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Perspective

Leveraging emotion for sustainable action

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SUMMARY

Behavioral science approaches to promoting sustainable action have mainly focused on cognitive processes, whereas the role of emotions has received comparably little attention. However, emotions have a great but currently not fully exploited potential to contribute to a sustainable behavior change. In this perspective, we summarize recent research emphasizing the central and indispensable role of emotion in human thinking and judgment. We discuss how these insights can promote affective reactivity toward sustainability issues, help leverage the potential of emotion to motivate action, and improve emotional climate change communication and intervention strategies. We outline a research agenda that we see as crucial for obtaining a solid evidence base on how emotions can optimally promote sustainable behavior. This paper is meant to stimulate discussion and a coordinated research effort on how emotions may be better leveraged to promote large-scale sustainable action and to promote a stronger integration of emotional strategies into the toolbox of policy makers.

INTRODUCTION

Developing a more sustainable lifestyle is one of the most pressing tasks facing our planet and its inhabitants. Millions of tons of plastic waste are polluting our water, air, and soil.¹ Extinctions and loss of biodiversity are altering key processes of the ecosystem.² Excessive greenhouse gas emissions result in climatic changes and extreme weather events.³ While the great majority of people nowadays are aware of these issues,^{4,5} too little is done to translate this knowledge into concrete sustainable actions. To promote the necessary behavioral changes, research in the social and behavioral sciences is investigating the determinants of sustainable behavior change,^{3,6} and policy makers have begun applying behavioral insights about human judgment and decision making to improve informational, financial, and legal instruments and to develop new intervention strategies.^{7–9}

Considerable progress has been made toward understanding factors that can motivate people to take up sustainable action or that can act as barriers.^{3,10} Up to now, behavioral research has mainly focused on cognitive factors such as risk perceptions, beliefs, values, attitudes, perceptions of social norms, perceptions of action efficacy, bounded rationality, and cognitive biases.^{3,10–12} Similarly, most intervention and communication strategies target cognitive processes, which are leveraged in an attempt to change behavior, for instance by communicating about specific environmental problems and ways to reduce them,^{13,14} by emphasizing the individual benefits of sustainable actions,¹⁵ by reframing the issue of climate change to increase citizen engagement,^{16,17} by implementing pricing policies to make sustainable behavior more attractive,¹⁸ or by introducing default options to promote sustainable choices.¹⁹ While these cognition-based approaches are important and sometimes do result in the intended behavior change, they are limited in their

scope. Importantly, they overlook the pervasive impact of emotions on human decision making and behavior.

This is striking, given that affect (a positive or negative feeling toward an event, such as climate change, or an object, such as a technology) and emotions (a more intense reaction such as fear, anger, pride, or guilt resulting in changes in motivational action tendencies, physiological reactions, expressions, and subjective feeling) have been shown to exert major influences on human thinking and behavior, and they are likely to play a critical role for a sustainable behavior change in several respects.^{20–23} A recent review²⁰ illustrates that the affective reactions that people experience toward climate change are consistently among the most important predictors of climate change risk perceptions,²⁴ willingness to engage in mitigation²⁵ and adaptation²⁶ behaviors, policy support,²⁷ and technology acceptance.^{28,29} Moreover, the affective reactions that people experience as a consequence of their own environmental behavior are among the most important drivers of sustainable action, above and beyond instrumental considerations.³⁰ These findings illustrate that emotional reactions toward climate change and toward sustainable actions play a central role in many judgments and behaviors that are highly relevant to a sustainable behavior change, pointing toward significant opportunities to promote sustainable large-scale action. However, this potential has been underexploited up to now.

For example, while the experience of strong affective reactions toward climate change is an important predictor of climate action,²⁰ not everybody experiences these strong affective reactions. Segmentation analyses show that 26% of US citizens are “alarmed” with regard to climate change, perceiving the issue as a serious threat and showing high motivation to act. In contrast, 25% are classified as either “disengaged,” “doubtful,” or “dismissive,” being neither very concerned nor motivated to act.³¹ The observed climate inaction of many people may thus



be related to the fact that they do not experience strong negative emotions toward sustainability issues, and lack vivid affective responses that would allow them to take up action.^{32,33} At the moment, however, we do not have a sufficient understanding of why some people react emotionally to climate change and others do not.

Multiple intervention strategies have been developed in attempts to externally induce emotions toward sustainability issues in order to leverage the impact of emotion on sustainable behavior.^{34–44} However, these attempts often failed to yield the intended changes in judgments and behaviors or even produced unintended boomerang effects. For instance, messages designed to induce fear of climate change did in some cases lead to stronger engagement with the topic, while other studies found no effect of such fear appeals, or observed a reduction of peoples' perceived response efficacy, which inhibited pro-environmental behavior.^{45–47} Interestingly, as we will develop in more detail below, many of these failures can be explained by taking into account recent developments in the affective sciences concerning the reciprocal links between emotion and cognition.^{20,48–50}

In this perspective, we argue that, in order to better leverage the potential of emotions to mobilize sustainable action, we need to pay close attention to these reciprocal mechanisms underlying the elicitation of emotions as well as their impact on human thinking and behavior. This includes extending our knowledge about the individual differences in affective responses toward environmental problems such as climate change, and about the concrete mechanisms and pathways by which emotions influence our thoughts and sustainable actions. We argue that research in the affective sciences has made considerable progress over the last decades, which has yielded important insights into these mechanisms, and that the field of sustainability could benefit from integrating these advances to a larger extent. However, most of the relevant emotion research has been done outside the context of climate change and sustainable action. Due to the specific nature of sustainability problems such as climate change (i.e., complex, temporally distant, probabilistic), the emotional reactions and their behavioral impacts may differ from those elicited in other domains.⁵¹ Before applying these insights to design large-scale behavioral interventions, more topical emotion research in the sustainability domain is needed.

Here we provide a systematic overview of the many ways in which affect and emotions can be important in the context of sustainable judgments and behavior, bringing together several strands of the literature that have been conducted in different academic subfields of the behavioral sciences. Our analysis highlights the central and indispensable role of emotion in human thinking, judgment, and behavior. We then outline how these insights can be exploited to promote sustainable action, illustrating how we can leverage our knowledge about the psychological mechanisms underlying the elicitation of emotion to facilitate emotional reactions toward sustainability issues, how we can use positive emotions to motivate long-term sustainable behavior change and increase well-being, and how we can use our knowledge about the consequences of emotions to improve existing affective sustainability interventions. We moreover outline a research agenda that we see as crucial for obtaining a solid evidence base on how emotions can optimally promote

sustainable behavior, taking into account interindividual and contextual factors that may play important roles. The paper is meant to stimulate discussion and a coordinated research effort on how emotions may be better leveraged to promote large-scale sustainable action, and to promote a stronger integration of emotional strategies into the toolbox of policy makers.

THE CENTRAL ROLE OF EMOTION FOR SUSTAINABLE BEHAVIOR

Emotions were long considered an irrational force that interferes with cognition and reasoned thought. Over the last decades, psychological and neuroscientific emotion research has made great strides toward a revision of this conceptualization, illustrating that emotions are necessary for a successful functioning of the human mind. Emotions are elicited when an event or an object is appraised as being relevant to one's concerns and one's values. They help us detect and understand potential risks and opportunities in our environment, provide important evaluative information, and reorient information processing toward relevant events.⁵² Their adaptive function is to prioritize value concerns that are potentially being threatened (in the case of negative emotions) or supported (in the case of positive emotions), providing the motivational momentum to help the individual to successfully deal with the challenge.⁵³ They are defined by the appraisal pattern underlying the situation⁵⁴ and trigger motivational action tendencies that facilitate coping with the situation.⁵⁵ The appraisal process can occur via associative and via reasoning-based mechanisms. Associative appraisal is largely based on previous experiences and can occur quickly and automatically, resulting in what is often referred to as affect in the sustainability literature. Reasoning-based appraisal occurs via a more effortful process that can assess new and abstract information, allowing for a more thorough and flexible analysis, resulting in full-blown emotional reactions.⁵⁶ Different emotions have different appraisal patterns, and lead to specific motivational tendencies. Fear, for instance, is defined by the appraisal of an uncontrollable threat that triggers defensive stances such as fight, flight, or freeze.⁵⁵ It is especially via these motivational tendencies that emotions can give direction to behavior. Recent psychological and neuroimaging research has illustrated how emotions can influence economic and social decision making by promoting specific behavioral tendencies such as approaching versus avoiding risky choices or by accepting versus rejecting unfair offers in economic games.⁵⁷

Affectively relevant information is moreover privileged by perceptual and attentional systems, allowing the information to be noticed rapidly and, once detected, become the focus of further processing and action.⁵⁸ For instance, eye-tracking studies have demonstrated that individuals with positive implicit attitudes toward low-carbon products are more likely to fixate on pictures of climate change⁵⁹ as well as on carbon footprint information.⁶⁰ Emotions moreover influence how new information is interpreted by increasing the influence of the appraisals associated with the current emotion.⁶¹ When a person is experiencing fear, for instance, which is associated with the appraisal that a negative event is difficult to control, newly encountered risks will be judged as less predictable and less controllable.⁴⁸ Memories of emotional events are encoded and consolidated more

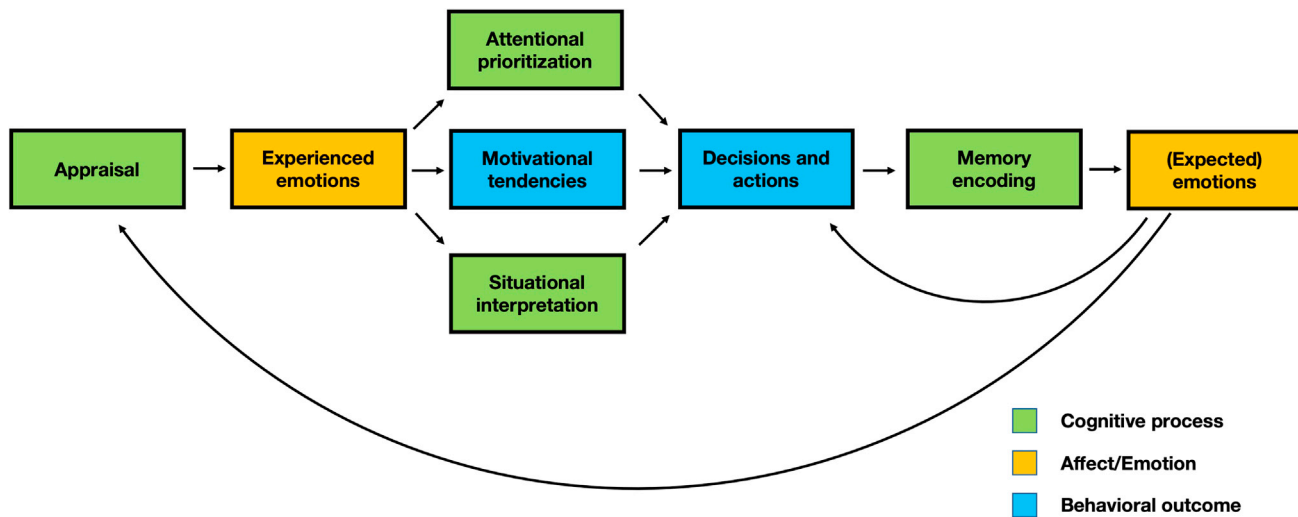


Figure 1. Emotion, cognition, and action are strongly intertwined

Appraisals drive emotions, and emotions influence how information is selected and interpreted, trigger motivational action tendencies, and leave memory traces that can guide future thought and behavior. Emotions influence our thoughts and actions at many different levels, pointing out the importance of considering their role in the context of sustainable behavior change.

deeply than memories of unemotional events, and have a persistence and vividness that other memories seem to lack.⁵² This increases their importance as guides for future behavior, when similar situations are encountered. Emotions thus operate as an adaptive filter that focalizes our thought and action on events that are relevant for an individual's concerns and values, and can have long-lasting effects by influencing future behavior in similar situations.

The experience of emotions moreover has immediate intrinsic value, as emotions have valence and thus are perceived as either pleasant or unpleasant feelings. The anticipation that one will experience an emotional response after showing a behavior can thus be the main reason a specific behavior is shown or avoided, as people generally act in a way to increase the number of their positive experiences and avoid negative ones.⁶² Consistent with this, the affective reactions that people experience or expect to experience as a consequence of their own environmental behavior have been shown to be among the most important drivers of sustainable action.³⁰

Thus, emotion, cognition, and action are strongly intertwined. Cognitions drive emotions, emotions drive cognition by influencing how information is selected and interpreted, emotions drive action by triggering motivational action tendencies, and emotions leave memory traces that can guide future thought and behavior (see Figure 1). This interconnectedness shows that emotions influence our thoughts and actions at many different levels, pointing out the importance of considering their role in the context of sustainable behavior change.

Emotional reactions toward sustainability issues

In order to better understand why people feel specific emotions toward climate change, or why they feel no emotions at all, a closer look at the cognitive-affective architecture outlined above may offer helpful insights. We experience emotions because we appraise that something important for our concerns and values is being threatened (resulting in negative emotions) or supported

(resulting in positive emotions).⁶³ We do not become emotional about unimportant things, but about things that concern us, things that relate to values that are important to us.⁵⁴ Whether people experience emotions toward sustainability issues or not thus likely depends on the centrality of the issue to their concerns and values. Indeed, climate scientists, who are very involved with the topic and consider it a major concern of theirs, report more intense positive and negative emotions toward climate change than the general population.³³ Value research has identified four value types that are especially relevant in the context of climate change and the environment: biospheric values (care about protecting nature and the environment), altruistic values (care about the well-being of others), egoistic values (care about personal resources such as wealth and status), and hedonic values (care about personal pleasure and comfort).⁶⁴ Individual tendencies to experience emotional reactions toward the current state of the environment show strong correlations with biospheric and altruistic values.⁶⁵ For instance, a study using large-scale data from the European Social Survey ($n = 44,387$) showed that the more strongly people endorse biospheric values, the more worry they report about environmental issues.⁶⁶ These findings are consistent with the notion of emotions as indicators of threats or opportunities with regard to valued objects and concerns (Figure 2A).

A lack of emotions toward sustainability issues can thus be due to two reasons: (1) an intact environment is a valued object to the person, but no threat is perceived (Figure 2B), or (2) an intact environment is a not a valued object for the person (Figure 2C).

Many sustainability problems share properties that may reduce the likelihood that they are perceived as a threat, even when the perceiver does value an intact environment. Climate change, for instance, is an abstract and cognitively complex phenomenon composed of disparate and seemingly incongruous events (e.g., increased rainfall in one region and increased droughts in others), which is communicated using

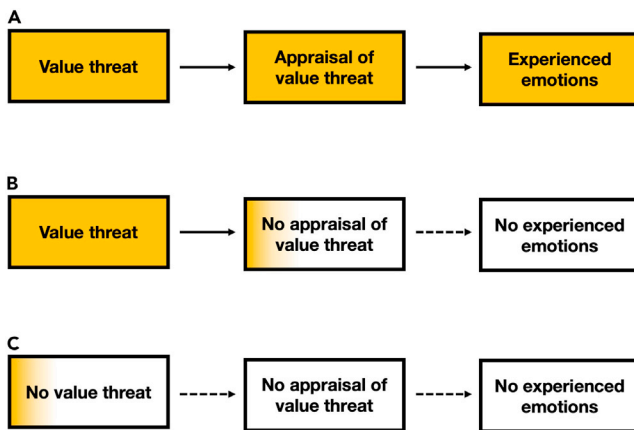


Figure 2. Emotions are indicators of appraised value relevance (A–C) (A) Emotions function as indicators of threats or opportunities to valued objects and concerns. A lack of emotions toward sustainability issues can thus be due to two reasons: (B) an intact environment is of value for the person, but no threat is being appraised, or (C) an intact environment is not of value for the person.

probabilities and is predicted to occur mainly in the future.^{23,51,67} These properties can make it difficult to appraise the relevance of the issue to one’s concerns and values, which is, however, a necessary condition for an emotion to occur. In order to facilitate the correct perception, the value threat can be made salient by emphasizing experiential aspects of climate change with engaging and easy-to-understand visualizations illustrating the impact of the phenomenon or the environmental impact of specific actions. In the case that an intact environment is not a valued object for the person, it may be important to consider that a variety of values can be threatened by climate change or supported by sustainable action. Indeed, communicating about climate change mitigation has been shown to increase policy support and climate action in climate change deniers when it was pointed out to them that mitigation can have additional benefits they care about, such as scientific and economic progress.¹⁵ Considering the mechanisms underlying emotion elicitation can help understand why some people experience affective reactions toward sustainability issues such as climate change and others do not. To this end, research should focus on understanding how *clearly understandable* and *value-relevant* implications of sustainability issues can be optimally transmitted to maximize affective reactivity and translate it into action, and explore whether different audience segments may be effectively addressed with different types of emotional appeals to promote sustainable action.

Leveraging the warm glow of sustainable behavior

In addition to guiding our interpretation of events in the environment, emotions also have intrinsic motivational value: people organize their actions to increase their positive emotions and reduce their negative emotions.⁶² Thus, not only the emotions one is experiencing at a given moment but also the emotions one anticipates to experience may be important drivers of action. Economists have introduced the concept of “warm glow” as a motivator of pro-social behavior,⁶⁸ which aims to explain people’s pro-social action with the subsequent experience of a pos-

itive emotional experience that rewards and reinforces the behavior. Recent research in the environmental domain has explored to what extent the anticipation of positive emotions and affective reactions can also motivate pro-environmental behavior. Findings show that people seem to indeed experience a warm glow when acting pro-environmentally, even literally: participants who received the feedback that they have a comparatively small carbon footprint perceived the room temperature as higher compared with participants who learned that they have a large footprint.⁶⁹ Longitudinal studies found that anticipated warm glow predicted pro-environmental behaviors 4 weeks later, over and above behavioral intentions.^{70,71} In other studies, the extent to which people engage in use of public transport,⁷² recycling behaviors,⁷³ and energy-saving behaviors³⁰ have all been shown to be substantially predicted by people’s anticipation of how good or bad they will feel after engaging in the behavior. Thus, when people expect to feel good when engaging in a specific action, driven either by hedonic aspects (e.g., the physical pleasure associated with a bicycle ride) or by eudaimonic aspects (the extent to which performing a morally right behavior adds meaningfulness and satisfaction to one’s life),⁷⁴ they are more likely to engage in the behavior. These anticipated increases in positive emotions have been proved a better predictor of behavior than the anticipated instrumental gains related to the behavior,³⁰ illustrating the power and priority of positive emotions as drivers of sustainable behavior. Studies focusing on individual emotions showed that making anticipated pride more salient right before a decision led to more pro-environmental intentions compared with anticipated guilt,⁷⁵ and showed that pride experienced after pro-environmental behaviors predicted subsequent pro-environmental behaviors, but only for participants who perceived that others also do a lot for the environment.⁷⁶

While behavioral intervention strategies routinely attempt to make sustainable actions more attractive by adding financial incentives such as premiums for choosing sustainable options or taxes for non-sustainable options, they have yet to discover the potential of emotional incentives. This strategy seems extremely promising in order to induce long-term behavior change, as positive emotions can both be a consequence of pro-environmental behavior (experienced warm glow) and an antecedent (anticipated warm glow). This strongly suggests the existence of a reinforcement mechanism where previously experienced positive affect can motivate and drive future pro-environmental behaviors. Consistent with this, positive affect has been shown to mediate the effect of prior pro-environmental behavior on future pro-environmental intentions.⁷⁷ Moreover, positive anticipated emotions had a stronger effect on intentions to fight climate change for individuals who are already showing climate-protecting behaviors, while negative emotions have a stronger effect for individuals who are not engaged in climate mitigation.⁷⁸ This finding is highly relevant as it indicates that a positive feedback loop is in place for people who consistently behave in a sustainable manner. Such a feedback loop may not only promote environmental quality but moreover contribute to the well-being of those who engage in meaningful sustainable actions. Research now needs to explore how this positive feedback loop can be triggered by interventions and communications (Figure 3).⁷⁹

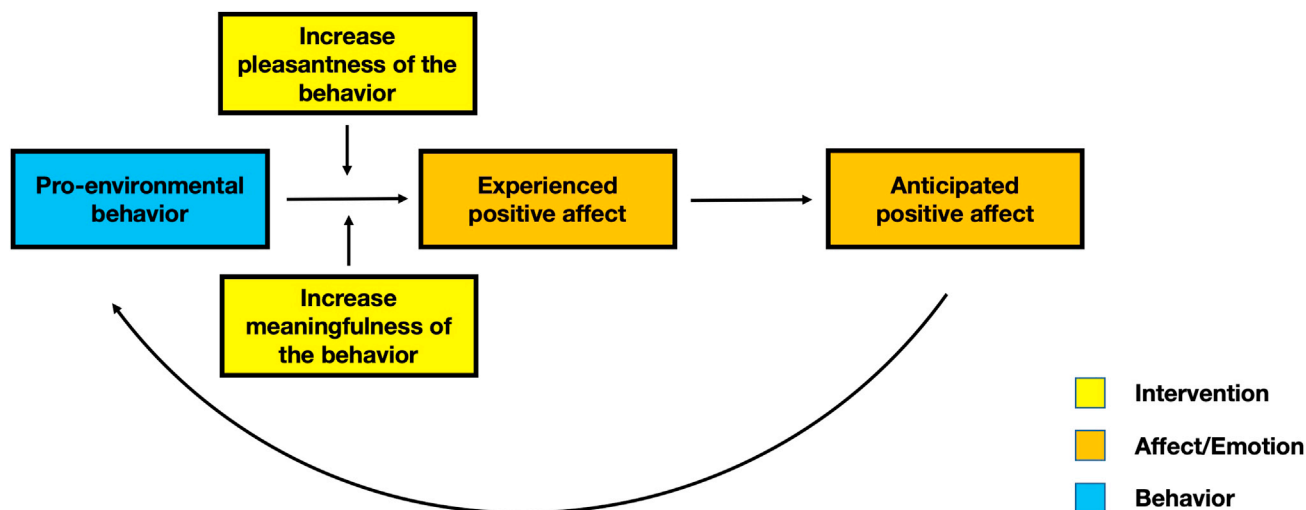


Figure 3. The virtuous cycle of positive affect

New classes of intervention strategies could aim to increase the positive affect experienced after pro-environmental behaviors in order to increase anticipated warm glow and trigger a feedback loop that may lead to long-term sustainable behavior change.

Improving affective strategies for sustainable action

Can we change the emotions that people experience toward climate change in order to promote climate action? Which emotions should we target to maximize chances of sustainable behavior change, and how should we go about it? Interventions have so far either aimed at eliciting negative emotions such as fear about climate change and guilt related to people's unsustainable behavior, or, more recently, emphasized positive messages that aim to promote hope and optimism that the problem can be solved.³⁹ These strategies have successfully promoted sustainable action in some cases, but in other cases failed to produce the desired results or even yielded opposing, unintended results.⁸⁰ Messages designed to induce fear of climate change did in some studies lead to stronger engagement with the topic, while other studies found no effect of such fear appeals, or observed a reduction of peoples' perceived response efficacy.^{45–47} Messages aiming to induce hope that climate change can be mitigated have been found to increase hope and climate action in some people, but to result in lower motivation to engage in mitigation efforts in others, to induce reactance, anger, and resentment in some, and to leave others completely unaffected.^{36,40,41} A current debate in the climate change communication literature turns around the issue of whether inducing intense fear may drive people into a passive state of avoidance, denial, or helplessness, as the threat posed by climate change may be perceived as too large to be solved successfully, and thus hope-based messages should be preferred.^{37,80–82} Critics of hope-based appeals, on the other hand, have pointed out that emphasizing progress in climate change mitigation may lead to complacency, as people may not see the need for personal action anymore.³⁷

A closer consideration of the cognitive-affective architecture outlined above allows us to understand and systematize the factors that need to be considered in the design and implementation of emotion-based interventions strategies. Emotions are elicited by specific appraisals. When emotions are being experienced,

they influence subsequent situational interpretations and judgments in line with these appraisals. The experimental induction of fear has been shown to lead to reduced cognitive estimates of personal efficacy and controllability when people make risk judgments.⁴⁸ People targeted by interventions that aim to provoke fear of climate change may as a consequence be less inclined toward sustainable behavior change (as they feel they cannot successfully act to mitigate the problems) and less inclined to support stringent policy attempts to control the problem (as they expect them to be ineffective). Thus, while fear-based interventions can have a positive impact when people did not previously perceive the magnitude of the threat and the intervention makes it clear to them (Figure 4A),³⁸ these interventions will backfire if they make people judge that they cannot successfully solve the problem because it is just too big (Figure 4B).⁴⁷ Similarly, the experimental induction of hope has been shown to increase cognitive estimates of the likelihood of positive outcomes when people make risk judgments.⁸³ Thus, while hope-based interventions can have a positive impact when people judge a problem to be unsolvable and the intervention points out potential pathways for them to solve it (active hope, Figure 4C),⁴¹ they will backfire if they make people judge that a problem will be solved without their doing anything (passive hope, Figure 4D).³⁶ During the design and validation of emotional messages, it is thus of utmost importance to assess whether the effects of emotions on key judgments of risk and behavioral control can account for the impact of the emotional messages on the willingness to act sustainably, and whether explicitly designing emotional messages to avoid “dysfunctional” cognitive effects can increase their efficacy to induce sustainable action.

GOING FORWARD: AN AGENDA FOR “GREEN” EMOTION RESEARCH

In this perspective, we aim to evaluate the potential of emotions, a rapid and efficient valuation system that can organize adaptive

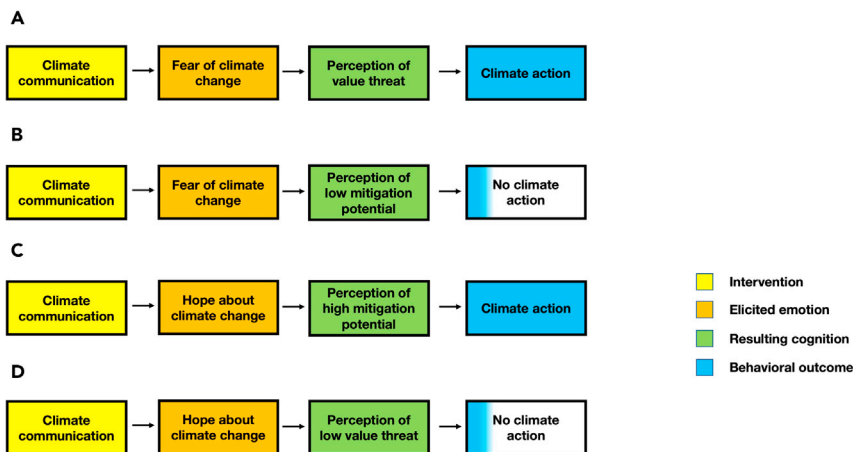


Figure 4. Using emotion theory to improve affective strategies for sustainable action

Considering the cognitive downstream effects of emotion may help understand when and how the induction of emotions toward climate change can backfire.

(A) Successful fear-based interventions clarify the magnitude of the threat to the target person and lead to climate action.

(B) Unsuccessful fear-based interventions make the target person judge that they cannot successfully solve the problem because it is just too big.

(C) Successful hope-based interventions point out pathways for the target person to contribute to solving the problem, increasing the perceived mitigation potential.

(D) Unsuccessful hope-based interventions make the target person believe that a problem will be solved even without their contribution, reducing the perceived threat.

reactions to threats and opportunities and can motivate behavior itself, in the context of sustainable behavior change. We argue that sustainability research and intervention development can gain a lot by integrating recent theoretical developments in the affective sciences that have yielded important insights into the elicitation mechanisms of emotions and their effects on cognition and behavior. However, as most of this research has been conducted outside the context of climate change and sustainable action, more topical emotion research is needed to obtain a more refined understanding of how emotions are linked to values, cognitions, and actions in the sustainability domain. In the remainder of this perspective, we summarize some of the major research questions that we think need to be addressed now. In order to address these and other questions, we suggest that it would be important to organize a large-scale research effort in order to gather an evidence base concerning the impact of emotions in the context of environmental problems and sustainable actions. Similar to the World Values Survey or the European Values Study, a longitudinally designed Environmental Emotion Survey would be an invaluable tool to gather the necessary knowledge to unlock the potential of emotions. In a first wave, this instrument could gather large-scale evidence about the antecedents and consequences of different emotional responses toward sustainability issues such as climate change, biodiversity loss, and environmental pollution, and in subsequent waves yield evidence about the impact of intervention approaches specifically targeting these elements.

Specify the conditions under which emotions can be a lever for behavior change

Based on the repeatedly observed failures to systematically promote sustainable behavior change via emotion induction, it has been argued that emotions should not be treated as levers that policy makers can use to elicit specific behaviors.⁸⁰ The impact of emotions on behavior is indeed complex, implemented within a dense network of interactions with cognitive and motivational mechanisms, and influenced by interindividual differences as well as contextual factors. As any other driver of behavior, emotions do not continuously affect our behavior all the time, do not affect everyone's behavior the same way, and do not affect behavior each time the same way. In order to effectively leverage

the force of emotions to promote sustainable behavior, it is thus necessary to specify the conditions under which the desired effects can occur. Empirical investigation of these conditions in longitudinal research designs will yield important insights into the merits and limits of emotion-based intervention strategies. In what follows, we outline some concrete recommendations to develop a more fine-grained understanding of interindividual and contextual factors that may affect the likelihood that emotions can be a lever for behavior change.

Optimize the match between specific emotions and sustainable actions

Previous investigations of the impact of emotion induction on sustainable action tended to focus on one single type of behavior per study, while the relationship between the emotion and the specific behavior was rarely discussed or taken into account. However, research in environmental psychology differentiates between different types of pro-environmental behavior with different sets of determinants. Stern,⁸⁴ for instance, distinguishes between environmental activism, behaviors in the public sphere, organizational behavior, and private-sphere environmentalism. Private-sphere behavior can be further differentiated into curtailment behaviors, related to reductions of individual resource consumption in everyday situations (e.g., reducing car trips, turning off the light), and adoption behaviors, related to decisions to invest financial resources into energy saving (e.g., investments in renewable energy tariffs, energy-efficient devices).⁸⁵ Climate change research differentiates between mitigation behaviors, which are aimed at emission reductions to minimize future impacts of climate change (e.g., saving electricity, implementing carbon taxes) and adaptation behaviors, which are aimed at adjustments to immediate negative consequences of climate change (e.g., evacuating from hazards, building flood defenses). Emotions trigger motivational action tendencies that facilitate specific types of behaviors.⁵⁵ Different emotions lead to different motivational tendencies, so it may be worth considering to what extent these tendencies map onto the behavior one wants to influence. A recent debate among environmental psychologists emphasized the need to focus intervention research on behaviors with high environmental impact.^{86–88} To optimally select target emotions for

affective interventions in the sustainability domain, research now should produce an evidence base to pinpoint the emotions that are most strongly linked with specific sustainable actions with high impact. For instance, fear triggers protective action tendencies with regard to a threat, while hope triggers action toward the obtention of an uncertain positive future.⁸⁹ It follows that messages targeting fear of climate change may be more suited to promoting adaptation behaviors, while messages targeting hope toward climate change may be more suited to promoting mitigation behaviors. Pride is linked to the display of personal achievement and status,⁹⁰ and may thus be especially suited to promoting renewable investments that are visible to others, while guilt is related to reparatory and compensatory behaviors,⁹¹ and may be especially suited for interventions aiming to promote constraint in resource use.

Carefully design affective interventions based on empirical knowledge about the emotion process

Emotions are elicited based on specific appraisal profiles and are associated with specific motivational tendencies. Fear, for instance, is defined by the appraisal of an uncontrollable threat that triggers defensive stances such as fight, flight, or freeze. Sadness reflects an irrevocable loss leading to the tendency to change one's circumstances. Anger is defined by the appraisal of a controllable negative event brought about by others, leading to active coping and retaliation behaviors such as punishing the blamed person. Disgust is triggered by closeness to an indigestible object or idea, resulting in motivational tendencies to expel and avoid. Guilt is brought about by a transgression of moral standards, driving behaviors aimed at reparation and social reintegration, while shame is linked to failures to live up to a moral ideal, leading to avoidance and social retreat.⁵⁵ As outlined above, emotions moreover influence how new information is interpreted by increasing the influence of the appraisals associated with the current emotion.⁶¹ Careful formulations considering the bidirectional links between emotion and appraisal are therefore crucial in the choice of target emotions and the intervention design in order to avoid backfire effects. For example, instead of debating whether fear-based or hope-based messages should be preferred,^{37,81} hybrid communications designed around a consideration of appraisals and downstream cognitive effects, which emphasize both the significance of the value threat and the fact that the problem can be successfully tackled by solution-oriented collective action, may be a promising avenue to increase sustainable action via emotions. Note that such a message is expected to contain elements of both fear and hope. Recent research in the health communication domain has introduced the concept of "emotional flow", referring of the dynamics of the emotional experience over the course of exposure to a health message.⁹² This concept seems highly useful to consider also in the domain of climate communications, where messages could be designed and evaluated that generate an affective dynamic from fear about the size of the problem toward hope that it can be resolved. Attention should moreover be paid to the relatively short temporal duration of emotional episodes and their impact on behavior. A recent study demonstrated that while film-induced sadness about climate change predicted subsequent donations, once a time delay of 1 h was introduced between film and decision, the impact of sadness

was substantially attenuated.⁹³ It is thus important to take this into account during the intervention design by placing the emotion message as closely as possible to the desired behavior (or by including safeguard mechanisms such as pre-commitments).⁹³ Another important line of research will be to study how and which emotions may be suited to encourage behavior change in the long term as well (see [trigger the virtuous cycle of warm glow](#) below).

Understand and address different audience segments to facilitate emotional reactions to sustainability issues

A lack of emotional responses toward sustainability issues can be due to the fact that an intact environment is not of value for the person, or that no value threat is perceived. Both barriers can in principle be addressed with strategies that make value threats and opportunities (more) salient. The perception of an environmental value threat could be facilitated by emphasizing experiential aspects of climate change with engaging visualizations; for example, by graphically illustrating current extreme weather events, or by translating the impact of one transatlantic flight into square meters of melting arctic ice.⁹⁴ A promising strategy to facilitate emotional responding in an audience with diverse value hierarchies could be to reframe sustainability issues with a focus on egoistic and hedonic concerns (e.g., personal health, comfort, status), which may be more compatible with the affective predispositions of individuals for whom biospheric and altruistic values are not central. In adapting to different audiences, it may furthermore be worthwhile to consider the fact that different value types have been associated with different types of emotions, in that people with self-centered values are more likely to experience emotions such as pride and anger, while people with other-focused values are more likely to experience socially engaging emotions such as guilt and closeness.⁹⁵ All of these emotions have previously been shown to motivate climate action in different contexts.^{34,43,44} Tailored affective interventions should thus attempt to target different emotions as well. For instance, interventions aimed at a mainly self-interested audience may focus on pride, while interventions aimed at an other-oriented audience may rather focus on guilt. This moreover implies the possibility that self-interested audiences may be more easily enticed toward renewable investments with pride-focused interventions, while other-oriented audiences may be more easily motivated toward constraint in resource use with guilt-focused interventions. Large-scale empirical investigations of the efficacy of tailored affective climate change messages in different population segments are required here to test these ideas.

Assess emotions adequately to validate affective interventions

So far, the development and validation of emotional climate change communications is to a large extent based on the explicit judgments of participants who indicate whether they intend to change their behavior after being exposed to the message.³⁹ However, people are limited in their ability to predict their future behavior or to accurately identify their internal mental states through self-reports.⁹⁶ Self-reports are subject to social desirability and may not always be reliable. Moreover, many aspects of the emotion process occur rapidly and in a partially automatic

fashion,⁹⁷ and are thus not necessarily accessible to introspection or able to be reported in a questionnaire. The aspects of the emotion process that reach consciousness may only represent the “tip of the iceberg.”⁹⁸ This issue needs to be tackled by combining multiple methods over and above self-report, such as the measurement of implicit affective associations using response time tasks,^{59,60} the measurement of affective processes at the neural level, and the assessment of the different components of the emotional response as it occurs in a dynamic fashion, including physiological responses and elicited action tendencies. Recent research from the health communication domain has found that neural activation in the ventromedial prefrontal cortex (VMPFC) toward persuasive messages was a reliable predictor of subsequent behavior change, explaining variance above and beyond a range of self-report measures.^{99,100} VMPFC activation did not only predict the behavior change of the individuals who were exposed to the messages in the scanner^{101,102} but also predicted the population effects of large-scale media campaigns (e.g., which campaign messages resulted in more phone calls to hotlines¹⁰³ or resulted in more clicks on links to obtain additional information¹⁰⁴). Extensive work in affective neuroscience has moreover mapped the emotional brain,¹⁰⁵ illustrating how appraisals and emotions are implemented at the neural level.⁹⁷ This work points to an important role of the amygdala as detector of the affective relevance of a stimulus¹⁰⁶ interacting with an extended network of other neural regions to orchestrate the emotional response.^{97,105} Measuring the interplay of affective and value-related brain regions to select and improve emotional interventions aiming to promote sustainable behavior change seems an enormously promising path for future research.¹⁰⁴

Trigger the virtuous cycle of warm glow

Facilitating the experience of warm glow may induce the long-term behavior change needed to fight climate change. Theory-based intervention strategies to kick-start the warm glow feedback loop should be developed and their effectiveness empirically investigated. Choice architecture interventions could, for instance, aim to increase the positive affect that can be elicited by sustainable actions (one example for this strategy are the “musical stairs”; <https://www.designoftheworld.com/piano-stairs/>). A second, complementary possibility would be to increase the meaningfulness and satisfaction derived from a behavior by triggering people’s values. People with strong biospheric values reported stronger positive feelings when engaging in sustainable actions.⁷⁴ Warm glow moreover mediated the effect of altruistic values on pro-environmental behaviors.⁷⁷ Warm glow thus represents the affective consequence of the appraisal that one’s own actions contribute to realize one’s values.⁷⁷ Positive emotions may alternatively be promoted by enhancing the extent to which sustainable actions are perceived to be meaningful in the context of one’s values, for example by stressing the moral nature and environmental impact of the actions. Choice architecture interventions may aim to connect everyday actions to values, for instance by installing a mirror at the bus stop where people can see their face framed by the slogan “I made the green choice.” In addition to considering emotions as a potential driver of sustainable action, it is important to take into account their contribution to individual well-being. Sustainable action can lead to positive emotions, thus

increasing personal well-being. On the flipside, even though negative emotions can contribute to sustainable action, they can decrease well-being. This should be considered and weighed with the potential positive behavioral and societal outcomes of such an intervention.

Explore the role of collective emotions for sustainable action

While many theories of emotions as well as empirical studies in the sustainability domain conceptualized emotions as experiences at the level of the individual, and investigate their impact on individual behavior, most sustainability problems are the result of collective behavior and require collective action to be solved. As a consequence, it has been argued that research should focus on group-based appraisals such as the collective responsibility for environmental damage and protection and the experience of group-based emotions; i.e., emotions that are experienced as the result of one’s membership in a social group.¹⁰⁷ Indeed, some studies found promising effects of inducing emotions such as collective guilt⁴² or collective pride.³⁴ However, the overall state of the evidence is quite mixed so far,²¹ and more empirical research is needed to explore the promising field of collective emotions in the domain of sustainability.

CONCLUSIONS

Emotions have a great but currently underexploited potential to contribute to a sustainable behavior change. Far from being irrational, they translate our values and concerns into action. They influence and drive our thoughts and actions at many different levels, and may become a crucial instrument in attempts to promote pro-environmental action. With this perspective, we hope to stimulate discussion and research on how emotions may be better leveraged to promote large-scale sustainable action and to promote a stronger integration of emotional strategies into the toolbox of policy makers.

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AUTHOR CONTRIBUTIONS

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