.g., Brown et al., 2013; Campbell-Arvai et al., 2014; Ebeling & Lotz, 2015).

Similarly, labeling interventions (e.g., Behavioural Insights Team (BIT), 2014; Camilleri et al., 2019; London Economics, 2015; OECD, 2017)) work because people focus on a small set of salient variables when making decisions (i.e., we satisfice[4] rather than optimize our choices). By increasing the saliency of the information that we would otherwise ignore, green labels make it easier for decision-makers to align intention with action. Moreover, interventions that ease decision-makers' ability to follow-through on public transport commitments (Bamberg, 2006; Matthies et al., 2006; Thøgersen, 2009) or make more salient the health-impacts of electricity production have been effective (Omar I. Asensio & Delmas, 2015; Omar Isaac Asensio & Delmas, 2016). Intervention designers should seek to make intended choices simple, clear, and easy while considering the behavioral biases that support behavior change.

In cases where people do not have set intentions, social norms can help to promote target behaviors. Norms that align with desired behaviors increase the potential for social and reputational benefits (e.g., recognition, pride),

4 Satisficing is based in the theory that humans do not possess infinite computational ability. Instead, we have a finite and biologically-'bound' cognitive capacity (Simon, 1956). Because of this, human decision-makers only have the capacity to consider and pay attention to a limited set of information when making decisions. We do not optimize each and every one of our choices (as a supercomputer might). We satisfice (combining satisfy and suffice) among options with a limited set of criteria that our brain uses when making decisions.

which can compel people to make 'greener' decisions. Conversely, social pressure (e.g., guilt, shame, etc.) can motivate people to avoid unsustainable behaviors. For example, norms can mean someone is recognized in their community for installing solar panels or judged for keeping the air conditioning on all day. People's inherent desire to conform becomes a highly powerful motivator when a community's average behavior is made visible and explicit (Allcott, 2011; Brandon et al., 2019; Kandul et al., 2020). This motivation is even stronger when our own behavior is also made visible to the community (e.g., Griskevicius et al., 2010; Müller & Rode, 2013; Yoeli et al., 2013). Finally, intervention designers should be mindful of the boomerang effect that drives well-performing households to consume more electricity, consumers to avoid purchasing EVs, or vegetarians to revert to meat: people tend to center their behavior on visible norms, regardless of their position relative to that norm. The use of injunctive or dynamic norms over purely descriptive ones may avoid or alleviate such effects (e.g., Barth et al., 2016; Sparkman & Walton, 2017).

Review of the application of social science

The application of behavioral insights has become prevalent in the fight against climate change, but there is less emphasis on integrating insights about the wider socio-ecological system. We highlight four main areas where intervention designers could do more to understand local contexts and dynamics in their intervention design.

The first involves a more systemic approach to behavior change. Many of the environmental problems illustrated in this section are structural with complex chains of actors (e.g., transportation, energy consumption, meat-eating). Yet, the current focus of climate mitigation interventions is on the behavior of individuals within the established system. For example, personalized travel plans and commitments may help some individuals use more public transportation (Fujii & Taniguchi, 2006; Matthies et al., 2006). A more impactful approach could be to address the socio-cultural barriers and norms to bus or train use (Kristal & Whillans, 2020). Additionally, Kormos et al., (2014) find that a normative messaging approach leads to a decrease in commuting trips but has no impact on non-commuting, task-specific trips. One program that emerged as engaging a number of actors and interests is the Solarize initiative (Gillingham & Bollinger, 2017). It targeted the behaviors of various actors in the system, including local government to provide symbolic and material support, local suppliers to provide discounted rates, and local organizers to provide community capacity building. This approach exemplifies behavior change that focuses on both the enabling social environment as well as the behavior of the direct actor.

The second area of improvement involves the homogeneous treatment of target actors. There is little acknowledgment of their varied needs, motivations, and social positions as related to climate mitigation behaviors. Yet, we know that different groups of people can react very differently to these interventions. Social analyses provide valuable insight into how homogenous messaging interventions may fail to address the diverse needs of heterogeneous actors. For example, a review of travel behavior in Europe and North America found that women were far more likely than men to take on the gendered role of caring for family and home. As a result, they often make less direct, multi-destination trips that do not occur on major transportation routes (Root & Schintler, 2003). In contrast, men's trips revolve around commutes to and from work on central routes. A personalized travel plan can only go so far in encouraging the use of public transport if said transport is geared only mainly to serve 'commuters. Additionally, besides Filippini et al.'s (2020) efforts to promote electric motorcycles in Nepal, we found no behavior change efforts exploring more informal, fuel-efficient transport options found in many parts of the world (e.g., *autos* in India, *bodas* in East Africa, and motorcycle taxis in Central America and Southeast Asia). These offer alternative solutions to transportation systems where highways are less common (Vermeiren et al., 2015) and improve the sustainability and access to urban transportation (Evans et al., 2018). More behavioral and social scientists should explore the potential of three-wheeled and two-wheeled vehicle electrification efforts.

Beale & Bonsall's (2007) social marketing campaign on bus use is a unique example of how identifying and addressing social differences can determine behavior change. Their first intervention identified that general marketing materials mostly encouraged women and frequent bus riders. In their second iteration, they tried

messaging that described buses as more convenient and logical than cars for specific types of trips, which appealed to men and infrequent bus riders. Where their first campaign had seen a reduction in bus usage by men, the second one led to an increase in bus riding, even though it appealed less to women. Practitioners should also be mindful of the diverging needs and perceptions of different cultural groups when attempting to replicate such interventions outside western Europe or North America (see, for example, Van et al., 2014, on the role that perceptions of public transport systems being 'chaotic' and 'unorderly' might play in Asia).

For energy interventions, providing eco-feedback through social comparison (Allcott, 2011; Jachimowicz et al., 2018) produces significantly different responses depending on the target population's culture (Ma et al., 2017). Social scientists have identified how gender and age shape the energy needs of decision-makers (Root & Schintler, 2003; Wilkowska et al., 2014). In Indonesia, for example, husband-wife household dynamics affect how much energy a household uses. When women control decisions about energy consumption in a household, energy consumption is lower than when men make decisions (Permana et al., 2015). Because women tend to be more cautious about household expenditures than men, gender becomes an essential consideration for intervention design. However, none of the interventions we reviewed target men specifically to reduce energy usage, emphasize the cost of energy-use to women, or try to empower women to make household energy decisions. There are few studies that have addressed gender but as part of a larger appeal to families, such as how individuals with children react more strongly to a general health frame (Omar I. Asensio & Delmas, 2015).

Third, we find that many interventions do not incorporate an explicit analysis of the relationship between the intervention target and the intervening institution. A failure to investigate these factors can lead to unintended consequences. For example, Sudarshan (2017) found that pairing social comparisons with monetary incentives to reduce energy usage nullified the former's effect. This was not due to some psychological bias but rather the specific relationship between Indian consumers and the government's electricity providers. Consumers' lack of trust in the implementer resulted in them seeing comparison-driven discounts as a way to disguise price surges in the future. Intervention designers should be mindful of the relationship between the actor and implementer to prevent potential backfire effects and support more equitable interventions.

Finally, ethical behavioral interventions should strive to prioritize target actors' goals and interests. Many climate mitigation behaviors ultimately come at a cost for consumers. For example, carpooling to work may reduce workers' autonomy because they are now bound to others' schedules (Kristal & Whillans, 2020) or feel a loss of liberty without their vehicle. In the U.S., driving and its associated institutions of suburban living, highway diners, and a car-centric popular culture emphasize individual freedom above everything else (Seiler, 2012). The adoption of plant-based diets also contradicts many personal and cultural values around eating meat. Plant-rich dishes still suffer from a stereotype of creating a less pleasurable or enjoyable eating experience (Macdiarmid et al., 2016) as well as a social judgment from meat eaters (MacInnis & Hodson, 2017). Behaviors like carpooling and choosing vegetarian dishes exist within a complex socio-ecological system and could burden those trying these for the first time unless practitioners address existing norms and values.

There can also be real financial costs for low-income and less-educated individuals if their interests and needs are missing from an intervention's design. For example, Ghesla et al. (2020) examined how green energy defaults in Switzerland disproportionately affect the poor by signing them up for more expensive energy contracts without their full awareness. Four years after the implementation, residents with lower incomes, less education, and who did not own property still had the expensive, default energy contract. While these residents had the choice to select a different contract, they found it difficult to do or did not know how to switch. Practitioners should not equate the existence and perception of options and need to ensure that people's free choice and personal autonomy are truly maintained.

Further Readings

Carattini, S., Péclat, M., & Baranzini, A. (2018). Social interactions and the adoption of solar PV: Evidence from cultural borders.

Gosnell, G., List, J. A., & Metcalfe, R. (2016). A New approach to an age-old problem: Solving externalities by incenting workers directly.

Ölander, F., & Thøgersen, J. (2014). Informing versus nudging in environmental policy. Journal of Consumer Policy, 37, 341–356. https://doi.org/10.1007/s10603-014-9256-2

Schall, D. L., & Mohnen, A. (2017). Incentivizing energy-efficient behavior at work: An empirical investigation using a natural field experiment on eco-driving. Applied Energy, 185, 1757–1768. https://doi.org/10.1016/j.apenergy.2015.10.163

Thondhlana, G., & Kua, H. W. (2016). Promoting household energy conservation in low-income households through tailored interventions in Grahamstown, South Africa. Journal of Cleaner Production, 131, 327–340. https://doi.org/10.1016/j.jclepro.2016.05.026

References

Allcott, H. (2011). Social norms and energy conservation. Journal of Public Economics, 95(9), 1082–1095. https://doi.org/10.1016/j.jpubeco.2011.03.003

Allcott, H., & Rogers, T. (2014). The Short-Run and Long-Run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation. American Economic Review, 104(10), 3003–3037. https://doi.org/10.1257/aer.104.10.3003

Al Mamun, A., Masud, M. M., Fazal, S. A., & Muniady, R. (2019). Green vehicle adoption behavior among low-income households: Evidence from coastal Malaysia. Environmental Science and Pollution Research, 26(26), 27305–27318. https://doi.org/10.1007/s11356-019-05908-2

Asensio, Omar I., & Delmas, M. A. (2015). Nonprice incentives and energy conservation. Proceedings of the National Academy of Sciences of the United States of America, 112(6), E510–E515. https://doi.org/10.1073/pnas.1401880112

Asensio, Omar Isaac, & Delmas, M. A. (2016). The dynamics of behavior change: Evidence from energy conservation. Journal of Economic Behavior & Organization, 126, 196–212. https://doi.org/10.1016/j.jebo.2016.03.012

Axsen, J., Orlebar, C., & Skippon, S. (2013). Social influence and consumer preference formation for pro-environmental technology: The case of a U.K. workplace electric-vehicle study. Ecological Economics, 95, 96–107. https://doi.org/10.1016/j.ecolecon.2013.08.009

Ayres, I., Raseman, S., & Shih, A. (2013). Evidence from Two Large Field Experiments that Peer Comparison Feedback Can Reduce Residential Energy Usage. The Journal of Law, Economics, and Organization, 29(5), 992–1022. https://doi.org/10.1093/jleo/ews020

Bachman, W., & Katzev, R. (1982). The effects of non-contingent free bus tickets and personal commitment on urban bus ridership. Transportation Research Part A: General, 16(2), 103–108. https://doi.org/10.1016/0191-2607(82)90002-4

Bacon, L., & Krpan, D. (2018). (Not) Eating for the environment: The impact of restaurant menu design on vegetarian food choice. Appetite, 125, 190–200. https://doi.org/10.1016/j.appet.2018.02.006

Bacon, L., Wise, J., Attwood, S., & Vennard, D. (2018). "Language of Sustainable Diets." Technical Note. (p. 20). World Resources Institute. https://www.wri.org/publication/renaming-vegetarian-dishes

Bamberg, S. (2002). Effects of implementation intentions on the actual performance of new environmentally friendly behaviours—Results of two field experiments. Journal of Environmental Psychology, 22, 399–411. https://doi.org/10.1006/jevp.2002.0278

Bamberg, S. (2006). Is a Residential Relocation a Good Opportunity to Change People's Travel Behavior? Results From a Theory-Driven Intervention Study: Environment and Behavior. https://doi.org/10.1177/0013916505285091

Banerjee, A., & Solomon, B. D. (2003). Eco-labeling for energy efficiency and sustainability: A meta-evaluation of US programs. Energy Policy, 31(2), 109–123. https://doi.org/10.1016/S0301-4215(02)00012-5

Barth, M., Jugert, P., & Fritsche, I. (2016). Still underdetected—Social norms and collective efficacy predict the acceptance of electric vehicles in Germany. Transportation Research Part F: Traffic Psychology and Behaviour, 37, 64–77. https://doi.org/10.1016/j.trf.2015.11.011

Bator, R. J., Phelps, K., Tabanico, J., Schultz, P. W., & Walton, M. L. (2019). When it is not about the money: Social comparison and energy conservation among residents who do not pay for electricity. Energy Research & Social Science, 56, 101198. https://doi.org/10.1016/j.erss.2019.05.008

Beale, J. R., & Bonsall, P. W. (2007). Marketing in the bus industry: A psychological interpretation of some attitudinal and behavioural outcomes. Transportation Research Part F: Traffic Psychology and Behaviour, 10(4), 271–287. https://doi.org/10.1016/j.trf.2006.11.001

Behavioural Insights Team. (2011). Behaviour Change and Energy Use (p. 35).

Behavioural Insights Team (BIT). (2014). Evaluation of the DECC and John Lewis energy labelling trial. Department of Energy and Climate Change. https://www.gov.uk/government/publications/evaluation-of-the-decc-and-john-lewis-energy-labelling-trial

Blake, J. (1999). Overcoming the 'value- action gap' in environmental policy: Tensions between national policy and local experience. Local Environment, 4(3), 257–278. https://doi.org/10.1080/13549839908725599

Bolderdijk, J. W., Steg, L., Geller, E. S., Lehman, P. K., & Postmes, T. (2013). Comparing the effectiveness of monetary versus moral motives in environmental campaigning. Nature Climate Change, 3(4), 413–416. https://doi.org/10.1038/nclimate1767

Brandon, A., Ferraro, P. J., List, J., Metcalfe, R., Price, M., & Rundhammer, F. (2017). Do The Effects of Social Nudges Persist? Theory and Evidence from 38 Natural Field Experiments (No. w23277; p. w23277). National Bureau of Economic Research. https://doi.org/10.3386/w23277

Brandon, A., List, J. A., Metcalfe, R. D., Price, M. K., & Rundhammer, F. (2019). Testing for crowd out in social nudges: Evidence from a natural field experiment in the market for electricity. Proceedings of the National Academy of Sciences, 116(12), 5293–5298. https://doi.org/10.1073/pnas.1802874115

Brown, Z., Johnstone, N., Haščič, I., Vong, L., & Barascud, F. (2013). Testing the effect of defaults on the thermostat settings of OECD employees. Energy Economics, 39, 128–134. https://doi.org/10.1016/j.eneco.2013.04.011

Buchanan, K., Russo, R., & Anderson, B. (2015). The question of energy reduction: The problem(s) with feedback. Energy Policy, 77, 89–96. https://doi.org/10.1016/j.enpol.2014.12.008

Camilleri, A. R., Larrick, R. P., Hossain, S., & Patino-Echeverri, D. (2019). Consumers underestimate the emissions associated with food but are aided by labels. Nature Climate Change, 9(1), 53–58. https://doi.org/10.1038/s41558-018-0354-z

Campbell-Arvai, V., & Arvai, J. (2015). The promise of asymmetric interventions for addressing risks to environmental systems. Environment Systems and Decisions, 35(4), 472–482. https://doi.org/10.1007/s10669-015-9566-1

Campbell-Arvai, V., Arvai, J., & Kalof, L. (2014). Motivating Sustainable Food Choices: The Role of Nudges, Value Orientation, and Information Provision. Environment and Behavior, 46(4), 453–475. https://doi.org/10.1177/0013916512469099

Carattini, S., Péclat, M., & Baranzini, A. (2018). Social interactions and the adoption of solar PV: Evidence from cultural borders.

Cherchi, E. (2017). A stated choice experiment to measure the effect of informational and normative conformity in the preference for electric vehicles. Transportation Research Part A: Policy and Practice, 100, 88–104. https://doi.org/10.1016/j.tra.2017.04.009

Costa, D. L., & Kahn, M. E. (2013). Energy Conservation "Nudges" and Environmentalist Ideology: Evidence from a Randomized Residential Electricity Field Experiment. Journal of the European Economic Association, 11(3), 680–702. https://doi.org/10.1111/jeea.12011

Dai, H., Milkman, K. L., & Riis, J. (2014). The Fresh Start Effect: Temporal Landmarks Motivate Aspirational Behavior. Management Science, 60(10), 2563–2582. https://doi.org/10.1287/mnsc.2014.1901

De Dominicis, S., Sokoloski, R., Jaeger, C. M., & Schultz, P. W. (2019). Making the smart meter social promotes long-term energy conservation. Palgrave Communications, 5(1), 51. https://doi.org/10.1057/s41599-019-0254-5

Degirmenci, K., & Breitner, M. H. (2017). Consumer purchase intentions for electric vehicles: Is green more important than price and range? Transportation Research Part D: Transport and Environment, 51, 250–260. https://doi.org/10.1016/j.trd.2017.01.001

DellaValle, N., & Zubaryeva, A. (2019). Can we hope for a collective shift in electric vehicle adoption? Testing salience and norm-based interventions in South Tyrol, Italy. Energy Research & Social Science, 55, 46–61. https://doi.org/10.1016/j.erss.2019.05.005

Dinner, I., Johnson, E. J., Goldstein, D. G., & Liu, K. (2011). Partitioning default effects: Why people choose not to choose. Journal of Experimental Psychology. Applied, 17(4), 332–341. https://doi.org/10.1037/a0024354

Duflo, E., Greenstone, M., Pande, R., & Ryan, N. (2013). Truth-telling by Third-party Auditors and the Response of Polluting Firms: Experimental Evidence from India*. The Quarterly Journal of Economics, 128(4), 1499–1545. https://doi.org/10.1093/qje/qjt024

Ebeling, F., & Lotz, S. (2015). Domestic uptake of green energy promoted by opt-out tariffs. Nature Climate Change, 5(9), 868–871. https://doi.org/10.1038/nclimate2681

Egbue, O., & Long, S. (2012). Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions. Energy Policy, 48, 717–729. https://doi.org/10.1016/j.enpol.2012.06.009

Egbue, O., Long, S., & Samaranayake, V. A. (2017). Mass deployment of sustainable transportation: Evaluation of factors that influence electric vehicle adoption. Clean Technologies and Environmental Policy, 19(7), 1927–1939. https://doi.org/10.1007/s10098-017-1375-4

Eriksson, L., Garvill, J., & Nordlund, A. M. (2008). Interrupting habitual car use: The importance of car habit strength and moral motivation for personal car use reduction. Transportation Research Part F: Traffic Psychology and Behaviour, 11(1), 10–23. https://doi.org/10.1016/j.trf.2007.05.004

Evans, J., O'Brien, J., & Ch Ng, B. (2018). Towards a geography of informal transport: Mobility, infrastructure and urban sustainability from the back of a motorbike. Transactions of the Institute of British Geographers, 43(4), 674–688. https://doi.org/10.1111/tran.12239

Filippini, M., Kumar, N., & Srinivasan, S. (2020). Nudging the Adoption of Fuel-Efficient Vehicles: Evidence from a Stated Choice Experiment in Nepal. In Economics Working Paper Series (Vol. 20/333) [Working Paper]. CER-ETH—Center of Economic Research at ETH Zurich. https://doi.org/10.3929/ethz-b-000412797

Flynn, R., Bellaby, P., & Ricci, M. (2009). The 'Value-Action Gap' in Public Attitudes towards Sustainable Energy: The Case of Hydrogen Energy: The Sociological Review. https://journals.sagepub.com/doi/10.1111/j.1467-954X.2010.01891.x

Fowlie, M., Wolfram, C., Spurlock, C. A., Todd, A., Baylis, P., & Cappers, P. (2017). Default Effects and Follow-On Behavior: Evidence from an Electricity Pricing Program (No. w23553; p. w23553). National Bureau of Economic Research. https://doi.org/10.3386/w23553

Fujii, S., & Taniguchi, A. (2006). Determinants of the effectiveness of travel feedback programs—A review of communicative mobility management measures for changing travel behaviour in Japan. Transport Policy, 13(5), 339–348. https://doi.org/10.1016/j.tranpol.2005.12.007

Garnett, E. E., Balmford, A., Sandbrook, C., Pilling, M. A., & Marteau, T. M. (2019). Impact of increasing vegetarian availability on meal selection and sales in cafeterias. Proceedings of the National Academy of Sciences, 116(42), 20923–20929. https://doi.org/10.1073/pnas.1907207116

Ghesla, C., Grieder, M., & Schubert, R. (2020). Nudging the poor and the rich—A field study on the distributional effects of green electricity defaults. Energy Economics, 86, 104616. https://doi.org/10.1016/j.eneco.2019.104616

Gillingham, K., & Bollinger, B. (2017). Solarize your community: An evidence-based guide for accelerating the adoption of residential solar.

Gosnell, G., List, J., & Metcalfe, R. (2016). A New Approach to an Age-Old Problem: Solving Externalities by Incenting Workers Directly. w22316. https://doi.org/10.3386/w22316

Griskevicius, V., Tybur, J. M., & Van den Bergh, B. (2010). Going green to be seen: Status, reputation, and conspicuous conservation. Journal of Personality and Social Psychology, 98(3), 392–404. https://doi.org/10.1037/a0017346

Guo, J., Zhang, X., Gu, F., Zhang, H., & Fan, Y. (2020). Does air pollution stimulate electric vehicle sales? Empirical evidence from twenty major cities in China. Journal of Cleaner Production, 249, 119372. https://doi.org/10.1016/j.jclepro.2019.119372

Hardisty, D. J., Beall, A. T., Lubowski, R., Petsonk, A., & Romero-Canyas, R. (2019). A carbon price by another name may seem sweeter: Consumers prefer upstream offsets to downstream taxes. Journal of Environmental Psychology, 66, 101342. https://doi.org/10.1016/j.jenvp.2019.101342

Hardman, S. (2019). Understanding the impact of reoccurring and non-financial incentives on plug-in electric vehicle adoption—A review. Transportation Research Part A: Policy and Practice, 119, 1–14. https://doi.org/10.1016/j.tra.2018.11.002

Helveston, J. P., Liu, Y., Feit, E. M., Fuchs, E., Klampfl, E., & Michalek, J. J. (2015). Will subsidies drive electric vehicle adoption? Measuring consumer preferences in the U.S. and China. Transportation Research Part A: Policy and Practice, 73, 96–112. https://doi.org/10.1016/j.tra.2015.01.002

Higgs, S., Liu, J., Collins, E. I. M., & Thomas, J. M. (2019). Using social norms to encourage healthier eating. Nutrition Bulletin, 44(1), 43–52. https://doi.org/10.1111/nbu.12371

Hörlén, A., Forslund, S., Nilsson, P., & Jönsson, L. (2008). Utvärderingsrapport av 'Inga löjliga bilresor 2008 (Evaluation Report of 'No Ridiculous Car Trips 2008"},. https://malmo.se/download/18.6e1be7ef13514d6cfcc800036835/Utv%C3%A4rdering+INGA+L%C3%96JLIGA+BILRESOR+2008.pdf

Hurlstone, M. J., Lewandowsky, S., Newell, B. R., & Sewell, B. (2014). The Effect of Framing and Normative Messages in Building Support for Climate Policies. PLOS ONE, 9(12), e114335. https://doi.org/10.1371/journal.pone.0114335

IPCC. (2014). Summary for policymakers. In Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (Eds.)]. Cambridge University Press. https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_full.pdf

Jachimowicz, J. M., Hauser, O. P., O'Brien, J. D., Sherman, E., & Galinsky, A. D. (2018). The critical role of second-order normative beliefs in predicting energy conservation. Nature Human Behaviour, 2(10), 757–764. https://doi.org/10.1038/s41562-018-0434-0

Jakobsson, C., Fujii, S., & Gärling, T. (2002). Effects of economic disincentives on private car use. Transportation, 29(4), 349–370. https://doi.org/10.1023/A:1016334411457

Kaaukauskas, A., Broberg, T., & Jaraite, J. (2017). Social Comparisons in Real Time: A Field Experiment of Residential Electricity and Water Use. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3075938

Kandul, S., Lang, G., & Lanz, B. (2020). Social comparison and energy conservation in a collective action context: A field experiment. Economics Letters, 188, 108947. https://doi.org/10.1016/j.econlet.2020.108947

Katzev, R., & Bachman, W. (1982). Effects of Deferred Payment and Fare Manipulation on Urban Bus Ridership. Journal of Applied Psychology, 67, 83–88.

Kennedy, E. H., Beckley, T. M., McFarlane, B. L., & Nadeau, S. (2009). Why We Don't "Walk the Talk": Understanding the Environmental Values/Behaviour Gap in Canada. Human Ecology Review, 16(2), 151–160. JSTOR.

Khurana, A., Kumar, V. V. R., & Sidhpuria, M. (2020). A Study on the Adoption of Electric Vehicles in India: The Mediating Role of Attitude. Vision: The Journal of Business Perspective, 24(1), 23–34. https://doi.org/10.1177/0972262919875548

Kim, S., Lee, J., & Lee, C. (2017). Does Driving Range of Electric Vehicles Influence Electric Vehicle Adoption? Sustainability, 9(10), 1–15.

Klege, R., Visser, M., Datta, S., & Darling, C. (2018a). The Effectiveness of Competition and Responsibility Assignment in Saving Energy: A Non-Residential example of the Power of the "Nudge." https://doi.org/10.13140/RG.2.2.15102.28485

Klege, R., Visser, M., Datta, S., & Darling, M. (2018b). Behavioural Nudges, a Non-Residential Case of Energy Conservation: Evidence from the 4th Dorp Street Building in the Western Cape. 20.

Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? Environmental Education Research, 8(3), 239–260. https://doi.org/10.1080/13504620220145401

Kormos, C., Gifford, R., & Brown, E. (2014). The Influence of Descriptive Social Norm Information on Sustainable Transportation Behavior: A Field Experiment. Environment and Behavior, 47. https://doi.org/10.1177/0013916513520416

Kristal, A. S., & Whillans, A. V. (2020). What we can learn from five naturalistic field experiments that failed to shift commuter behaviour. Nature Human Behaviour, 4(2), 169–176. https://doi.org/10.1038/s41562-019-0795-z

Kurz, V. (2018). Nudging to reduce meat consumption: Immediate and persistent effects of an intervention at a university restaurant. Journal of Environmental Economics and Management, 90, 317–341. https://doi.org/10.1016/j.jeem.2018.06.005

Lane, B., & Potter, S. (2007). The adoption of cleaner vehicles in the UK: Exploring the consumer attitude–action gap. Journal of Cleaner Production, 15(11), 1085–1092. https://doi.org/10.1016/j.jclepro.2006.05.026

Larrick, R. P., & Soll, J. B. (2008). The MPG Illusion. Science, 320(5883), 1593–1594. https://doi.org/10.1126/science.1154983

List, J., Metcalfe, R., Price, M., & Rundhammer, F. (2017). Harnessing Policy Complementarities to Conserve Energy: Evidence from a Natural Field Experiment (No. w23355; p. w23355). National Bureau of Economic Research. https://doi.org/10.3386/w23355

London Economics. (2015). Study on the impact of energy label—and potential changes to it consumer understanding purchase decisions [Text]. European Commission. https://ec.europa.eu/energy/studies/study-impact-energy-label-%E2%80%93-and-potential-changes-it-%E2%80%93-consumer-understanding-and-purchase_en

Loy, L. S., Wieber, F., Gollwitzer, P. M., & Oettingen, G. (2016). Supporting Sustainable Food Consumption: Mental Contrasting with Implementation Intentions (MCII) Aligns Intentions and Behavior. Frontiers in Psychology, 7. https://doi.org/10.3389/fpsyg.2016.00607

Ma, G., Lin, J., Li, N., & Zhou, J. (2017). Cross-cultural assessment of the effectiveness of eco-feedback in building energy conservation. Energy and Buildings, 134, 329–338. https://doi.org/10.1016/j.enbuild.2016.11.008

Maan, S., Merkus, B., Ham, J., & Midden, C. (2011). Making it not too obvious: The effect of ambient light feedback on space heating energy consumption. Energy Efficiency, 4(2), 175–183. https://doi.org/10.1007/s12053-010-9102-6

Macdiarmid, J. I., Douglas, F., & Campbell, J. (2016). Eating like there's no tomorrow: Public awareness of the environmental impact of food and reluctance to eat less meat as part of a sustainable diet. Appetite, 96, 487–493. https://doi.org/10.1016/j.appet.2015.10.011

MacInnis, C. C., & Hodson, G. (2017). It ain't easy eating greens: Evidence of bias toward vegetarians and vegans from both source and target. Group Processes & Intergroup Relations, 20(6), 721–744. https://doi.org/10.1177/1368430215618253

Matthews, L., Lynes, J., Riemer, M., Del Matto, T., & Cloet, N. (2017). Do we have a car for you? Encouraging the uptake of electric vehicles at point of sale. Energy Policy, 100, 79–88. https://doi.org/10.1016/j.enpol.2016.10.001

Matthies, E., Klöckner, C. A., & Preißner, C. L. (2006). Applying a Modified Moral Decision Making Model to Change Habitual Car Use: How Can Commitment be Effective? Applied Psychology: An International Review, 55(1), 91–106. https://doi.org/10.1111/j.1464-0597.2006.00237.x

Monroe, J., Lofgren, I., Sartini, B., & Greene, G. (2015). The Green Eating Project: Web-based intervention to promote environmentally conscious eating behaviours in US university students. Public Health Nutrition, 18, 1–11. https://doi.org/10.1017/S1368980015002396

Mortensen, C. R., Neel, R., Cialdini, R. B., Jaeger, C. M., Jacobson, R. P., & Ringel, M. M. (2019). Trending Norms: A Lever for Encouraging Behaviors Performed by the Minority. Social Psychological and Personality Science, 10(2), 201–210. https://doi.org/10.1177/1948550617734615

Müller, S., & Rode, J. (2013). The adoption of photovoltaic systems in Wiesbaden, Germany. Economics of Innovation and New Technology, 22(5), 519–535. https://doi.org/10.1080/10438599.2013.804333

OECD. (2017). Tackling Environmental Problems with the Help of Behavioural Insights. OECD. https://doi.org/10.1787/9789264273887-en

Ölander, F., & Thøgersen, J. (2014). Informing Versus Nudging in Environmental Policy. Journal of Consumer Policy, 37, 341–356. https://doi.org/10.1007/s10603-014-9256-2

Park, E., Lim, J., & Cho, Y. (2018). Understanding the Emergence and Social Acceptance of Electric Vehicles as Next-Generation Models for the Automobile Industry. Sustainability, 10(3), 662. https://doi.org/10.3390/su10030662

Permana, A. S., Aziz, N. Abd., & Siong, H. C. (2015). Is mom energy efficient? A study of gender, household energy consumption and family decision making in Indonesia. Energy Research & Social Science, 6, 78–86. https://doi.org/10.1016/j.erss.2014.12.007

Pohjolainen, P., Vinnari, M., & Jokinen, P. (2015). Consumers' perceived barriers to following a plant-based diet. British Food Journal, 117(3), 1150–1167. https://doi.org/10.1108/BFJ-09-2013-0252

Rai, V., & Robinson, S. A. (2013). Effective information channels for reducing costs of environmentally- friendly technologies: Evidence from residential PV markets. Environmental Research Letters, 8(1), 014044. https://doi.org/10.1088/1748-9326/8/1/014044

Root, A., & Schintler, L. (2003). Gender, Transportation, and the Environment. In D. A. Hensher & K. J. Button (Eds.), Handbook of Transport and the Environment (Vol. 4, pp. 647–663). Emerald Group Publishing Limited. https://doi.org/10.1108/9781786359513-036

Schall, D. L., & Mohnen, A. (2017). Incentivizing energy-efficient behavior at work: An empirical investigation using a natural field experiment on eco-driving. Applied Energy, 185, 1757–1768. https://doi.org/10.1016/j.apenergy.2015.10.163

Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. Psychological Science, 18(5), 429–434. https://doi.org/10.1111/j.1467-9280.2007.01917.x

Seebauer, S. (2015). Why early adopters engage in interpersonal diffusion of technological innovations: An empirical study on electric bicycles and electric scooters. Transportation Research Part A: Policy and Practice, 78, 146–160. https://doi.org/10.1016/j.tra.2015.04.017

Seiler, C. (2012). Welcoming China to Modernity: US Fantasies of Chinese Automobility. Public Culture, 24(2 (67)), 357–384. https://doi.org/10.1215/08992363-1535534

Simon, H. A. (1956). Rational choice and the structure of the environment. Psychological Review, 63(2), 129–138. https://doi.org/10.1037/h0042769

Smith, N., Goldstein, D., & Johnson, E. (2013). Choice Without Awareness: Ethical and Policy Implications of Defaults. Journal of Public Policy & Marketing, 32, 159–172. https://doi.org/10.1509/jppm.10.114

Sparkman, G., & Walton, G. M. (2017). Dynamic Norms Promote Sustainable Behavior, Even if It Is Counternormative. Psychological Science, 28(11), 1663–1674. https://doi.org/10.1177/0956797617719950

Sparkman, G., & Walton, G. M. (2019). Witnessing change: Dynamic norms help resolve diverse barriers to personal change. Journal of Experimental Social Psychology, 82, 238–252. https://doi.org/10.1016/j.jesp.2019.01.007

Sparkman, G., Weitz, E., Robinson, T. N., Malhotra, N., & Walton, G. M. (2020). Developing a Scalable Dynamic Norm Menu-Based Intervention to Reduce Meat Consumption. Sustainability, 12(6), 2453. https://doi.org/10.3390/su12062453

Spence, A., Leygue, C., Bedwell, B., & O'Malley, C. (2014). Engaging with energy reduction: Does a climate change frame have the potential for achieving broader sustainable behaviour? Journal of Environmental Psychology, 38, 17–28. https://doi.org/10.1016/j.jenvp.2013.12.006

Steinhorst, J., Klöckner, C. A., & Matthies, E. (2015). Saving electricity—For the money or the environment? Risks of limiting pro-environmental spillover when using monetary framing. Journal of Environmental Psychology, 43, 125–135. https://doi.org/10.1016/j.jenvp.2015.05.012

Sudarshan, A. (2017). Nudges in the marketplace: The response of household electricity consumption to information and monetary incentives. Journal of Economic Behavior & Organization, 134, 320–335. https://doi.org/10.1016/j.jebo.2016.12.015

Tertoolen, G., van Kreveld, D., & Verstraten, B. (1998). Psychological resistance against attempts to reduce private car use. Transportation Research Part A: Policy and Practice, 32(3), 171–181. https://doi.org/10.1016/S0965-8564(97)00006-2

Thøgersen, J. (2009). Promoting public transport as a subscription service: Effects of a free month travel card. Transport Policy, 16(6), 335–343. https://doi.org/10.1016/j.tranpol.2009.10.008

Thøgersen, J., Jørgensen, A.-K., & Sandager, S. (2012). Consumer Decision Making Regarding a "Green" Everyday Product. Psychology & Marketing, 29(4), 187–197. https://doi.org/10.1002/mar.20514

Thondhlana, G., & Kua, H. W. (2016). Promoting household energy conservation in low-income households through tailored interventions in Grahamstown, South Africa. Journal of Cleaner Production, 131, 327–340. https://doi.org/10.1016/j.jclepro.2016.05.026

Thulin, E., & Rakhimov, A. (2019). Helping the Climate Because Others Do: An Exploratory Analysis of the Psychological Predictors of Intention to Perform High Impact Pro-Environmental Behaviors [Preprint]. PsyArXiv. https://doi.org/10.31234/osf.io/kah7s

UNEP. (2017). The emissions gap report 2017. United Nations Environment Programme (UNEP). https://wedocs.unep.org/bitstream/handle/20.500.11822/22070/EGR_2017.pdf?sequence=1&isAllowed=y

Van, H. T., Choocharukul, K., & Fujii, S. (2014). The effect of attitudes toward cars and public transportation on behavioral intention in commuting mode choice—A comparison across six Asian countries. Transportation Research Part A: Policy and Practice, 69, 36–44. https://doi.org/10.1016/j.tra.2014.08.008

Vennard, D., Park, T., & Attwood, S. (2018). "Language of Sustainable Diets." Technical Note. (p. 16). World Resources Institute. : www.wri.org/publication/encouraging sustainable-food-consumption.

Vermeiren, K., Verachtert, E., Kasaija, P., Loopmans, M., Poesen, J., & Van Rompaey, A. (2015). Who could benefit from a bus rapid transit system in cities from developing countries? A case study from Kampala, Uganda. Journal of Transport Geography, 47, 13–22. https://doi.org/10.1016/j.jtrangeo.2015.07.006

Verplanken, B., & Roy, D. (2016). Empowering interventions to promote sustainable lifestyles: Testing the habit discontinuity hypothesis in a field experiment. Journal of Environmental Psychology, 45, 127–134. https://doi.org/10.1016/j.jenvp.2015.11.008

Verplanken, B., Walker, I., Davis, A., & Jurasek, M. (2008). Context change and travel mode choice: Combining the habit discontinuity and self-activation hypotheses. Journal of Environmental Psychology, 28(2), 121–127. https://doi.org/10.1016/j.jenvp.2007.10.005

Wilkowska, W., Farrokhikhiavi, R., Ziefle, M., & Vallée, D. (2014). Mobility requirements for the use of carpooling among different user groups. Undefined. /paper/Mobility-requirements-for-the-use-of-carpooling-Wilkowska-Farrokhikhiavi/a6293702e0bf2d065613c113ce1532dfa0246fa5

Williamson, K., Satre-Meloy, A., Velasco, K., & Green, K. (2018). Climate Change Needs Behavior Change: Making the Case For Behavioral Solutions to Reduce Global Warming. Rare. https://rare.org/wp-content/uploads/2019/02/2018-CCNBC-Report.pdf

Yeomans, M., & Herberich, D. (2014). An experimental test of the effect of negative social norms on energy-efficient investments. Journal of Economic Behavior & Organization, 108, 187–197. https://doi.org/10.1016/j.jebo.2014.09.010

Yoeli, E., Hoffman, M., Rand, D. G., & Nowak, M. A. (2013). Powering up with indirect reciprocity in a large-scale field experiment. Proceedings of the National Academy of Sciences, 110(Supplement 2), 10424–10429. https://doi.org/10.1073/pnas.1301210110

Young, W., Hwang, K., McDonald, S., & Oates, C. J. (2010). Sustainable consumption: Green consumer behaviour when purchasing products. Sustainable Development, 18(1), 20–31. https://doi.org/10.1002/sd.394

Zarazua de Rubens, G., Noel, L., & Sovacool, B. K. (2018). Dismissive and deceptive car dealerships create barriers to electric vehicle adoption at the point of sale. Nature Energy, 3(6), 501–507. https://doi.org/10.1038/s41560-018-0152-x

CENTER FOR BEHAVIOR & THE ENVIRONMENT

Rare inspires change so people and nature thrive. Conservation ultimately comes down to people—their behaviors toward nature, their beliefs about its value, and their ability to protect it without sacrificing basic life needs. And so, conservationists must become as skilled in social change as in science; as committed to community-based solutions as national and international policymaking.

The Center for Behavior & the Environment at Rare is translating science into practice and leveraging the best behavioral insights and design thinking approaches to tackle some of the most challenging environmental issues. Through partnerships with leading academic and research institutions, they are bringing the research into the field to connect the next generation of behavioral scientists with practitioners on the front lines of our greatest environmental challenges.

To learn more, visit behavior.rare.org

STAP SCIENTIFIC AND TECHNICAL ADVISORY PANEL
An independent group of scientists that advises the Global Environment Facility

gef UN environment programme

The Global Environment Facility (GEF) was established on the eve of the 1992 Rio Earth Summit to help tackle our planet's most pressing environmental problems. Since then, the GEF has provided close to $20.5 billion in grants and mobilized an additional $112 billion in co-financing for more than 4,800 projects in 170 countries. Through its Small Grants Programme, the GEF has provided support to nearly 24,000 civil society and community initiatives in 133 countries.

The Scientific and Technical Advisory Panel (STAP) comprises seven expert advisers supported by a Secretariat, which are together responsible for connecting the GEF to the most up to date, authoritative, and globally representative science. The STAP Chair reports to every GEF Council meeting, briefing Council members on the Panel's work and emerging scientific and technical issues.