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Psychology of Climate Change

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Abstract

Human behavior plays a critical role in causing global climate change as well as in responding to it. In this article, I review important insights on the psychology of climate change. I first discuss factors that affect the likelihood that individuals engage in a wide range of climate actions. Next, I review the processes through which values affect climate actions and reflect on how to motivate climate actions among people who do not strongly care about nature, the environment, and climate change. Then I explain that even people who may be motivated to engage in climate actions may not do so when they face major barriers to act. This implies that to promote wide-scale climate actions, broader system changes are needed. I discuss relevant factors that affect public support for system changes that facilitate and enable climate action. Finally, I summarize key lessons learned and identify important questions for future research.

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INTRODUCTION

Global climate change threatens the health, economic prospects, security, and basic food and water resources of billions of people and is therefore one of the most important threats the world is facing today (IPCC 2018, 2022a). The reality of climate change is already evident, as demonstrated in more extreme weather events such as heat waves, heavy downpours, flooding, and droughts that threaten human health, security, well-being, livelihood, food and water supply, infrastructure, and economic growth (IPCC 2018, 2022a). Over 150,000 deaths and 5 million disability-adjusted life years (DALYs) per year can be attributed to climate change, mainly in developing countries (Patz et al. 2005).

The negative impacts of climate change are expected to become more severe if global warming increases further (IPCC 2018, 2022a). Limiting the temperature increase to 1.5°C rather than 2°C would have important benefits for people and nature. These would include less extreme weather events, lower sea-level rise, lower impacts on biodiversity (e.g., warm-water corals, mangroves), lower impacts on food production as well as about 50% fewer people facing water shortages and several hundred million fewer people being exposed to climate-related risks and susceptible to poverty (IPCC 2018).

Human actions are estimated to have already increased global temperature by 1°C compared to preindustrial levels, with many regions (e.g., the Arctic) facing warming levels two to three times greater than the global averages (IPCC 2018, 2022a). This anthropogenic climate change is predominantly caused by emissions of CO_2 and methane due to combustion of fossil fuels (coal, oil,

gas), deforestation, and livestock farming (IPCC 2014). Many human actions would contribute to reducing climate change (i.e., climate mitigation actions; Clayton et al. 2015; Creutzig et al. 2018; Dietz et al. 2009, 2013; Grübler et al. 2018; Hackmann et al. 2014; IPCC 2022b; ISSC & UNESCO 2013; Stern et al. 2016; Vlek & Steg 2007; Wolske & Stern 2018). For example, people can use low-carbon energy sources and carriers (e.g., solar photovoltaics, heat pumps), adopt energy-efficient appliances and systems, implement home insulation, engage in energy-saving behaviors, purchase products that cause low greenhouse gas emissions during their production (e.g., animal-free products) and transport (e.g., local products), and engage in behavior supporting a circular economy (e.g., reducing waste, sharing products, refurbishing products) (IPCC 2022b). Next to changing consumption behavior, individuals can contribute to limiting climate change through citizen and organizational behavior—for example, by protesting (e.g., joining climate strikes); voting for political parties that have ambitious climate goals; influencing the policies and actions of organizations they belong to; and supporting technology, policy, and system changes aimed at reducing greenhouse gas emissions (Stern et al. 2016, Wolske & Stern 2018).

Substantial and consistent changes in a wide range of behaviors are needed to limit climate change to below 2°C (IPCC 2018, 2022b). Behaviors with a high mitigation potential would be particularly effective, including low-carbon transportation (e.g., flying less, driving less, shifting to electric vehicles), dietary changes (e.g., fewer animal products, less food waste), energy-saving refurbishments, and shifts to renewable energy sources (IPCC 2022b, Ivanova et al. 2020).

As we are already facing the negative consequences of climate change, people not only need to mitigate climate change but also have to adapt to it (IPCC 2022a). Governments all over the world are implementing measures to reduce the negative impacts of climate change. Yet, people would need to take climate adaptation actions as well to protect themselves from climate change risks, for example, by seeking information on how to adapt to climate change risks in their region, taking preparatory actions (e.g., having an emergency kit, wearing protective clothing), purchasing insurance, evacuating from areas prone to climate change hazards, and supporting policies and system changes that would reduce the negative impacts of climate change (Van Valkengoed & Steg 2019).

In this article, I review important insights on the psychology of climate change, focusing on climate change mitigation, which has been studied more extensively. I first discuss two factors that can motivate individuals to engage consistently in a wide range of climate actions: climate change beliefs and values. Second, I reflect on how to motivate climate actions among people who do not strongly care about nature, the environment, and climate change by emphasizing previous climate actions and by communicating the values, expectations, and actions of others. Third, I explain that people may not consistently engage in climate actions, even though they may be motivated to do so, because of lack of awareness and structural and systemic barriers for change. Fourth, I discuss factors that affect support for policy and system changes that aim to facilitate and encourage climate action. Finally, I briefly reflect on key lessons learned, implications of psychological research on climate change for other pressing societal problems, and important questions for future research.

UNDERSTANDING CLIMATE ACTION

Efforts to promote climate actions will be more effective if they address key antecedents of relevant actions and remove critical barriers for change. Hence, it is important to understand which factors influence climate actions. Given the wide scale of actions needed to effectively mitigate and adapt to climate change (Grübler et al. 2018; IPCC 2018, 2022a,b; Van Valkengoed & Steg 2019; Van Vuuren et al. 2018), it is particularly important to identify general antecedents

that affect the likelihood that people will engage in many different mitigation and adaptation behaviors, in different contexts, over and again (Steg 2018). Below, I review two relevant general antecedents: climate change beliefs and personal values.

Climate Change Beliefs and Climate Actions

A relevant general factor that motivates people to engage in various climate actions is the extent to which people believe in climate change. Three types of climate change beliefs have been distinguished: the extent to which people perceive climate change as real, the extent to which people believe climate change is human caused, and the extent to which people believe climate change has negative (rather than positive) consequences. Although the perceptions of the reality, causes, and consequences of climate change are conceptually different and reflect different stages of climate change denial that may affect climate actions differently (Rahmstorf 2004, Van Rensburg 2015), they are strongly positively related, indicating that if people believe climate change is real, they are also more likely to believe it is caused by human actions and has negative consequences (Van Valkengoed et al. 2021). In other words, it is not likely that people who perceive anthropogenic climate change as real believe it has positive consequences. In a similar vein, all three types of climate beliefs are equally strongly related to climate change mitigation and adaptation actions (Heath & Gifford 2006, Van Valkengoed et al. 2021). Specifically, people are more likely to (intend to) engage in climate change mitigation behavior and to support mitigation policy the more they believe climate change is real, is human caused, and has negative rather than positive consequences (Ding et al. 2011, Hornsey et al. 2016, Van Valkengoed et al. 2021). Similarly, people are more likely to take adaptive actions and support climate change adaptation policies when they more strongly perceive climate change as real, human caused, and threatening (Bateman & O'Connor 2016, Brink & Wamsler 2019, Mildenberger et al. 2019, Van Valkengoed et al. 2021). Climate change beliefs have been found to affect climate action indirectly: Stronger climate change perceptions increase the likelihood that people perceive specific climate hazards (such as flooding), and they strengthen feelings of personal responsibility and moral obligation to act, which in turn encourage climate actions (Albright & Crow 2019, Zawadzki et al. 2020).

Interestingly, people across the world generally believe strongly in the reality, anthropogenic origins, and negative consequences of climate change, as reflected in a growing concern about climate change (Capstick et al. 2015, Leiserowitz et al. 2021, Steg 2018). This may explain why efforts to increase climate change perceptions appeared to produce rather weak effects (Rode et al. 2021). These findings indicate that climate change denial is not widespread and that it is critical to understand why people do not persistently act in line with their strong climate change beliefs (Steg 2018).

Some have argued that adaptation behavior is likely to inhibit climate change mitigation behavior, as people may believe there is no longer a need to limit climate change if they can successfully adapt. Yet, it appears that mitigation and adaptation behaviors are positively related (Brügger et al. 2015, Niles et al. 2016). This may be because, as indicated above, stronger climate change beliefs promote both climate change mitigation and adaptation actions, probably because both actions share a common goal: to avoid the negative consequences of climate change.

Values and Climate Actions

Other general factors that are likely to affect a wide range of climate actions are personal values. Values reflect general desirable goals that transcend situations and serve as guiding principles in people's lives (Schwartz 1992). Values direct attention and affect the perceived importance and evaluation of different consequences of choice options (Feather 1995, Hitlin & Piliavin 2004,

Stern & Dietz 1994). Four types of values are most likely impacted by climate actions and are therefore most relevant to understand them (Dietz 2015, Steg & De Groot 2012). Two types of values make people focus on the personal consequences of choice options: hedonic values that imply that people strive to improve their feelings and reduce effort (e.g., pleasure, enjoying life), and egoistic values that imply that people strive to enhance their resources (e.g., wealth, social power). Two other types of values make people focus on the collective costs and benefits of choice options: Altruistic values make people focus on ways to increase the welfare of others and benefit society (e.g., equality, helpful), and biospheric values imply that people strive to enhance the quality of nature and the environment (e.g., protecting the environment, preventing pollution).

In general, people across the world endorse all four values to some extent. Yet, they prioritize these values differently, which affects their perceptions, preferences, and actions (Feather 1995, Steg et al. 2014a, Stern & Dietz 1994). For example, individuals with strong biospheric values, compared to individuals with strong egoistic values, are more likely to perceive climate change as real, human caused, and having negative consequences and to acknowledge that their actions contribute to it (Corner et al. 2014; De Groot & Steg 2007, 2008; Jansson et al. 2011; Nordlund & Garvill 2002; Steg et al. 2005; Stern et al. 1995). Furthermore, research among different populations in different cultures shows that strong hedonic and egoistic values oftentimes inhibit climate change mitigation actions and support for climate mitigation policy, as such actions often involve some personal costs (e.g., money, effort, inconvenience), at least in the short term (Honkanen & Verplanken 2004; Nordlund & Garvill 2002; Stern et al. 1995, 1998; see Dietz 2015 and Steg & De Groot 2012 for reviews). For example, people generally believe that traveling by car is more comfortable and takes less time than traveling by public transport (Steg 2005), and weatherproofing one's house is rather expensive and cumbersome, indicating that such actions can threaten hedonic and egoistic values. In contrast, strong altruistic, and particularly strong biospheric, values generally promote climate actions and support for climate policy in different parts of the world, as such actions obviously benefit others, nature, and the environment (Bouman et al. 2020b, Nordlund & Garvill 2002, Sharpe et al. 2021, Steg et al. 2014b, Taylor et al. 2014, Thøgersen & Ölander 2002; see Dietz 2015, Steg 2016, and Steg & De Groot 2012 for reviews). For example, the stronger individuals' biospheric values, the more likely they are to adopt residential solar photovoltaic systems, invest in energy efficiency and home insulation, save energy and hot water, drive less and use sustainable transport modes, and limit their meat consumption (Balcombe et al. 2013; Jakovcevic & Steg 2013; Kastner & Matthies 2016; Namazkhan et al. 2019, 2020; Nordlund & Garvill 2003; Schultz & Zelezny 1998; Ünal et al. 2019; Wolske et al. 2017; Zeiske et al. 2021). Stronger biospheric values promote such behaviors not only in the private sphere but also at work, including energy-saving behaviors and pro-environmental investment decisions (Ruepert et al. 2017, Zhang et al. 2013). Moreover, individuals with stronger biospheric values are more likely to support climate policies, vote for political parties that promise to implement climate policies, engage in environmental activism (such as protesting, signing petitions, and supporting environmental organizations), and boycott companies that pollute (Steg et al. 2005, 2011; Stern & Dietz 1994; Stern et al. 1995, 1999; Verplanken & Holland 2002). Interestingly, stronger biospheric values promote climate actions even among those who rather strongly endorse hedonic values as well (Tolppanen & Kang 2020), suggesting that biospheric values provide a strong motivational base for consistent climate actions.

The findings that strong biospheric values motivate individuals to consistently engage in a wide range of climate actions can explain why different types of climate actions tend to be positively related, including different types of behavior (Berger 1997, Bratt 1999, Gatersleben et al. 2002, Thøgersen & Ölander 2003, Whitmarsh & O'Neill 2010) and policy support (Brick & Lai 2018, Thøgersen & Noblet 2012). Similarly, a meta-analysis suggests that initial climate

actions generally promote subsequent climate actions (Maki et al. 2019), particularly when people engaged in the initial behavior for environmental reasons or when the environmental benefits of the actions are emphasized (Carrico et al. 2018; see also Peters et al. 2018). These findings suggest that people are likely to engage in many different climate actions as these actions result from the same underlying motivation to protect the environment, including biospheric values and climate change beliefs (see Brick & Lai 2018, Brügger & Höchli 2019, Sharpe et al. 2021, Thøgersen & Crompton 2009, Thøgersen & Ölander 2003).

HOW DO BIOSPHERIC VALUES INFLUENCE CLIMATE ACTIONS?

As values reflect general goals that people strive for in their life, they mostly affect behavior indirectly, via behavior-specific evaluations, beliefs, and norms (Dietz 2015, Steg 2016). Notably, people consider in particular the consequences of actions that have important implications for the values they prioritize (Steg 2016). For example, financial costs and benefits are especially important among those who strongly endorse egoistic values, whereas environmental consequences are particularly important to individuals with strong biospheric values (Collins et al. 2007, Perlaviciute & Steg 2015). Similarly, individuals with stronger biospheric values are more likely to consider the environmental consequences of available options when making choices (De Groot & Steg 2010, Schuitema & De Groot 2015, Steg et al. 2014b, Verplanken & Holland 2002), whereas individuals with strong hedonic values are more likely to consider the hedonic consequences of the options (e.g., by prioritizing their taste preferences), and individuals with strong altruistic values mostly consider the consequences of their choices for others (Steg et al. 2014b).

In a similar vein, people are less sensitive to the (higher) prices of sustainable products when their biospheric values are activated (Hahnel et al. 2014). Also, information about the environmental benefits of actions is most likely to strengthen pro-environmental intentions and policy support among those who strongly endorse biospheric values (Bolderdijk et al. 2013a, Boomsma & Steg 2014, Van den Broek et al. 2017), indicating that environmental information especially galvanizes climate actions when people are motivated to do something with the information, given their key values.

Further, values affect the perception of the consequences of options (Feather 1995). Interestingly, options that are expected to have positive consequences for individuals' important values tend to be evaluated as overly positive, also regarding consequences that seem less important for such core values, while options that are expected to have negative implications for individuals' important values tend to be evaluated overly negatively (Perlaviciute & Steg 2015). For example, individuals with stronger egoistic values not only evaluate the personal consequences of nuclear power more favorably (e.g., low costs, security of energy supply) but also more strongly believe that nuclear power benefits the environment (e.g., via reductions in CO_2 emissions). Yet, individuals with strong biospheric values evaluate nuclear power as more unsafe and do not believe that nuclear power has more environmental benefits compared to those with weak biospheric values (De Groot et al. 2013, Perlaviciute & Steg 2015). Similarly, individuals with stronger biospheric values not only evaluated low levels of street lighting as more acceptable but also reported feeling safer when lighting levels were lower after learning about the negative environmental impacts of street lighting (Boomsma & Steg 2014). Hence, people tend to believe that options that support the values they prioritize have many benefits, while options that threaten their values are expected to have mainly negative consequences.

The Value-Belief-Norm (VBN) theory of environmentalism (Stern 2000, Stern et al. 1999) further specifies how values affect behavior via behavior-specific beliefs and norms. Notably, similarly to the findings discussed above, VBN theory proposes that people with stronger biospheric and altruistic values (and weaker egoistic and hedonic values) are more likely to be aware of the

climate impact of their actions, which increases their likelihood of recognizing that their behavior would help to mitigate climate change. This in turn strengthens personal norms, reflecting feelings of responsibility and moral obligation to act on climate change, which motivate people to act accordingly. VBN theory has been successful in explaining a wide range of climate actions in different parts of the world, including intention to reduce car use, adoption of sustainable innovations, sustainable apparel consumption, environmental citizenship, willingness to sacrifice to mitigate climate change, and support for climate policies (Bronfman et al. 2015; Chen 2015; Gomes et al. 2022; Hiratsuka et al. 2018; Jakovcevic & Steg 2013; Jansson et al. 2010, 2011; Lind et al. 2015; Lopez-Mosquera & Sánchez 2012; Nordlund & Garvill 2003; Steg et al. 2005; Stern et al. 1999; Ünal et al. 2019; Wolske et al. 2017). These findings suggest that people with strong altruistic values, and particularly those with strong biospheric values, are more likely to be intrinsically motivated to engage in climate actions, as doing so is in line with what they find important. Intrinsically motivated people act without being coerced and without receiving external rewards for it, because acting in line with their values and doing good makes them feel good and yields intrinsic rewards (Pelletier et al. 1998; Taufik et al. 2015; Venhoeven et al. 2016, 2020). As intrinsic motivation comes from inside an individual, it is self-sustaining and long-lasting, making it a solid source of consistent climate actions (Osbaldiston & Sheldon 2003; Steg 2016; Van der Linden 2015, 2018).

Values, Emotions, and Climate Actions

Values affect behavior not only via behavior-specific cognitions but also via emotions. Specifically, emotions are likely to signal that important values are being threatened (resulting in negative emotions) or supported (resulting in positive emotions) (Bouman et al. 2020b, Brosch 2021, Brosch & Steg 2021, Perlaviciute et al. 2018), which motivates people to take actions to reduce the threat or pursue the benefits. Indeed, the stronger individuals' biospheric values are, the more they experience negative emotions toward climate change (such as worry), which in turn increases their feelings of responsibility to mitigate climate change, willingness to engage in climate actions, and support for climate policies (Bouman et al. 2020b, Brosch et al. 2014, Hahnel & Brosch 2018, Perlaviciute et al. 2018, Smith & Leiserowitz 2014, Wang et al. 2018). Similarly, refraining from climate actions may elicit negative emotions (e.g., guilt, shame, sadness), and anticipating such negative emotions can motivate climate actions such as using public transport, recycling (Carrus et al. 2008), purchasing pro-environmental products (Onwezen et al. 2013), and environmental citizenship behavior (e.g., demonstrating, signing a petition; Rees et al. 2015). More generally, climate actions supporting important values may elicit positive emotions, while climate actions that threaten people's key values may elicit negative emotions (Perlaviciute et al. 2018). In turn, such anticipated positive emotions are likely to promote (support for) climate actions, while anticipated negative emotions are likely to inhibit (support for) climate actions (Jia & Van der Linden 2020, Odou & Schill 2020, Perlaviciute et al. 2018). Indeed, the more people expect to feel good after engaging in recycling, the more likely they are to recycle (Geiger et al. 2019, Kraft et al. 2005), and the more individuals anticipate to feel good when conserving energy, the stronger their intention is to reduce their energy consumption (Taufik et al. 2016). Notably, climate actions may elicit positive feelings not only because they are pleasurable but also because they are meaningful, virtuous, and morally right (Jia & Van der Linden 2020; Kashima et al. 2014; Taufik et al. 2015; Van der Linden 2018; Venhoeven et al. 2013, 2016, 2020). This indicates that climate actions may be intrinsically rewarding when they satiate important values and make people feel they are doing something meaningful (i.e., eudaimonia; Venhoeven et al. 2016). Indeed, review studies and meta-analyses suggest that climate actions elicit positive feelings and can enhance individual well-being (Creutzig et al. 2022, Johnson Zawadzki et al. 2020).

WHAT IF BIOSPHERIC VALUES ARE NOT PRIORITIZED?

People across the world generally endorse biospheric values rather strongly (Bouman & Steg 2019, De Groot et al. 2012, Hanel et al. 2018, Hiratsuka et al. 2018, Jakovcevic & Steg 2013, Sargisson et al. 2020, Steg 2016, Ünal et al. 2019), which implies there is a strong value basis for consistent climate actions. Yet, not all people prioritize biospheric values, and biospheric values may not always play a central role in the decisions people make. So an important question is, how can we motivate people to consistently engage in climate actions when biospheric values are not prioritized or not likely to play a decisive role in the choices they make? Below, I review four ways to motivate the less motivated to act on climate change: strengthening biospheric values, emphasizing one's previous climate actions, emphasizing the extent to which others endorse biospheric values, and changing the social costs and benefits of climate actions.

Strengthening Biospheric Values

A first strategy to motivate the less motivated would be to try to strengthen biospheric values, so they are more likely to be prioritized and to steer the decisions people make. It is generally believed that values have their source in basic human needs and societal demands (Feather 1995) and that they are formed in childhood, on the basis of personal experiences and the cultures individuals are intertwined in (Hitlin & Piliavin 2004). Once values are formed, they are relatively stable across time (Feather 1995, Thøgersen & Ölander 2002), as people hardly think about their values in depth and thus generally do not challenge them; values act as truisms (Maio & Olson 1998). Moreover, individuals tend to interpret events to fit their values (Bardi & Goodwin 2011), making values relatively resistant to change.

However, some studies suggest that the strength of values can change when people encounter situations that challenge their values, thereby reducing their truism status (Hansen et al. 2014, Lönnqvist et al. 2011, Sheldon 2005; see Bardi & Goodwin 2011 for a review). For example, communication with members of a new group may cause individuals to reflect on their own values and to change them in line with the values of the new group that they identify with. Furthermore, the strength of values may change when people become aware that their values are not in line with how they see themselves and realize that they apparently hold values to a different degree than they previously thought. Moreover, some values may no longer be adaptive when people have experienced important life changes, making them downgrade the values they cannot pursue in the new situation and more strongly endorse the values that are supported in the new situation. Further, scientific discourses, education programs, and public debates may make people aware that their current way of life is threatened, which may make them downgrade values that underlie actions that cause these problems and more strongly endorse values that promote actions that reduce these problems. For example, public debates may enhance individuals' awareness that climate change threatens their current way of life and well-being. As a consequence, they may more strongly endorse biospheric values that promote actions to reduce the threats of climate change and downgrade the importance of hedonic and egoistic values that encourage practices that cause climate change (Lindenberg & Steg 2013). However, empirical evidence on the extent to which these different factors and processes affect the strength of different values, and on how stable and long-lasting potential value changes are, is limited; future research is needed to systematically test these accounts.

Emphasize Previous Climate Actions

Biospheric values can affect climate actions via environmental self-identity: The stronger individuals' biospheric values are, the more likely they are to see themselves as pro-environmental and to engage in a wide range of climate actions (Gatersleben et al. 2014; Ruepert et al. 2016; Van der

Werff et al. 2013a, 2014b). Indeed, a stronger environmental self-identity appeared to promote a wide range of climate actions (Barbarossa et al. 2017; Cornelissen et al. 2008; Gatersleben et al. 2014; Kashima et al. 2014; Lacasse 2015, 2016; Loebnitz et al. 2015; Peters et al. 2018; Ruepert et al. 2016; Van der Werff et al. 2013a,b, 2014a,b; Whitmarsh & O'Neill 2010). Yet, environmental self-identity not only depends on the extent to which people endorse biospheric values but also is strengthened when people recognize they engaged in climate actions, while environmental self-identity is weakened when people realize they engaged in actions that cause climate change (Van der Werff et al. 2014b). These findings are in line with self-perception theory, which proposes that people derive their self-image from observing their previous actions (Bem 1972). Previous climate actions particularly strengthen environmental self-identity when these actions more clearly signal that one is a pro-environmental person—that is, when the actions were voluntarily chosen, relatively costly, and uncommon—and when people engage in the actions for environmental reasons (Cornelissen et al. 2008, Peters et al. 2018, Van der Werff et al. 2014a; see also Burger & Caldwell 2003). In contrast, positive changes in environmental self-identity are inhibited when climate actions can be attributed to external factors, for example, when people are paid for them or when they act out of situational constraints (Burger & Caldwell 2003, Venhoeven et al. 2016).

These findings suggest that climate actions can be promoted by reminding individuals of their previous climate actions, as this is likely to strengthen their environmental self-identity. People are motivated to be consistent and act in line with the way they see themselves (Gatersleben et al. 2014, Van der Werff et al. 2014b), and doing so makes them feel good about themselves (Venhoeven et al. 2016). This may also explain why interventions that capitalize on individuals' motivation to be consistent promote climate actions (see Steg 2016 for a review). For example, commitment strategies, whereby people pledge to engage in climate actions, and implementation intentions, whereby individuals additionally indicate how and when they will perform the relevant actions and how they will cope with any obstacles, motivate people to keep their promises and act accordingly (Abrahamse & Steg 2013; Bamberg 2000, 2002; Lokhorst et al. 2013).

Perceived Biospheric Values of Others

As indicated earlier, people across the world generally endorse biospheric values quite strongly. Yet, people seem to underestimate the extent to which others endorse biospheric values (Bouman & Steg 2019, Bouman et al. 2020a, Hanel et al. 2018, Sanderson et al. 2019, Wang et al. 2021), and the strength of others' pro-climate beliefs (Mildenberger & Tingley 2019). These results may hint to a selfless-self bias, that is, the tendency to see oneself as more prosocial and pro-environmental than average. However, people seem to overestimate the extent to which their fellow group members endorse biospheric values when they compare themselves with members of an ingroup that is prototypically seen as pro-environmental. For example, liberals in the United States generally believe that other liberals more strongly endorse biospheric values than they do (Bouman et al. 2020a). These findings suggest that perceptions of group values and the climate beliefs of one's group members are based on existing stereotypes about the relevant group rather than on a selfless-self bias.

Underestimating the extent to which others endorse biospheric values can inhibit climate actions (Bouman et al. 2021b), as people are motivated to act in line with what the groups they belong to find important, and they may assume that others would disapprove of climate actions. Also, people may feel less responsible to act or may feel that their individual actions would be inefficacious to limit climate change when they believe others do not care and act as they do (Bouman & Steg 2019, Bouman et al. 2021b). Yet, on a positive note, these findings imply that people are more likely to engage in climate actions when they believe other group members strongly endorse biospheric values and engage in climate actions. This indeed seems to be the case (Wang

et al. 2021), particularly when members strongly identify with the relevant group and when they do not strongly endorse biospheric values themselves (Bouman et al. 2020a). These findings suggest that communicating that most other group members have strong climate change beliefs, strongly care about nature and the environment (as is consistently shown in research), and act accordingly can promote climate actions, particularly among those who are not strongly motivated themselves. There is indeed some initial evidence suggesting that people are more likely to engage in and support climate actions when they learn about the extent to which others believe in climate change (Mildenberger & Tingley 2019). Yet, future research is needed to test how to best communicate that others generally have strong biospheric values, hold strong climate beliefs, and engage in various climate actions and to determine when such communication is most effective to promote society-wide climate actions.

More generally, individuals are likely to internalize the goals of the groups they belong to, particularly when they strongly identify with the group, which motivates them to act in line with the group goals (Fielding & Hornsey 2016, Jans 2021, Jans & Fielding 2019, Turner 1991). This implies that individual climate actions can be promoted when people join groups that care about nature, the environment, and climate change. Different groups may be relevant in this respect, including community groups, organizations, and political parties and their leaders.

Indeed, involvement in community energy initiatives encourages sustainable behavior (Biddau et al. 2016, Middlemiss 2011) and provides an additional motivation to engage in climate actions to individuals, even when controlling for individuals' pro-environmental motivations (Sloot et al. 2018). Involvement in community energy initiatives may have broader impacts, as it can motivate individuals to also engage in other behaviors that benefit the environment and the community, such as environmental citizenship behaviors (e.g., donating to an environmental organization) and social activities (Sloot et al. 2018). Interestingly, community energy initiatives are also likely to attract people who are not strongly motivated to engage in climate actions themselves, as people may become involved in such initiatives not only because they care about the environment but also because they are motivated to meet and interact with others in their community (Sloot et al. 2019). These findings suggest that community energy initiatives can motivate climate actions among those who do not strongly care about the environment themselves.

Next, perceptions of organizational environmental values can impact climate actions. Specifically, corporate environmental responsibility, reflecting the extent to which organizations strive to reduce their environmental impact and implement policies to achieve this ambition, can promote climate actions among their employees as well as customers (Ruepert et al. 2017, Sharpe et al. 2022, Van der Werff et al. 2021, Zhang et al. 2013). Interestingly, corporate environmental responsibility seems to enhance employees' intrinsic motivation to engage in climate actions rather than extrinsically motivating them to act in line with prevalent social (i.e., organizational) norms (Sharpe et al. 2022). Specifically, the more employees believe that their organization is committed to corporate environmental responsibility, the more they feel personally responsible and committed to act, which in turn promotes climate actions (Sharpe et al. 2022). Interestingly, perceived corporate environmental responsibility appears to promote climate actions at work especially when employees that do not strongly endorse biospheric values themselves (Ruepert et al. 2017). Together, these findings suggest that organizational environmental goals can motivate climate actions among employees who are not strongly motivated to protect the environment, as they are likely to adopt the organizational goals as their own goals, thereby enhancing their intrinsic motivation to engage in climate actions. These findings are particularly promising as many organizations have explicated environmental goals in their mission statements and profile themselves as environmentally responsible (Flammer 2013, Ruepert et al. 2017), which may promote climate actions among their employees and clients.

Furthermore, individual climate actions can be affected by perceptions of the extent to which political parties and their leaders care about nature, the environment, and climate change. For example, political elite cues (such as press releases by political parties, roll call votes on climate change bills, and hearings on climate change) can affect public climate concerns. Specifically, pro-climate action statements of Democrats increased public climate concerns, whereas anti-climate voting by Republicans reduced them (Brulle et al. 2012). Similarly, in the European Union, climate change is perceived as more threatening, and people are more likely to engage in climate actions, if political party elites are united rather than divided in supporting environmental issues (Sohlberg 2017). Also, greenhouse gas emissions in both the United States and Europe are lower when legislators have strong environmental records (Dietz et al. 2015, Jensen & Spoon 2011). Moreover, similar to what was described above, the more strongly citizens believe that their government aims to reduce environmental problems, the more strongly they see themselves as pro-environmental, which in turn promotes support for climate policies (Van der Werff et al. 2021), suggesting that citizens may internalize the pro-environmental goals of their government.

Interestingly, the election in the United States of Donald Trump, known to be a climate skeptic political leader, seems to have polarized public beliefs: Trump supporters reported weaker climate change beliefs after the election, while his opponents reported stronger climate change beliefs than before (Zawadzki et al. 2020). After Trump was elected, climate change beliefs were particularly likely to weaken as emotions toward the Republican party became more positive, suggesting that emotions drive the influence of political leaders on partisans' beliefs (Hahnel et al. 2020). These findings suggest that political group identity affects how political leaders influence climate change perceptions and actions (Hahnel & Brosch 2016).

Social Costs and Benefits

People consider not only the individual and environmental costs and benefits of climate actions but also their social costs and benefits (Farrow et al. 2017), although they do not always seem to recognize this (Nolan et al. 2008, Noppers et al. 2014). Indeed, people are more likely to engage in climate actions when they think others expect them to do so (Barth et al. 2016, Harland et al. 1999, Kastner & Stern 2015), particularly when they strongly identify with the group (Bamberg et al. 2015). People are motivated to act in line with such injunctive norms to gain social approval and avoid social sanctions (Cialdini et al. 1990). These findings suggest that climate actions can be encouraged by strengthening injunctive norms to act.

Moreover, people are more likely to engage in climate actions the more they believe or expect that others will act as well (i.e., through strong descriptive norms or peer effects; Noppers et al. 2019, Rai et al. 2016), particularly when they do not have strong attitudes about the behavior (Wolske et al. 2020). Descriptive norms affect choices as they signal what actions are likely to be adaptive and effective (Cialdini et al. 1990). It seems that people generally think that others act less pro-environmentally than they do (Bergquist 2020, Levinston & Uren 2020), which can inhibit climate actions (Bergquist 2020). Hence, it could be important to inform people that many others do engage in climate actions. Such descriptive norm information can indeed promote climate actions (Allcott 2011; Nolan et al. 2008; Schultz et al. 2007, 2015), although the effect size is small (Abrahamse & Steg 2013). When climate actions are not common yet, the descriptive norm is likely to inhibit wide-scale engagement, as people may assume it is not adaptive to do so. Yet in such cases climate actions can be promoted by emphasizing that more and more people are starting to adopt the behavior, which can encourage climate actions among those with a relatively weak intrinsic motivation to act (Carfora et al. 2022). Such dynamic or trending norms indicate that the behavior is increasingly seen as important and as a sensible thing to do (Bolderdijk & Jans 2021, Mortensen et al. 2019, Sparkman & Walton 2017, Sparkman et al. 2020), and they

can enhance self-efficacy by showing that the behavior is feasible as well as strengthen injunctive norms indicating that the behavior is important to others (Sparkman & Walton 2019).

Additionally, talking with peers can promote climate actions by raising awareness of new options and reducing uncertainties about the feasibility and the pros and cons of climate actions (Palm 2017, Wolske et al. 2020). Moreover, it can facilitate observational learning (Wolske et al. 2020), and peers can provide social support (Wolske et al. 2017). Indeed, group-based behavior-change approaches seem to encourage sustained climate actions because they offer a sense of mutual learning and support (Hargreaves et al. 2008, Staats et al. 2004).

Furthermore, people are more likely to engage in climate actions when they think this would signal something positive about them to self or others (Griskevicius et al. 2010; Kastner & Stern 2015; Milinski et al. 2006; Noppers et al. 2014, 2016; Rezvani et al. 2015; Schuitema et al. 2013; Stoll-Kleemann & Schmidt 2017; White & Sintov 2017). Interestingly, symbolic factors seem to promote the adoption of sustainable innovations particularly when people believe these innovations have some disadvantages (Noppers et al. 2015) and when they expect only few others would adopt them (Noppers et al. 2019), possibly because this enhances the signaling function of the relevant action. These findings suggest that symbolic factors can play an important role in promoting climate actions in early adoption phases, when innovations generally still have some drawbacks.

In sum, various social factors affect climate actions, including perceptions of group values, social norms, social support, and symbolic factors. Future research is needed to examine whether such social factors could promote climate actions among those who do not strongly care about nature, the environment, and climate change, like group values seem to do, and whether this can be another route to motivate the less motivated.

WHY DO PEOPLE NOT ALWAYS ACT UPON THEIR BIOSPHERIC VALUES?

Even people with strong biospheric values may not consistently act upon these values and refrain from taking climate actions in some situations. Below, I discuss three reasons people may not always act in line with their biospheric values: lack of awareness that relevant actions contribute to (mitigating) climate change, values not being salient in a given situation, and high behavioral costs.

Awareness of Climate Impact of Actions

First, as explained above, values oftentimes affect behavior indirectly, via behavior-specific beliefs and norms. Such behavior-specific beliefs and norms may affect the likelihood that people act upon their biospheric values. For example, even people with strong biospheric values may not be aware of the climate impact of specific actions, in which case biospheric values would not be related to individuals' awareness of these consequences, as proposed by VBN theory. For example, many people are not aware of the climate impacts of meat consumption (Abrahamse 2019, Macdiarmid et al. 2016), which may explain why biospheric values are not strongly related to meat consumption (Abrahamse et al. 2009a). Similarly, many people are not aware of the amount of energy used to produce, transport, and dispose of goods and to deliver services (Abrahamse et al. 2007), which may explain why biospheric values, environmental beliefs, and personal norms are only weakly related to such embodied energy use (Abrahamse & Steg 2009). This is particularly important as embodied energy use constitutes about half of total household energy use (Kok et al. 2006, Reinders et al. 2003).

These findings suggest that it is important to ensure that people be aware of the climate impacts of actions, including life-cycle impacts of goods and services, as to empower them to act upon

their biospheric values. Indeed, providing energy feedback proved effective in encouraging energy savings within households (Delmas et al. 2013, Karlin et al. 2015) and at work (Young et al. 2015), particularly when provided in real time or immediately after the action (Abrahamse et al. 2005, Delmas et al. 2013, Tiefenbeck et al. 2016).

Similarly, emphasizing the environmental benefits of particular actions promotes such actions (Asensio & Delmas 2015, Bolderdijk et al. 2013b, Graham & Abrahamse 2017, Schwartz et al. 2015), also in the long term (Asensio & Delmas 2016). In fact, these studies suggest that environmental appeals can be more effective than financial appeals, suggesting that people are more strongly motivated to pursue environmental benefits than financial gains. One reason for this finding, which is counterintuitive to many people, is that pursuing environmental benefits is believed to be more worth the effort than pursuing financial benefits (Dogan et al. 2014). The latter is probably the case because pursuing environmental benefits makes people feel good as it satiates biospheric values (which are important to many people) and makes them feel they are doing something meaningful, as explained earlier.

Yet, although knowledge is important when people do not know which actions would support or threaten their biospheric values, it is not sufficient to encourage climate actions when people are not motivated to act. Indeed, motivational factors such as values are generally more strongly related to climate actions than knowledge is (Ünal et al. 2018).

Salience of Biospheric Values

Second, biospheric values may not always be salient in a given choice context, making it less likely that they will affect the decisions people make. Indeed, people with relatively strong biospheric values are more likely to engage in value-congruent behavior when these values are activated (Maio 2010, Steg et al. 2014a, Verplanken & Holland 2002). Interestingly, when having to choose between pro-environmental and prosocial options, individuals with stronger biospheric values are more likely to act pro-environmentally when their biospheric values are activated, and those with relatively weaker biospheric values are less likely to act pro-environmentally when their biospheric values are activated, compared to a control group (Conte et al. 2021). Similarly, encouraging people to reflect upon the implications of information on the negative impact of meat consumption, compared to only providing information, resulted in lower reductions in meat consumption among people with relatively weak biospheric values (Zeiske 2021). These findings suggest that activating biospheric values may have detrimental effects among those who do not strongly endorse these values, probably because it makes them realize they do not care about nature and the environment that much.

High Behavioral Costs Due to Structural Factors

Behavior is influenced not only by motivational factors, such as values, environmental and climate concerns, and personal norms, but also by structural factors such as the availability of technologies, products, and infrastructures; price regimes; institutions; and laws and regulations. Such structural factors define the costs and benefits of choice options, which can have major implications for how attractive and feasible it is to engage in climate actions. Indeed, the availability of good recycling facilities promotes recycling (Geiger et al. 2019), long journey time and the high costs of alternative travel modes may prevent people to refrain from flying (McDonald et al. 2015), and high investment costs may inhibit people from investing in low-carbon technologies. On the other hand, offering free public transport tickets can promote public transport use (Fujii et al. 2001, Hunecke et al. 2001, Thøgersen 2009), and providing subsidies can promote investments in sustainable innovations such as heat pumps and solar thermal heating (Kastner & Stern 2015).

People are less likely to act upon their biospheric values when climate actions are associated with substantial costs (e.g., effort, time, money, inconvenience), as in such cases, acting in line with one's biospheric values would conflict with hedonic and egoistic values that are generally also important to people (Bouman & Steg 2019, Steg 2016). Indeed, biospheric values and related factors such as environmental concern and personal norms seem less strongly related to climate actions that are associated with significant costs or constraints on behavior, such as reducing energy use (Abrahamse & Steg 2011), reducing car use (Bamberg & Schmidt 2003, Diekmann & Preisendörfer 2003, Steg et al. 2014a), and reducing flying (Alcock et al. 2017), compared to less costly actions, such as eco driving (Ünal et al. 2018), recycling (Diekmann & Preisendörfer 2003, Geiger et al. 2019), and adopting environmental citizenship (e.g., signing a petition, supporting environmental organizations; Gärling et al. 2003, Stern et al. 1999). These findings are in line with the low-cost hypothesis that postulates that when the costs of actions are relatively high, individuals tend to prioritize avoiding costs over their desire to act on their biospheric values and personal norms (Diekmann & Preisendörfer 2003). Yet, the A-B-C (attitude-behavior-conditions) model (Guagnano et al. 1995, Stern & Oskamp 1987) proposes an inverted U-shaped relationship between such motivational factors and behavior, with the relationship being strongest when the behavioral costs are moderate. Specifically, the A-B-C model postulates that motivational factors such as biospheric values, climate change beliefs, environmental concerns, and personal norms may also be weakly related to climate actions when the personal costs of actions are very low, as in such cases, anyone will be likely to act, irrespective of the strength of their motivation. Indeed, feelings of personal responsibility to recycle particularly predicted recycling when recycling facilities were relatively poor compared to when good facilities were present (Guagnano et al. 1995; see also Geiger 2020). Similarly, personal norms were less predictive of support for policies that facilitated climate actions (and thus involved no costs) compared to policies that inhibited environmentally harmful actions (Keizer et al. 2019), and the relationship between personal norms and intentions to reduce car use was weaker the easier individuals found it to drive less (Abrahamse et al. 2009b). These findings suggest that motivational factors like biospheric values are most strongly related to climate actions that are associated with moderate (rather than no or high) costs.

Structural factors can typically not be changed by individuals but are rather shaped by the choices and actions of a wide variety of other actors, including governments, industry, businesses, trade organizations, and NGOs. This implies that to promote wide-scale climate actions, broader changes in policies, organizations, institutions, and political systems (in short, system changes) are needed in order to remove barriers that inhibit climate actions and create conditions that enable them (see IPCC 2018). Such system changes can empower individuals to act upon the values they deem important in their life by increasing the feasibility and attractiveness of climate actions. Additionally, system changes may signal that others care about climate change and the environment, which can encourage people to engage in climate actions (Bouman & Steg 2019; see the section titled Perceived Biospheric Values of Others). Moreover, system changes (including climate policies) may change social norms [i.e., perceptions of which behavior is generally (dis)approved and perceived to be important; Eisner et al. 2021, Kinzig et al. 2013] and reassure people that others will engage in climate actions as well, making their own climate actions seem more useful. Further, system changes can make people feel that their efforts to mitigate climate change are recognized, thereby serving as a complement rather than a substitute of individuals' intrinsic motivation, which can support consistent climate actions (Koessler & Engel 2021). In contrast, system changes that facilitate climate actions may be counter-effective when people perceive that they are merely compensated for their efforts. For example, financial incentives can crowd out intrinsic motivation to

engage in climate actions (Falk & Szech 2013, Frey 1997), give people the impression that they have a license to pollute when they pay for it (see Gneezy & Rustichini 2000), and make people less attentive to the environmental benefits of actions (Schwartz et al. 2015). These findings suggest that the effects of system changes depend on how such changes are perceived and interpreted (see also Kopelman et al. 2002, Weber 2018), and that it is critical that system changes be framed and understood as supporting rather than forcing or offering compensation for climate actions. Future research is needed to understand to what extent, how, and when system changes are likely to encourage wide-scale climate actions.

A next important issue is what motivates decision makers to initiate and implement system changes that would facilitate and support individuals' climate actions. Relatively little is known about what motivates and enables industrial and commercial organizations, governmental agencies, and NGOs to act on climate change (Rickards et al. 2014, Steg et al. 2021, Stern et al. 2016). Yet, it seems likely that climate actions within organizations and companies are affected by similar factors as climate actions by individuals (Ruepert et al. 2015), as decisions are ultimately made by individuals, although in a different role. Indeed, climate actions at work are more likely when employees evaluate the relevant actions more positively (reflecting positive attitudes; Flannery & May 2000), when workers are more aware of the negative environmental impact of their actions (Gadenne et al. 2009), and when they have a stronger personal norm to act sustainably (Scherbaum et al. 2008). Moreover, the stronger employees' biospheric values are, the more strongly they believe that their organization aims to reduce its environmental impact and has implemented policies to do so, and the more likely they are to make sustainable investment choices (Ruepert et al. 2017). Interestingly, it appears that the environmental and financial performance of companies are positively related, suggesting that environmentally responsible organizational practices are profitable as well (Tebini et al. 2016); communicating this positive relationship may promote climate actions in organizations.

Perceptions of the biospheric values of others may not only inhibit individual climate actions but also impede top-down actions by, for example, governments, as politicians may be reluctant to implement climate policies when they think the groups they represent do not strongly care about nature, the environment, and climate change (Bouman & Steg 2019). Likewise, industry and business leaders may be reluctant to develop and introduce sustainable products when they (wrongly) believe that most people do not strongly care about nature, the environment, and climate change, as they may think the market potential for such products is low. The lack of actions by political, industry, and business leaders may in turn demotivate individuals to act, not only because it may make them feel their actions would be futile, but also because individual climate actions are likely to be relatively costly and cumbersome as long as they are not mainstream and supported by policy and system changes. Hence, underestimating the extent to which different actors endorse biospheric values and act upon them may have wide-ranging effects, as it can reduce the motivation of a wide range of actors to engage in climate actions. This, in turn, may confirm and strengthen the misperception that most actors do not care about nature, the environment, and climate change and that other actors do not engage in climate actions, resulting in a self-fulfilling prophecy (Bouman & Steg 2019).

Here, again, it would be important to communicate the wide support that exists for climate actions. This is particularly important because in many cases coordinated actions are needed, across key organizations and actors (Stern et al. 2016). Notably, organizational actions may also need to be supported and facilitated by system changes—for example, when such actions are rather costly or threaten organizations' competitiveness. In this respect, governments can implement policies to develop, facilitate, and require low-carbon options and systems (Stern et al. 2016).

ACCEPTABILITY OF CLIMATE POLICY AND SYSTEM CHANGES

From the discussion above, it is clear that system changes are critical to promote society-wide climate actions. Yet, such system changes are likely only implemented when they are acceptable to the public. Hence, it is critical to understand which factors affect the extent to which different system changes are acceptable to the public, as this provides important insights into how to successfully design, implement, and communicate changes that are widely supported by society. Next to the motivational factors I discussed above, at least four other factors seem to affect the public acceptability of system changes: the perceived costs and benefits of system changes, distributive fairness, procedural fairness, and trust in responsible actors.

Perceived Costs and Benefits

The public acceptability of system changes is higher when people expect more positive and less negative effects for themselves, others, and the environment (Boudet 2019, Demski et al. 2015, Drews & Van den Bergh 2016, Perlaviciute & Steg 2014). Hence, like behavior, the acceptability of system changes is driven not only by self-interest but also by a consideration of the impacts on others and the environment. As indicated above, the perceptions of such costs and benefits are affected by individual characteristics, such as values: System changes that support individuals' key values are perceived to have more positive and less negative consequences, while the opposite is true for system changes that are believed to threaten individuals' key values (Steg 2016). Moreover, the public acceptability of climate mitigation strategies increases when people are made aware of adaptation costs (Greenhill et al. 2018), suggesting people consider long-term costs as well. These findings suggest that it is critical to address the concerns and interests of those who are likely to be affected by the proposed system changes. Trials can build public support for system changes, if people experience that the policy or change has more positive effects than they anticipated (Eliasson 2014, Weber 2015). For example, people evaluated a transport pricing policy as more acceptable, and indicated that the scheme had more positive impacts on the environment, traffic jams, and parking problems, after the scheme had been in place for 6 months compared to before the scheme was implemented (Schuitema et al. 2010). Similarly, providing people the opportunity to try out and use new technology can enhance acceptability of such technologies (Rezvani et al. 2015). The question remains of why public acceptability increases after successful trials and experiences; for example, it may be because people underestimate the positive effects of change before experiencing it or because people adapt their beliefs to their new behavior (i.e., due to cognitive dissonance reduction; Festinger 1957).

Distributive Fairness

Public acceptability also depends on how the costs and benefits of changes are distributed across groups (i.e., on distributive fairness; Visschers & Siegrist 2012). Specifically, system changes are more acceptable when costs and benefits are distributed equally across groups and when vulnerable groups, future generations, nature, and the environment are protected (Drews & Van den Bergh 2016, Evensen et al. 2018, Sjöberg & Drottz-Sjöberg 2001). Indeed, people are more likely to oppose a wind farm project when only part of the community is expected to benefit from it (Cass et al. 2010, Gross 2007), while pricing policies are more acceptable when people expect that such policies would affect people equally and when they believe such policies would protect nature, the environment, and future generations (Schuitema et al. 2011). Distributive fairness can be enhanced by compensation schemes, for example, by offering additional benefits to people who would be negatively affected by the proposed changes (Perlaviciute & Steg 2014, Zaal et al. 2014).

For example, the public acceptability of pricing policies appears to be higher when redistributing revenues toward those affected (Schuitema & Steg 2008) and when earmarking revenues for environmental purposes (Sælen & Kallbekken 2011, Steg et al. 2006). Yet, compensation schemes may not enhance perceived distributive fairness when they do not address important (nonfinancial) concerns people have (Leer Jøgersen et al. 2020, Ter Mors et al. 2012). Moreover, compensation schemes may not be effective if people disagree about which compensation would be worthwhile or if they feel that they are being bribed (Aitken 2010, Cass et al. 2010).

Procedural Fairness

The public acceptability of system changes depends not only on the evaluation of (the distribution of) the outcomes of the changes but also on how relevant decisions have been taken, as reflected in perceptions of procedural fairness. Notably, changes are perceived as more fair and acceptable when transparent procedures have been followed and people feel that their interests and concerns have been taken seriously. Indeed, public acceptability is higher when the public (Arvai 2003, Bidwell 2016, Dietz 2013, Terwel et al. 2012, Walker & Baxter 2017) or public society organizations (Bernauer & Gampfer 2013, Bernauer et al. 2016, Terwel et al. 2010) participate in the decision making; when individuals are offered the opportunity to express their opinion, can have a voice, and feel treated with respect; and when decision making is unbiased (Evensen et al. 2018, Gross 2007, Natl. Res. Counc. 2008, Perlaviciute et al. 2018). Perceived procedural fairness and public acceptability are particularly enhanced when people have the feeling they can influence major, rather than only minor, decisions regarding projects (Liu et al. 2019, 2020b). On the other hand, people seem to want to participate more in decision making on local projects and less in decision making on national or general plans and policy goals that are likely to steer such local developments (Perlaviciute & Squintani 2020). Hence, it is important to consider how people can be involved earlier on, when they can have a more substantial influence on the decision process. Importantly, engaging the public in decision making on how to address climate change may not only enhance public acceptability but also result in higher-quality decisions by bringing in public knowledge and views that may otherwise be missed (Bidwell 2016, Dietz 2013).

Trust in Responsible Actors

The general public typically does not have sufficient expertise nor the capacity to implement and manage system changes. Rather, the public needs to rely on the expertise and good intentions of agents who are responsible for initiating and managing system changes. This implies that the level of trust in such agents affects the acceptability of system changes. Indeed, public support is higher when individuals trust parties with implementing or managing policies, system changes, and technologies (Drews & Van den Bergh 2016; Liu et al. 2019, 2020a; Merk et al. 2015; Michaels & Parag 2016; Perlaviciute & Steg 2014; Terwel et al. 2011, 2012; Van Valkengoed & Steg 2019). Public acceptability appears to depend particularly on trust in the integrity of responsible actors (i.e., whether they are believed to be transparent and honest), while trust in the competence of responsible actors mostly affects public support when integrity-based trust is low (Liu et al. 2020a). Trust may affect not only the acceptability of system changes that are forced upon people (such as the implementation of wind parks) but also the likelihood that people take advantage of policies that support climate actions. For example, people seem more likely to use financial incentives that support energy conservation when the incentive programs are operated by trusted organizations (Stern et al. 1986).

CONCLUDING REMARKS

It is often believed that many people do not engage in climate actions because they are motivated by self-interest and do not care about nature, the environment, and climate change. Yet, as explained above, research indicates that people generally do care about nature, the environment, and climate change, and they are motivated to engage in climate action. However, they generally underestimate the extent to which others care and act, which may inhibit their climate actions. Moreover, people may face important barriers to engage consistently in climate actions. Such barriers can be removed by implementing structural changes that support and enable wide-scale climate actions. Such changes are more likely to be implemented when they are supported by the public. Public support for such system changes depends not only on the perceived costs and benefits of such changes but also, and maybe even more so, on whether the costs and benefits are distributed fairly, whether fair decision-making procedures are followed, and whether people trust the actors implementing the changes.

This review indicates that behavior change is not the sole responsibility of consumers and citizens. Rather, many actors can enable and support society-wide climate actions, including decision makers in governments, businesses, industry, and NGOs (Steg et al. 2021). This observation raises important questions for future research. First, we need to better understand what motivates decision makers to implement system changes and whether their actions are affected by similar factors and processes as the actions of consumers and citizens. Here, again, (mis)perceptions of the extent to which others care and act may play a key role, as decision makers may be reluctant to implement changes when they underestimate the level of support for change among the general public. This, in turn, can confirm and strengthen the misperception that decision makers do not care about nature, the environment, and climate change, and it may further demotivate individuals to engage in climate actions, turning the underestimations of others' level of care and actions into a vicious circle that inhibits wide-scale climate actions. Hence, it seems critical to communicate that many actors do care about nature, the environment, and climate change and act accordingly. Future research is needed to understand how to facilitate the coordination of many different actors in different roles so as to achieve the systemic changes that are needed to enable and motivate wide-scale climate actions.

Second, and relatedly, incremental changes are unlikely to be sufficient to limit the negative impacts of climate change (IPCC 2018). Rather, transformational changes are needed to drastically reduce greenhouse gas emissions, fundamentally reshaping the systems in which we function. For example, we are likely to move to net-zero energy systems that more strongly rely on (intermittent) renewable energy sources that households not only consume but also produce, which may challenge security of energy supply (Grübler et al. 2018, Perlaviciute et al. 2021). Moreover, the food system may need to be transformed so as to reduce reliance on animal proteins that significantly contribute to climate change (Grübler et al. 2018, Perlaviciute et al. 2021). Key questions here are what type of future world people prefer and support and how to reconcile possible different views and preferences among people. Addressing these questions may be challenging, as people may have difficulties in understanding the merits of systemic changes that involve a rather different way of life that they have not seen before. Moreover, we need to understand how to achieve transformational changes that enable consistent climate actions that secure human well-being as well, which requires the coordinated actions of many different actors, as indicated above.

Psychological research on climate change has provided important insights into what motivates people to contribute to addressing collective problems that affect all people across the world. Future research can test whether similar factors and processes play a role in managing other pressing collective problems, including the mitigation of other environmental problems (e.g., biodiversity

loss, plastic pollution), adaptation to climate change (Van Valkengoed & Steg 2019), and collective health problems (e.g., planetary health or pandemics such as COVID-19; Bouman et al. 2021a). Integrating insights from environmental and health psychology can be fruitful in this respect. More generally, interdisciplinary collaboration is pivotal to better understand the interaction between people and the systems in which they function, thereby integrating micro and macro perspectives. Related to this, future research is needed to integrate insights from psychological studies into broader climate sciences, so as to better account for the human dimensions of climate change. This is particularly important as people with different roles and responsibilities play a key role in mitigating and adapting to climate change by engaging in a range of climate actions and by initiating and supporting system changes.

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