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# The effects of norms on environmental behavior

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## Abstract

The study of norms is of paramount importance in understanding human behavior. An interdisciplinary literature, using varying definitions and conceptions, shows when and why norms emerge and spread, what form they can take, and how they are enforced. Here, we focus on theoretical and empirical literatures that treat norms as a factor influencing human behavior. We first present a new taxonomy of norms, which builds upon and merges previous taxonomies, to distinguish between different types of norms and enforcement mechanisms. We then provide a conceptual framework that identifies causes of the effects of norms based on psychological theories, which can serve as a foundation for much of the empirical economic literature measuring norm effects. Finally, we present an overview of empirical economic papers that study the effects of norms on environmentally relevant behavior, as a particularly relevant area for the study of norms. The aim of this overview is to highlight which effects have been insufficiently studied and to give a sense of the potential of norms, which should help policymakers to intervene in a more targeted way to address existing environmental problems.

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## **Introduction**

The interest in norms and the desire to better understand them has increased greatly in recent years. This is particularly true for the analysis of environmental behavior, which appears to be strongly affected by norms, from decisions about how we eat, dress, or move around, to decisions about how we use energy or water, to decisions about how we deal with waste and things we no longer need.

While the concepts of norms vary across disciplines (Cialdini and Goldstein 2004; Young 2015), they often refer to a shared understanding in society about appropriate behaviors and wide participation in implementing and enforcing these behaviors. Norms exist in all human societies in various forms, contexts, and dimensions. Knowing how norms work and can be influenced provides policy makers with a powerful tool (Nyborg et al. 2016). In the environmental field, political processes are often accompanied or even enabled by changes in norms (Nyborg 2018). Climate change is a prominent example, where progress on international climate policy is limited and much activity takes place at the local and individual level.

In this paper, we compile theoretical and empirical literatures that interpret norms as a factor influencing human behavior, with a primary focus on environmental and prosocial behavior. To address the problem of different definitions in this literature, we begin with a new taxonomy that captures the key dimensions of norms and their conceivable combinations. We then elaborate a conceptual structure that presents causes for the effects of various types of norms on human behavior based on psychological theories. These theories have found their way into a variety of empirical studies, including the empirical economic literature on the measurement of norm effects, which we review in the last part of the paper. In this last part, we limit ourselves to environmental and prosocial behavior because this appears to be an area where people are increasingly looking out for and potentially influencing each other, and where there is a pressing need for policymakers to better understand how norms guide behavior. Our focus on norms as

a factor influencing behavior leaves out the theoretical literature in economics, game theory, and evolutionary biology typically treating norms as a description of equilibrium or steady-state behavior, which is excellently summarized in other overviews (e.g. Farrow, Grolleau, and Ibanez 2017; Nyborg 2018; Ehrlich and Levin 2005; Nowak and Sigmund 2005; Okada 2020).<sup>1</sup>

## **Taxonomy of norms**

The concepts of social norms and of norms in general are ambiguous and employed inconsistently within the literature. Several taxonomies have been developed in the social sciences to distinguish between the various forms, functions, and dimensions of norms (Farrow, Grolleau, and Ibanez 2017). Table 1 presents the taxonomy we use in this paper, which we have developed by merging, adjusting, and refining previous conceptualizations (Schwartz 1977; Schwartz and Howard 1982; Cialdini, Reno, and Kallgren 1990; Stern et al. 1999; Farrow, Grolleau, and Ibanez 2017; Nyborg 2018; Bicchieri and Dimant 2019).

We base our taxonomy on a broad definition of norms to include both injunctive and descriptive norms as two fundamentally different concepts that are used in the literature. We define a norm as the rule that characterizes a subset of all possible behaviors as either appropriate or normal. An ‘injunctive norm’ describes what is appropriate in a certain situation whereas a ‘descriptive norm’ describes what people actually do.

If the goal of studying norms is to understand their effects on behavior, we need to consider whose norm it is. Is it about an individual who finds a certain behavior appropriate or engages

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<sup>1</sup> Farrow, Grolleau, and Ibanez (2017) provide an overview of how norms have entered economics theoretically, picking up on topics such as self-image (e.g. Elster 1989), identity economics (e.g. Akerlof and Kranton 2000), normative expectations (e.g. Sugden 2000), or prosocial behavior (e.g. Bénabou and Tirole 2006). Nyborg (2018) explains how social norms are understood in game theory and evolutionary game theory (e.g. Young 1998, 2015, Nyborg and Rege 2003, Rege 2004). Nowak and Sigmund (2005) and Okada (2020) summarize theoretical work in evolutionary biology on norms as assessment rules in indirect reciprocity (e.g. Ohtsuki and Iwasa 2006) while Ehrlich and Levin (2005) cover norms as conventions from a cultural evolution perspective.

in it, or is it about a community that evaluates or exhibits behavior, or is it about a legislative authority that prescribes or prohibits behavior? Norms held by these different types of actors may closely interact and emerge from one another, yet keeping a conceptually clear distinction facilitates the study of norms and their effects on behavior.

To adapt one's behavior to norms, one must know or form beliefs about existing norms. People sometimes send misleading signals, misinterpret signals from others, have biased beliefs, or simply lack information about relevant others in the population. We therefore differentiate between a 'perceived norm,' which refers to an individual's subjective beliefs, and an 'objective norm,' which refers to actual behavior or attitudes. Although any information that individuals use to make decisions is ultimately subjective, it is useful to distinguish conceptually between perceptions that affect human behavior and objective facts.

Finally, compliance with existing norms crucially depends on whether and how a norm is enforced. We call purely internal motives such as satisfaction, inner peace, or avoidance of guilt 'personal enforcement.' Seeking social approval or avoiding social disapproval or sanctions is called 'social enforcement.' The third form is 'legal enforcement,' through state coercion, where individuals are subject to measures set by law if they deviate from a legal norm. These different enforcement mechanisms can occur separately or simultaneously, reinforcing or displacing each other, but again, conceptual separation is important for understanding the different effects.

While all four dimensions in our taxonomy shown in Table 1 can in principle be combined with each other, some dimensions are closely correlated or overlapping. For example, legal enforcement applies only to legal norms. The separation between the subject of the norm and its enforcement thus contains some redundancies, but it aids clear thinking about what characterizes and differentiates norms.

## **A conceptual structure on the causes of norm effects**

Figure 1 provides a graphical illustration of the various interactions between different types of norms and their influence on individuals' decision making. The aim of this figure is to show the most important channels of influence and to explain our current state of knowledge on the basis of theories from social, cognitive, developmental, and motivational psychology.

An individual's decision-making process is at the center of the illustration. This process is a result of a person's past experiences, knowledge, and situational circumstances expressed in terms of expectations about payoffs from the available behavioral options. The intentions that result from the individual and situation-specific weighing of expected payoffs are finally translated into actions (Fishbein and Ajzen 1981). Conceptually, it is useful to distinguish between an intention as an unobservable outcome of an internal cognitive process and an external behavior that is visible to the social world (Ajzen 1991). Intentions may not translate into actions, leading to an intention-behavior gap (Sheeran 2002). The action taken, together with actions of others, determines the individual's payoff. The payoff provides feedback information about the success of the own behavioral choice given the circumstances and gives rise to a learning process, in which a person changes and adapts her expectations, depending on how expedient they are in the given situation (Bandura 1999).

Let's first look at the connections between an individual's current behavior, shown in the center of the figure, and the individual's personal norms, shown on the left. The current individual behavior is added to the objective personal descriptive norm. The objective norm provides the basis for how the person perceives herself, which in turn influences her future behavior through strivings for self-consistency (Elliott 1986). The perception of own behavior also influences the personal injunctive norm. According to the self-perception theory (Bem 1967; Bem 1972) and

other consistency theories (Heider 1946; Festinger 1957), past behavior is evaluated in an internal post-hoc reasoning process and may be attributed to normative beliefs. This post-hoc process is more likely to happen if a person's behavior is associated with high payoffs. In other words, the more successful one's past behavior has been, the more likely it is judged as appropriate. The development of the personal injunctive norm is a complex process involving also other norms, which will be described further below. Once formed, it exerts a decisive influence on an individual's behavior as deviations from the personal injunctive norm create feelings of inner conflict, failure, guilt, or shame (Schwartz 1977; Schwartz and Howard 1981; Schwartz and Howard 1982).

Social norms are shown below and above the individual decision-making process in the figure. Individual behaviors, aggregated over time and people, constitute the objective social descriptive norm. Likewise, the aggregation of all individual attitudes over time and people forms the objective social injunctive norm (Cooter 1998; Carbonara, Parisi, and von Wangenheim 2008). Objective social norms are the bases for how individuals perceive social norms, but perceived social norms may deviate due to observation errors or motivated information seeking and reasoning (e.g. Johnston and Dark 1986; Kunda 1990). The perceived social descriptive norm affects individuals' decision-making through conformism and imitation (Schultz et al. 2007; Schultz, Khazian, and Zaleski 2008; Smith 2012). Observation of others provides clues as to what behavior is effective and adaptive, and thus encourages imitation (Cialdini, Reno, and Kallgren 1990). In addition to the tendency to follow others, observing others can also lead individuals to adjust their personal view of what is appropriate behavior (Miller and Dollard 1941; Bandura 2001).

Social injunctive norms influence people's behavior by changing their expectations of social responses to their behavior, such as sanctions, disapproval, or recognition (Elster 1989; Ajzen 1991; Sunstein 1996; Ellickson 2001; Schultz et al. 2007; Jacobson, Mortensen, and Cialdini

2011). They also play an important role in the development and change of personal injunctive norms. This process of norm internalization is a learning process in which the perceived social injunctive norms are integrated through moral cognition and reasoning (Kohlberg 1964; Piaget 1965[1932]; Kohlberg 1978; Hoffman 2000).

Because of the close link between personal injunctive norms and individual behavior, there is an equally close link between social injunctive norms and collective behavior. Behavior in a society is often used as an indicator of what is considered right and wrong in that society (Bicchieri 2005; Morris et al. 2015; Nyborg 2018). People's tendency to assign causes to behaviors, and see their environment as more controllable than it is, may lead them even to equate the perceived social descriptive norm with the perceived social injunctive norm (Heider 1958; Kelley 1967).

Legal norms are shown at the top of the figure. Their purpose is to increase or decrease the expected and actual payoffs associated with the available behavioral actions and to regulate individuals' behaviors. But they also have effects that go beyond that. According to the expressive law theory (Cooter 1998; Cooter 2000), a newly introduced law changes people's perceptions of social injunctive norms and thus also their personal injunctive norms independent of the altered payoffs (Tyler 1990; Tyler and Huo 2002). In addition, many people ascribe some normative power to the law and tend to adapt their personal injunctive norms to legal norms, just because they are legal (for a review see Larcom, Panzone, and Swanson 2019). These shifts at the individual level, due to altered payoffs and attitudes, then add up to shifts at the societal level and change the objective social descriptive and injunctive norms.

The conceptual structure in Figure 1 also provides guidance on where policy can intervene to influence behavior. We can distinguish between policies that *directly* target individual behavior (the blue box) and those measures that aim to affect (perceived) personal or social norms, and thus *indirectly* influence individual behavior. Policies that target behavior directly include price



regulation, command-and-control regulation, or adjustments of the choice architecture. All these measures affect individuals' expected payoffs by making environmentally harmful behavior more costly, less beneficial, or less convenient. Policies that influence behavior indirectly through manipulation of norms, which are called "active norm management" by Kinzig et al. (2013), include primarily the provision of information, for example about others' behavior or attitudes. Personal injunctive norms might be activated by making consumers aware of the circumstances under which a product was produced.

Of course, Figure 1 is more valuable to policy the better the interactions are empirically tested, which is the subject of the next chapter.

### **Empirical analyses of social and personal norms**

The literature on the empirical analysis of norms is growing rapidly, and it is virtually impossible to provide a comprehensive overview of it. We limit our review to studies which (i) address behaviors and norms that can be ranked in terms of environmental friendliness or prosociality, (ii) measure behaviors in ways that have consequences for oneself and/or other people and are not purely hypothetical, and (iii) use either randomized treatments or norms measured in an incentive-compatible manner to examine the effects of norms. In the case of field experiments, we further limit the selection to studies dealing with environmental behavior and the use of natural resources.

Table 2 provides an overview of the selected lab and field studies. It contains information on how the different types of norms are implemented, what the main results are, and how the studies are distributed across the different types of norms.

Objective social descriptive norms are implemented by giving subjects information about the behavior of others or having them observe the behavior of others directly. In the field experimental settings, subjects receive information on other people's energy conservation (Schultz et al. 2007; Allcott 2011), residential water usage (Ferraro, Miranda, and Price 2011; Tiefenbeck et al. 2013), towel reuse (Goldstein, Cialdini, and Griskevicius 2008; Reese, Loew, and Steffgen 2014), recycling or littering behavior (Reiter and Samuel 1980; Cialdini, Reno, and Kallgren 1990; Schultz 1999), use of public transport (Gravert and Olsson Collentine 2021), or food choice (Sparkman and Walton 2018; Einhorn 2020; Griesoph et al. 2021). The information can be provided in writing, for example as an enclosure to the energy or water bill or by manipulating the decision context. Studies of littering behaviors, for instance, vary the amount of litter already lying around to visualize the behavior of others (Reiter and Samuel 1980; Sagebiel et al. 2020). Participants in lab experiments directly observe or receive information about how other people behave in a variety of games, such as dictator games (Bicchieri and Xiao 2009; Krupka and Weber 2009), modified dictator games (Schram and Charness 2015; Goeschl et al. 2018), public goods games (Carpenter 2004; Dal Bó and Dal Bó 2014), ultimatum games (Bicchieri and Chavez 2010), or gift exchange games (Thöni and Gächter 2015).

In the case of objective social injunctive norms, studies use messages or smileys to inform subjects about what other people consider to be appropriate or important (Bicchieri and Xiao 2009), for example, whether saving energy is an important value (Bonan et al. 2020). Some of the techniques, such as smileys, convey not only social injunctive norms, but also, for example, a positive feeling triggered by the nice picture or the feeling of being rewarded or being better than others (Bhanot 2021). Alternatively, subjects are confronted with third party advice, which may refer to moral principles or appropriate behavior (Keizer, Lindenberg, and Steg 2008; Ferraro and Price 2013; Dal Bó and Dal Bó 2014; Schram and Charness 2015; Einhorn 2020).

For instance, Panzone et al. (2021a) investigate the reaction of online grocery shoppers when an online banner is shown noting the moral importance of reducing one's carbon footprint. Using lab experiments, Dal Bó and Dal Bó (2014) show how cooperative behavior and expectations in a public goods game change when subjects are told that, for moral reasons, one should treat others as one would like to be treated or maximize the benefit to all. Schram and Charness (2015) study behavior in a modified dictator game in which subjects receive advice on what they "ought" to do from a group of uninvolved participants.

Providing objective information about social norms changes the subjective beliefs and, through them, the behavior of individuals. However, most studies only measure the change in behavior and not the changed perceptions. It is also important to note that what subjects learn about objective social norms through information, observation, or advice relates to a fraction of the population, sometimes only individual members. Many studies deliberately leave it open to how many and which people the communicated behavior or attitudes refer to. This is partly for methodological reasons, when for example the communication of virtuous and harmful behavior is to be compared in different treatments. A systematic investigation of the reference group therefore is an important task for future research to study which persons are regarded as relevant and which weightings are made by the decision maker (Knight Lapinski and Rimal 2005).

Lab experiments have been used to elicit perceived social norms, using a focusing technique where subjects are asked to guess how others behave in the case of descriptive social norms, or what others consider to be appropriate in the case of injunctive social norms. Correct guesses are rewarded to provide an incentive to guess correctly and reveal the true beliefs (Krupka and Weber 2009; Bicchieri and Chavez 2010).

Objective personal descriptive norms are operationalized by providing subjects with information about their own past behavior, for example, their past energy consumption (Allcott

2011; Allcott and Rogers 2014; Andor et al. 2020) or recycling behavior (Schultz 1999). Schultz (1999), for example, finds that reminding subjects of their past recycling behavior leads them to behave more environmentally friendly than a control group that receives no information. This information about own past behavior is often provided in combination with information about what others do or find appropriate (Goldstein, Cialdini, and Griskevicius 2008; Allcott 2011). Although providing information about both own and others' behavior helps subjects to assess their own behavior (Bonan et al. 2020), it impedes a clean differentiation between norms. In the future, it might be useful to think about other ways of assessing own behavior that are not so much based on other people as on environmental necessities or hypothetical best-practice scenarios.

There are relatively few studies of personal injunctive norms (Kantola, Syme, and Campbell 1984; Panzone et al. 2021b). Panzone et al. (2021b) have subjects recall environmental protection measures they took in the past week before they are asked to go grocery shopping at an online supermarket. They find that remembering past environmentally friendly actions lead to more climate-friendly grocery purchases. Kantola, Syme, and Campbell (1984) observe that drawing consumers' attention to a contradiction between their previously measured attitudes toward electricity conservation and their actual high electricity consumption is more effective in inducing energy savings than merely informing them about their being high electricity consumers or giving them no information about consumption.

The studies presented in Table 2 show that subjects tend to adjust their behavior in the direction of the presented norm and behave more environmentally friendly or prosocially. In certain cases, however, prosocial behavior decreases, for example, when highly cooperative individuals adjust their behavior towards a less cooperative norm. Using social injunctive norms, in addition to social descriptive norms, reduces this 'boomerang effect' (Schultz et al. 2007). Some studies find that adaptation to selfish norms is stronger than to cooperative norms

(Thöni and Gächter 2015). Adaptation towards social descriptive and injunctive norms increases with the social proximity between decision makers and people who form the reference group (Dimant 2019; Bicchieri et al. 2022). Adaptation also increases when a punishment option is available (Dal Bó and Dal Bó 2014; Bicchieri, Dimant, and Xiao 2021) or when choices are made public (Schram and Charness 2015). Naturally, people differ in their inclinations to adapt towards the norm (Ayres, Raseman, and Shih 2013). For example, Costa and Kahn (2013) find that liberals and environmentalists react more strongly to home energy reports than conservatives.

Our review also shows that the effects of social norms depend on which environmental behavior is studied. Social norms appear to have robust effects on mostly private environmental behaviors that cannot be observed by outsiders, that can be adapted relatively easily, and that are usually associated with saving money, like energy or water consumption, waste avoidance or separation. However, when it comes to how we eat, dress, or get around, social norms do not seem to have robust effects. Unfortunately, these are areas for which there are only few studies that meet our selection criteria. The available evidence suggests that norms only have small or no effects in these areas. The studies on sustainable food consumption find no evidence that behavior does change much when people receive injunctive messages from third parties (Einhorn 2020; Panzone et al. 2021a). The findings for social descriptive norms are mixed; some studies find no effect (Einhorn 2020; Griesoph et al. 2021), while others show that specific ways of framing the descriptive norm can foster sustainable choices even when it refers to minority behavior (Demarque et al. 2015; Sparkman and Walton 2018). A study on public transport finds no evidence that informing potential new customers who have recently moved to the area that a majority of residents occasionally use public transport affects behavior (Gravert and Olsson Collentine 2021). Existing studies on sustainable clothing are largely based on self-reported consumption decisions or do not include a norm treatment which is why they

are not listed in Table 2 (Hustvedt and Bernard 2010; Kumar, Manrai, and Manrai 2017; Lin and Niu 2018; Kim and Seock 2019; Lo, Tsarenko, and Tojib 2019; Park and Lin 2020). The results are again mixed. For example, Hiller Connell and Kozar (2012) find that members of a sorority did not report making more sustainable clothing choices after having received injunctive messages about the implications of clothing for sustainability in general, human rights, or environmental protection. Frick et al. (2021) show that a sufficiency-promoting message by an online clothing store leads to more sustainable clothing decisions. However, a high number of likes and comments, signaling social endorsement of the message, does not seem to further increase the effect.

It has yet to be determined whether this difference in the effects of norms really exists between unobservable and observable environmental behavior, and if so, what factors are responsible. The unobservable environmental behavior that has been studied so far is relatively easy to adapt and mostly produces economic gains, which could facilitate the operation of norms. In contrast, changing the way one gets around, dresses, or eats often comes at a loss of utility. Another possible explanation is that people are less knowledgeable about unobservable behavior and the norms provided are more likely to contain new information. The norms regarding observable behaviors are more likely to already be factored into the respective decisions. In addition, the choices that are visible to the people around us are arguably harder to change because they are more relevant to our social identity. On the other hand, the visibility of behavior could mean that social norms, once they exist, are more easily enforced in these areas. The interplay of social and personal norms and of visibility and identity would certainly be worth exploring in more detail (Gromet et al. 2013).

### **Future research on norms**

Compared to the effects of norms on individual behavior, we still know little about how norms affect each other. Only few studies have examined how information about objective social norms affects individuals' perceptions of social norms (Bicchieri and Xiao 2009; Goeschl et al. 2018) or how social injunctive norms affect personal injunctive norms (Bertoldo and Castro 2016; d'Adda et al. 2020). The analysis of personal norms is generally more challenging than the analysis of social norms because we need different information about the same person; either how their behavior changes over time or how their views and behavior differ. The latter comparison may entail the problem that subjects may give socially desired answers. One solution might be to measure to what extent subjects intervene in the environmental or prosocial decisions of others with the assumption that interventions are made only when one's own personal injunctive norms have been violated (Fehr and Fischbacher 2003, 2004; Lieberman and Linke 2007). A perhaps more reliable method consists in the application of neuroscience to measure brain activity when subjects change their behavior after receiving norm messages (Falk et al. 2010), shift or refuse to shift their attitudes (Berns 2005; Yomogida 2017), or punish norm violators (de Quervain et al. 2004).

When and why people accept a norm as their own personal standard for appropriate behavior is probably one of the most important questions because only then can we assume that people will adapt their behavior and help to enforce the norm in society in the long term. Relatively little is known about how personal injunctive norms are constructed, and under what circumstances, in what ways, and how often they change. Research on whether the introduction or abolition of rules change people's views about appropriate behavior may serve as a stimulus. For example, plastic bag consumption in England was reduced after the introduction of a fee, not only because of the higher price, but also because of changes in consumer attitudes (Larcom, Panzone, and Swanson 2019). Voter turnout in Switzerland was influenced more by the abolition of the voting duty than by the possibility of postal voting, although the latter had a

much larger effect on the costs (Funk 2007). Lab experiments confirm that the introduction of rules and fees affect the willingness to cooperate and beliefs in others' cooperation, even when they do not eliminate the free-rider incentives (Tyran and Feld 2006; Galbiati and Vertova 2014; Romaniuc 2016; Dannenberg and Gallier 2020). The duration of the behavioral adjustment must also be taken into account. For example, a public library's reminder to return books on time had only a short-term effect on return behavior (Apesteguia, Funk, and Iriberry 2013). A better understanding of this black box of internalization processes will be key to changing environmental behaviors at sufficient scale for more sustainable development by providing social information and other interventions. Empirical research can help identify factors that will allow for better predictions of the effects of interventions, such as when an intervention will promote norm internalization and reinforce desired behavior, as observed for the reduction of plastic bags (Convery, McDonnell, and Ferreira 2007), or when it will do the opposite, as in the famous example of late pickups at the Haifa school (Gneezy and Rustichini 2000). They can also help determine what kind of interventions will spark consumer experimentation (Larcom, Rauch, and Willems 2017) and willingness to try new things not yet used by the masses.

It is also essential to examine the effects of norms when they are in conflict with each other. It has been found, for example, that perceived social descriptive norms dominate perceived social injunctive norms when they are in conflict with each other (Cialdini, Reno, and Kallgren 1990; Keizer, Lindenberg, and Steg 2008; Bicchieri and Xiao 2009). Social injunctive norms may be more influential when subjects must expect social reactions, such as approval or disapproval, while social descriptive norms may be more influential when such reactions do not occur or are not visible. Lab experiments dispose of a wide range of tools to investigate and compare different combinations of norms and contexts (Dal Bó and Dal Bó 2014; Schram and Charness 2015; Bicchieri, Dimant, and Xiao 2021).



Finally, the alignment of views and behavior through social norms can also have adverse effects, for example, when this happens within segregated groups in a polarized society (Stewart et al. 2019; Green et al. 2020; Druckman et al. 2021; Bühren and Dannenberg 2021; Vasconcelos et al. 2021). In the case of climate protection, or the fight against the corona pandemic, measures are sometimes taken or not taken for political or ideological reasons. These are telling examples of how the emergence of a social norm in one group can reduce the likelihood of the same norm emerging in other groups. A systematic investigation of social networks and reference groups, heterogeneity in norm adherence, the interactions between political elites and the public, and the role of the media and institutions remain important issues for future research on norms.

## **Conclusion**

A better understanding of how and under what circumstances norms influence environmental behavior is important not only for those studying human behavior but also for policymakers. When the effects of social norms are taken into account, stronger and sometimes different interventions are generally appropriate (Kinzig et al. 2013; Nyborg et al. 2016; Frank 2020). For example, a seemingly inefficient policy to promote the diffusion of low-emission cars can become efficient if one considers that a person's decision to buy a low-emission car also influences his or her friends' car choices in that direction (e.g. Ulph and Ulph 2021; Müller and von Wangenheim 2017). We hope that this paper will help identify research gaps in this important area and equip policymakers with better knowledge to take more targeted actions to influence environmental behavior.

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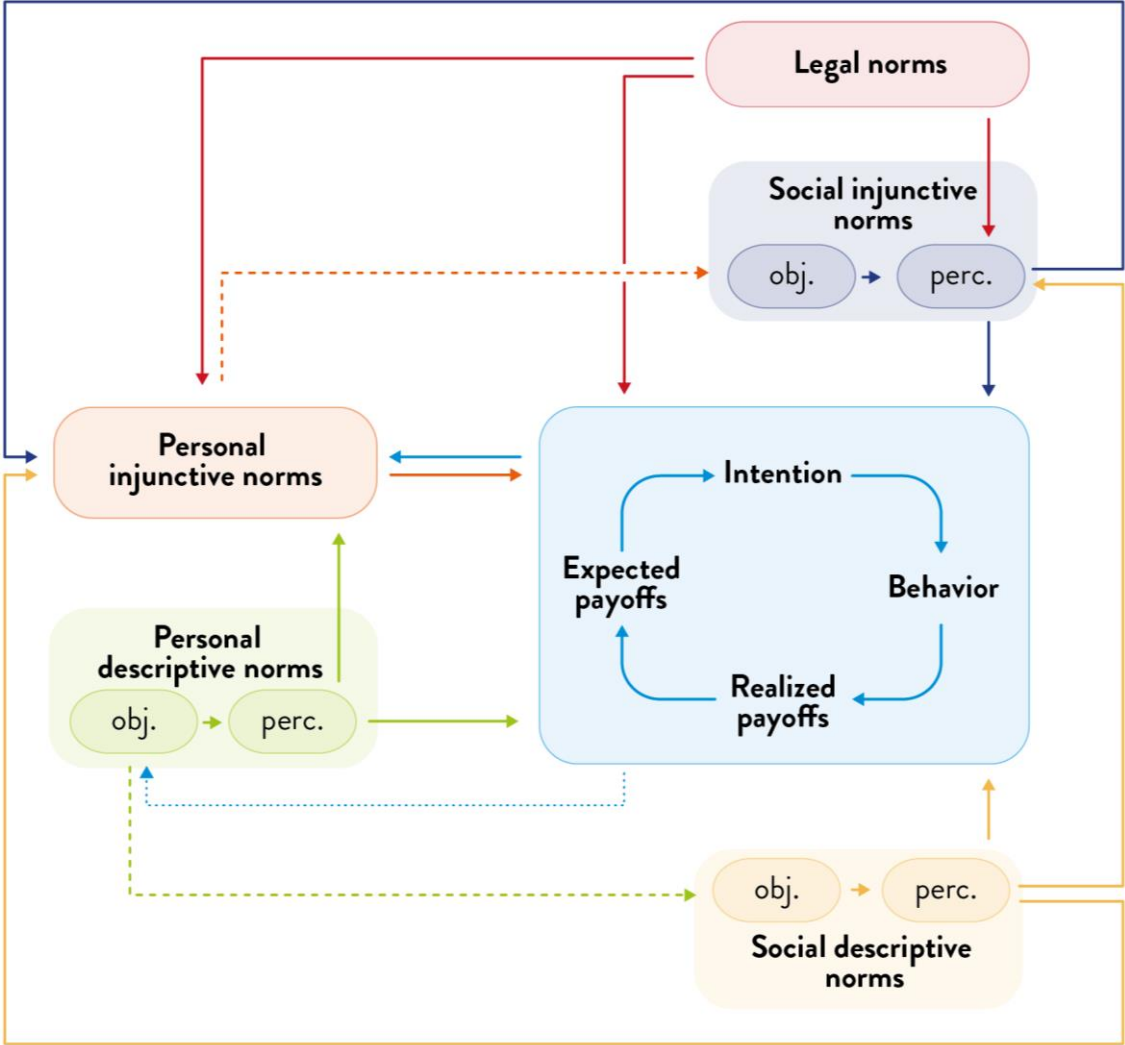
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Figure



**Figure 1. The effects of norms.** The figure shows a conceptual structure of norm influences. The arrows represent the influence of the source variable on the change of the targeted variable. The blue rectangle in the center right illustrates the basic decision-making process. All other rectangles refer to a specific type of norm. The personal descriptive, social descriptive, and social injunctive norms are differentiated between their objective and perceived components. This distinction does not apply to personal injunctive norms, which we assume to be inherently subjective. The figure captures how legal norms may exert influence on other norms but not how those other norms in turn affect legal norms, which is beyond the scope of this paper. A norm may influence decision-making, be influenced by it, or influence other norms. Each assumption concerning either of the three is depicted as a solid arrow. The objective components of norms are aggregations over time (dotted arrow) or individuals and time (dashed arrows).

## Tables

**Table 1. Taxonomy of norms.**

Dimension	Type of norm				
<b>Quality of the norm</b>	<i>Descriptive norm</i>		<i>Injunctive norm</i>		
	Perceivable situation-specific behavior aggregated over time and/or individuals		Situation-specific behavior that is seen as (in)appropriate		
	<i>Personal descriptive norm</i>	<i>Social descriptive norm</i>	<i>Personal injunctive norm</i>	<i>Social injunctive norm</i>	<i>Legal injunctive norm</i>
<b>Quality × Subject of the norm</b>	An individual regularly follows a behavioral pattern	A significant proportion of individuals regularly follows a behavioral pattern	An individual considers a behavior as (in)appropriate for him-/herself (self-oriented) and/or others (other-oriented)	A significant proportion of individuals considers a behavior as (in)appropriate for themselves (self-oriented) and/or others (other-oriented)	The legislator considers a behavior as (in)appropriate
<b>[Quality × Subject ×] Perspective on the norm</b>	<i>Objective</i>		<i>Perceived</i>		
	Actually prevalent norm		Subjective perception of a norm		
<b>[Quality × Subject × Perspective ×] Enforcement of the norm</b>	<i>Personally enforced</i>		<i>Socially enforced</i>		<i>Legally enforced</i>
	Internal feelings such as good or bad conscience		Social (dis)approval, social sanctions or rewards		Legal sanctions or rewards

**Table 2: Operationalization of norms in laboratory and field studies.**

Norm	Norm implementation	Main results	Laboratory studies	Field studies
Objective social descriptive norm	Subjects receive information about the past behavior of others	Subjects adapt their behavior and belief about others towards the norm  Previously cooperative people reduce their prosocial behavior (boomerang effect); previously non-cooperative people increase their prosocial behavior  Social proximity strengthens adaptation  Larger gap between own behavior and norm strengthens adaptation	Bicchieri and Xiao 2009; Krupka and Weber 2009; Raihani and McAuliffe 2014; Goeschl et al. 2018; Bicchieri and Dimant 2021	Goldstein, Cialdini, and Griskevicius 2008; Schultz, Khazian, and Zaleski 2008; Bohner and Schlüter 2014; Reese, Loew, and Steffgen 2014  Schultz et al. 2007; Nolan et al. 2008; Allcott 2011; Carrico and Riemer 2011; Peschiera and Taylor 2012; Ayres, Raseman, and Shih 2013; Costa and Kahn 2013; Delmas and Lessem 2014; Dolan and Metcalfe 2015; Schultz et al. 2015; Shen, Cui, and Fu 2015; Alberts et al. 2016; Anderson et al. 2017; De Dominicis et al. 2019; Andor et al. 2020; Bonan et al. 2020  Ferraro, Miranda, and Price 2011; Ferraro and Price 2013; Tiefenbeck et al. 2013; Bernedo, Ferraro, and Price 2014; Seyranian, Sinatra, and Polikoff 2015; Hahn et al. 2016; Sparkman and Walton 2017; Jaime Torres and Carlsson 2018; Bhanot 2021  Demarque et al. 2015; Sparkman and Walton 2017; Richter, Thøgersen, and Klöckner 2018; Einhorn 2020; Griesoph et al. 2021  Gravert and Olsson Collentine 2021  Schultz 1999
	Subjects observe the behavior of others	Subjects adapt their behavior towards the norm  Social proximity strengthens adaptation  Observing selfish behavior strengthen adaptation	Carpenter 2004; Thöni and Gächter 2015; Gächter, Gerhards, and Nosenzo 2017; Dimant 2019	Oceja and Berenguer 2009; Delmas and Lessem 2014  Sussman and Gifford 2013  Cialdini, Reno, and Kallgren 1990; Keizer, Lindenberg, and Steg 2008; Bator, Bryan, and Schultz 2011  Reese et al. 2013; Hamann et al. 2015
Perceived social descriptive norm	Subjects are asked to guess the behavior of others	Subjects adapt their behavior towards their guess about the descriptive norm	Krupka and Weber 2009	Griesoph et al. 2021
Objective social injunctive norm	Subjects get third party advice on appropriate behavior or moral principles	Subjects adapt their behavior towards the advice  Accompanying information about others' behavior strengthens the effect of the advice  Punishment option strengthens the effect of the advice	Dal Bó and Dal Bó 2014; Schram and Charness 2015	Schultz, Khazian, and Zaleski 2008; Bohner and Schlüter 2014  Nolan et al. 2008; Ito, Ida, and Tanaka 2018  Ferraro, Miranda, and Price 2011; Ferraro and Price 2013; Tiefenbeck et al. 2013; Bernedo, Ferraro, and Price 2014; Seyranian, Sinatra, and Polikoff 2015  Einhorn 2020; Panzone et al. 2021a  Sussman and Gifford 2013  Keizer, Lindenberg, and Steg 2008

				de Groot, Abrahamse, and Jones 2013; Kallbekken and Sælen 2013; Hamann et al. 2015; Jagau and Vyrastekova 2017; Stöckli, Dorn and Liechti 2018
	Subjects receive information about what others consider to be appropriate	Subjects adapt their behavior and belief about others' attitudes towards the norm	Bicchieri and Xiao 2009; Raihani and McAuliffe 2014; d'Adda et al. 2020; Bicchieri, Dimant, and Xiao 2021	Bonan et al. 2020 Linder, Lindahl, and Borgström 2018 de Groot, Abrahamse, and Jones 2013 Stöckli, Dorn and Liechti 2018
	Subjects receive information about how appropriate their behavior is by comparing it to the behavior of others	Subjects adapt their behavior towards the norm Combination of social injunctive and descriptive norm avoids the boomerang effect	-	Schultz, Khazian, and Zaleski 2008 Schultz et al. 2007; Oceja and Berenguer 2009; Allcott 2011; Ayres, Raseman, and Shih 2013; Costa and Kahn 2013; Handgraaf, van Lidth de Jeude, and Appelt 2013; Delmas and Lessem 2014; Dolan and Metcalfe 2015; Andor et al. 2020; Bonan et al. 2020 Jaime Torres and Carlsson 2018; Bhanot 2021
Perceived social injunctive norm	Subjects are asked to guess what others consider to be appropriate	Subjects adapt their behavior towards their guess about the injunctive norm	Krupka and Weber 2009; Bicchieri and Chavez 2010	-
Objective personal descriptive norm	Subjects receive information about their own past behavior	Information increases prosocial behavior Increase is larger for subjects with low baseline behavior	-	Kantola, Syme, and Campbell 1984; Schultz et al. 2007; Allcott 2011; Peschiera and Taylor 2012; Ayres, Raseman, and Shih 2013; Costa and Kahn 2013; Handgraaf, van Lidth de Jeude, and Appelt 2013; Delmas and Lessem 2014; Dolan and Metcalfe 2015; Schultz et al. 2015; Shen, Cui, and Fu 2015; Alberts et al. 2016; Anderson et al. 2017; Andor et al. 2020; Bonan et al. 2020 Ferraro, Miranda, and Price 2011; Ferraro and Price 2013; Tiefenbeck et al. 2013; Bernedo, Ferraro, and Price 2014; Seyranian, Sinatra, and Polikoff 2015; Hahn et al. 2016; Jaime Torres and Carlsson 2018; Bhanot 2021 Schultz 1999
Perceived personal descriptive norm	Subjects are asked to remember or report their own past behavior	-	-	Panzone et al. 2021b
Perceived personal injunctive norm	Subjects receive information about what they themselves considered to be appropriate in the past and how they actually behave	Subjects adapt their behavior if their previously stated personal injunctive norm is in conflict with their actual behavior	-	Kantola, Syme, and Campbell 1984

Note: Colors indicate the environmentally relevant behavior. Cyan: reuse; green: energy consumption; blue: water consumption; red: food choice; purple: transportation; gold: recycling; orange: littering; pink: waste avoidance.