Psychological Research and Global Climate Change

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Abstract

Human behaviour is integral not only to causing global climate change but also to responding and adapting to it. Here we argue that psychological research should inform efforts to address climate change, in order to avoid misunderstandings about human behaviour and motivations that can lead to ineffective or misguided policies. We review three key research areas: describing human perceptions of climate change: understanding and changing individual and household behaviour that drives climate change; and examining the human impacts of climate change and adaptation responses. Although much has been learned in these areas, we suggest important directions for further research.

Keywords: climate change, behaviour, perceptions, adaptation, mitigation, psychology

Psychological Research and Global Climate Change

Global climate change is one of the major threats facing humanity. Human interactions with climate occur at all levels of social organization,[1] but research to date has focused largely on institutional actors (e.g., governments, industries) and on the technological, demographic, and economic trends that drive climate change. Factors that influence decisions and behaviour at the individual level have received significantly less attention.[2] However, individual behaviour is important[3] and ultimately drives societal change via adoption of technologies and support for policies. Unless we examine how people perceive climate change, what factors influence mitigation and adaptation behaviours, and how climate change will affect human well-being, we will be unable to respond effectively as a society. Too much policy is based on oversimplifications and erroneous assumptions about these factors, such as that informing individuals about climate change science is sufficient to affect decisions and behaviours.[4,5,6] Ignoring insights from psychological research can handicap progress towards a low-carbon, sustainable future.[7,8]

Here, we review the unique contribution that a psychological approach[9,10] can provide for understanding and addressing climate change, complementing work from other disciplines. Psychological research employs rigorous empirical methods to investigate individual perceptions and cognitions, individual and collective behaviours, and psychological well-being related to climate change. This research incorporates physiological, cognitive, affective, and interpersonal processes, as well as factors in individuals' social, cultural, biophysical, and engineered environments.[5,11] Some of the resulting insights are surprising or counterintuitive;

in other instances, they serve as a reminder to consider factors that may be overlooked. In this paper we focus on three key areas in which psychological research contributes to the climate change literature: 1) public perceptions of climate change; 2) human behavioural drivers of climate change and mitigation responses; and 3) impacts of climate change on human well-being and adaptation responses (Fig. 1). In each case, we review existing research and recommend key directions for future research. We conclude by considering the ways that psychologists can contribute to multi- and interdisciplinary teams to understand and inform climate change mitigation and adaptation.

Understanding public perceptions of climate change

There is great variability in public understanding of climate change and willingness to support action. Counterintuitively, public acknowledgement of the problem is not purely a function of education or knowledge and has not grown along with the scientific consensus.[12,13] It is important to understand why people do or do not endorse the need to address climate change, especially in countries with relatively low levels of agreement.[14,15] Psychological research shows that much diversity in understanding can be attributed not to what we learn about climate change but to how, and from whom, we learn: the sources of our information and how we evaluate those sources. In general, direct experiences of events related to climate change are more powerful than second-hand information in informing attitudes and behaviour,[16,17] which in part explains why local, observable conditions (including environmental risks, such as air pollution) typically influence concerns more than distant ones, like climate change.[18] Yet global warming beliefs also influence assessment of changes in local climatic conditions: for example, national survey data from the US revealed that, compared to people

who accepted the reality of global warming, people who believed that global warming was not happening were less likely to remember (accurately) that they had experienced a warmer-than-usual summer during the previous year.[19] This shows that the effect of experience on perceptions of climate change is moderated by other factors (Fig. 2). Thus, one must also look to other sources of influence on climate change related beliefs, attitudes, and behaviours.

Climate change communication. Psychological research highlights that, for messages to be attended and responded to, sources must be trusted and attractive; the message relevant, clear and coherent; and the audience motivated and able to act.[20] This is also evident from the growing literature on persuasive communication about climate change.[21] In many countries, the primary source of information on climate change is the mass media.[18] Where media outlets are associated with differing ideologies or communities of interest and present different views, people tend to preferentially accept the views of trusted and attitudinally reinforcing information sources, while other information sources are ignored and discounted. Partly for this reason, social and political identities are critical determinants of climate change perceptions in many countries.[15] National surveys show an increasing divergence between voters on the left and those on the right in the US[22] and to some extent in the UK;[23] individuals with right-of-center politics or with belief systems that emphasize individual autonomy rather than collective ties are most rejecting of mainstream climate science, less likely to engage in behavioural change, and less likely to support policies for action to limit climate change.[24] Indeed, at least in the US and UK, acceptance versus rejection of climate science seems to be linked far more to political ideology and worldview than to any other factor, and that polarization has increased over time.[25] Regression analyses of survey data show that political

party identification is a major predictor of climate change beliefs, even when controlling for ideology,[26] demonstrating that this is a function of group identity and not just of a shared belief system. However, although political polarization and significant skepticism are apparent in countries where there are interest-based efforts to shape public opinion (i.e., by conservative think tanks and media outlets[22,27]), other regions, such as Latin America and sub-Saharan Africa, show higher and growing levels of concern with little apparent skepticism or ideological polarization.[12] These findings critically underscore the importance of attending to the social processes that direct people toward particular sources of information, and considering how to provide information through multiple channels to reach different audiences.[28]

Motivational processes and cognitive biases. The discomfort due to the profound political, ethical and social implications of climatic change can lead climate change messages to be rejected. Political and other identities do more than suggest which information sources are trustworthy; research shows that they also provide people with the mental models that shape their understandings and motivate particular interpretations of the information that is received, which is filtered through lenses of values and identities.[29] Rejection of the scientific consensus can be linked to the perceived threat to one's current way of life that is associated with policies aimed to combat climate change.[14] For example, Americans who read an article that attributed climate change to China's excess energy use were more likely to attribute climate change to human behaviour than those who read an article attributing it to American excess energy use.[30] These motivational biases can work in concert with biases in information processing to create resistance to climate change information. The 'availability heuristic' in human cognition suggests that risk perceptions will be influenced by recent or common events that are more

cognitively 'available'.[31] Survey and experimental evidence shows that concern about climate change increases with current media coverage, sometimes coupled with direct experience such as fluctuations in local weather conditions.[32,33] Tendencies to be overly optimistic about the future, and to focus on the present rather than the future, are other biases that threaten people's ability and motivation to respond in effective ways to long-term, gradually developing environmental changes and related threats. Ample research suggests that perceptions of risk are heavily conditioned by mental shortcuts, emotions, environmental cues, social experiences and contextual factors.[34]

Misperceptions tend to persist because individuals interpret messages in light of prior experience, beliefs, values and expectations and to seek out information that confirms rather than tests their beliefs.[35] In one study, people who accepted or rejected the idea of climate change were asked to read two articles, one presenting mainstream climate science and the other a climate skeptic view. The rejecters perceived the skeptical article as more reliable than the nonskeptical article, whereas the reverse was found for the accepters; importantly, both groups reported becoming more convinced of their views.[36] Even misperceptions about climate change that are not value-laden – such as conflation with ozone depletion – endure if they are not directly counteracted because new information is fitted into existing conceptual frameworks.[37]

Future Research Directions

1. This evidence indicates a need to further examine relevant social identities, in order to better understand how beliefs about climate change have become ideologically polarized in certain

populations, and to develop educational interventions and communications tailored to the values and possible misperceptions of specific audiences.[38]

2. We need more research into the ways known information-processing biases affect responses to climate change. For example, discounting of the future may be less prominent in the environmental domain than elsewhere.[39,40]

Human behavioural drivers of climate change and mitigation responses

Analyses of household emissions as drivers of climate change, and of ways to reduce them, have traditionally focused on consumer technologies that use fossil fuels (e.g., building, automotive, and appliance technologies), technologies that would reduce this usage, and the economic forces affecting their adoption and use. Psychological concepts complement such analyses by examining non-economic predictors of adoption and use of these technologies, including cognitive and motivational factors such as values and beliefs, and social factors such as norms and public commitments, as well as features of programs intended to influence behaviour such as the type of information and forms of financial incentives provided. Research shows that these factors differ in relative importance for different types of behaviour, such as household adoption, use, and maintenance of consumer technologies, and behaviour in different domains.[5,6,41,42,43] With some types of behaviour, research has shown that intrinsic factors (e.g. values) are often more important than extrinsic ones (e.g. incentives).[5,41,44,45] It is important to recognize that many behavioural decisions are influenced by factors outside of conscious awareness[46] (Fig. 3). To the extent that behavioural choices are made in conscious response to the threat of climate change, the factors discussed in the previous section on

perceptions will be relevant; however, a great deal of environmentally-relevant behaviour is driven by forces such as norms, habits, and default options.

Reducing use of energy-consuming technologies. Important behavioural choices in technology use include the use of private automobiles versus other travel modes; levels of home heating and cooling; and usage of household appliances, including time of use of electricity. Behavioural analyses of such choices have been conducted since the 1970s, and have developed in sophistication over time alongside improved technologies for monitoring and delivering energy-use information to consumers, such as "smart" meters and in-vehicle consumption feedback devices. Information in the form of feedback on one's energy use relative to past performance or other people's performance has successfully reduced energy use in some cases[44,47,48] but it can backfire. Field experiments in which people are randomly assigned to receive feedback about their neighbours' consumption show that people may increase their energy use when the feedback reveals that they are outperforming others,[49] indicating the important role of social norms in moderating the impact of feedback upon behaviour.

Policies seek to influence consumer decisions about technology use by providing information, for example, via energy efficiency labels that make consumers aware of the fossil energy used by the appliance or embodied in the supply chains of what they purchase.[50] Psychological studies can improve the effectiveness of this approach,[6,51] for example by determining whether tying information about energy use to environmental or financial motives influences its effectiveness. Overall, however, research shows that information has greater impacts on behaviour if it is tailored to consumers' personal situations and resonates with their

important values.[52] Social influence approaches (e.g. making a public commitment or observing

role models) can also be influential in reducing emissions.[44,47] The 'block leader' approach,

which capitalizes on social networks by engaging volunteers in a particular neighbourhood to

deliver the interventions, inform neighbours on specific issues, and offer assistance in realizing

the intended changes, can be particularly effective.[44] In general, people are more likely to

engage in energy use reduction when they have strong self-transcendence values (that is values

that stress protecting the natural environment or causes such as social justice), self-identify as a

pro-environmental person, are aware of (energy-related) problems caused by their behaviour,

feel morally obliged to engage in energy-saving behaviours, have favorable attitudes towards

energy savings, feel capable of engaging in these behaviours, and have a social context that

supports their behaviours.[5,41,44,45]

Inducing investment in low-emissions technologies. Research shows that households

seriously underinvest in low- or zero-carbon technologies[3] compared to what would lower their

overall costs—what has been called the energy-efficiency gap.[53,54] Much of this gap is due to

non-financial factors that can be altered to increase consumer responsiveness to incentives.

For example, response to incentive programs for home insulation implemented by different

organizations has varied by a factor of 10 or more, depending on trust in the organizations,

approaches to marketing, and program implementation, including levels of effort required of

the household to take advantage of the incentives.[55] Program design must attend carefully to

processes of thinking and decision making within the target households.[56,57] Although financial

incentives can be influential, attention to these cognitive processes can suggest complements

to existing or new financial incentives, and are especially important when the latter are not an option.[58]

Psychological research has been particularly useful in revealing the limitations of financial inducements, whose effects often last only as long as the incentives are in place.[47] When the goal is a one-time technology purchase, this may be sufficient. However, focusing individuals' attention on possible financial gain may reduce their engagement in subsequent sustainable actions, as their emphasis shifts from doing good to gaining a profit.[59] In one field experiment, people responded less strongly to an economic appeal (to get their tire pressure checked) than to a nature-focused or even a neutral appeal.[52] Research shows that nonfinancial factors, such as the symbolic value of a behaviour as an expression of identity or status and beneficial effects to the environment, may have greater effects on adoption and on use than prices and costs for some kinds of low-emissions technology.[60,61] This is particularly true when possible financial benefits are small relative to the effort needed to gain them.[52,62]

Public acceptance of technologies and policies. Psychological research informs understanding of "not in my back yard" (NIMBY) responses [63] to nearby energy projects, which lead individuals and communities to oppose local development of wind farms or oil and gas extraction.[64] People form strong emotional bonds with a place (place attachments) and may develop a sense of self that is tied to the place (place identities) .[65] Research shows that responses to a range of energy technologies, including offshore wind farms [66] and power lines,[67] are rooted in people-place bonds in complex ways, so that technologies perceived to maintain or enhance the distinctive qualities of a place are supported by individuals with strong place attachments and identities whereas technologies perceived to threaten those qualities are

opposed. Thus renewable energy sources are evaluated not just in terms of objective costs and benefits but also in terms of their perceived fit with the local (natural and socially-defined) environment. Responses are also explained by values, levels of trust in project developers, and the perceived fairness of both decision-making procedures and how costs and benefits are distributed.[64,67]

One of the most important ways in which individuals can have an impact is through collective action, such as support for public policies and social movements to reduce greenhouse gases at larger scales through participating in demonstrations, making financial contributions to social movements, signing petitions, and voting.[43] Studies suggest that policies that reward people for energy-saving behaviour and adoption of energy-efficient technologies are more acceptable than policies punishing high energy use or promoting curtailment behaviour.[68] Policy acceptance is affected by beliefs about the seriousness of relevant environmental problems, beliefs about the personal and environmental consequences of policies, the extent to which people think they can help reduce these problems, and their feelings of moral obligation to help reduce these problems.[69,70] People evaluate policies positively or negatively depending on how much they trust the responsible institutions and on how they believe the policies will affect important values. Perceived justice and fairness, affected by both policy attributes and individual perceptions, can strongly affect responses to policies;[69,71] in some populations, policies are evaluated as more acceptable and fair when people believe that future generations, nature and the environment are protected (reflecting environmental justice), and when everybody would be equally affected.[72]

Future Research Directions

1. Research could further study the role of non-financial factors influencing high-impact household behaviours that could mitigate climate change, particularly the adoption of environmentally-friendly technologies, and the ways in which these factors interact with monetary inducements.

2. More work is needed by psychologists in collaboration with political scientists and sociologists to illuminate the gap between individual action and societal impact by identifying the circumstances in which individuals take action, alone or collectively, that can bring about large-scale policy changes.

Impacts on Human Well-being and Adaptation Responses

Human behavioural changes are necessary not only to mitigate the effects of climate change but also to adapt to them. Climate change will affect psychological health and well-being in ways that are often overlooked. Abrupt environmental events, experienced as natural disasters, will have direct impacts on mental health and quality of life; in addition, indirect impacts will result from gradually evolving and often cumulative environmental stresses on livelihoods, economic opportunity, and sociocultural conditions[73,74] (Fig. 4). Awareness of these impacts can encourage public engagement and inform attempts to encourage effective adaptations that minimize negative effects and capitalize on possibilities for more positive changes.

Direct and indirect impacts. Climate change is likely to increase the frequency, extent, or intensity of extreme weather events such as heat waves, drought, and flooding,[75] producing many social stresses.[76] Due to traumatic experiences, loss of loved ones, economic disruption, etc., abrupt disaster events can lead to anxiety, depression, post-traumatic stress disorder, and

other negative psychological outcomes.[77,78] Such events also disrupt the social and institutional

systems that promote health and well-being, including informal social networks and organized

mental health services, although disasters sometimes increase social solidarity as communities

come together to address the consequences of disasters. Negative impacts are more likely for

those in the developing world and those who are economically or socially marginalized,

exacerbating inequality and resentment and increasing the likelihood of individual and societal

conflict.[79,80] Slowly evolving changes in environmental conditions will also have significant

impacts. Gradual increases in temperature and shifts in rainfall patterns will affect livelihood

opportunities and local economies, placing many at risk of economic loss, food insecurity, and

the psychological impacts that result. Both gradual and abrupt environmental changes can

result in migrations and forced displacement,[81] which can lead to a range of social and

psychological impacts, including feelings of anxiety, grief and loss, and disruption to networks

of support and belonging.[82] Policy makers often ignore these potential impacts[83] although there

is increasing attention to it among the military. (See, for example, the 2014 Climate Change

Adaptation Roadmap from the U.S. Department of Defense, available at

http://www.acq.osd.mil/ie/download/CCARprint.pdf).

   Adaptation responses. People will need to alter their behaviour to adapt to an altered

climate. There has been extensive consideration of the economic factors that affect the

capacity of individuals to adapt their livelihoods and lifestyles. Recent evidence suggests that

psychological variables are also important.[84,85] As was true for perceptions and for behaviours

driving climate change, there is a social component to this process. For example, farmers who

discuss climate change and agricultural innovations with their peers are more likely to innovate

in their own cultivation practices .[86] Because many resources are managed collectively, and are therefore subject to conflicts over short-term individual interests versus long-term collective interests,[87] adaptation to climate change in some ways constitutes a social dilemma.[88] A wide body of psychological research describes precursors to and conditions for cooperative behaviour, such as a trust and a sense of collective identity; this research is highly relevant here and can be applied to encourage effective adaptation, e.g. by providing those who manage a shared resource opportunities to meet as a group and discuss their shared concerns.[89]

Societal preparations for disasters can help to reduce negative impacts. However, it is critical to consider how individuals understand and act on information about risk, which, as described earlier, is heavily filtered through social psychological processes [90] and mental models.[28] People typically underestimate the likelihood of being affected by disaster events, and therefore tend to under-react rather than over-react.[91] Community preparedness and response to natural disasters can be improved by considering these processes in the design of education and messaging; for example, by accompanying risk information with information about the specific personal implications of the risk and about specific actions to address the risk.[92,93] The social and geographical context is also important. Strong place-based identities have been shown to impede successful adaptation, reducing willingness to learn new skills or to contemplate relocation.[94]

Future Research Directions

1. More research is needed on the impacts of climate change on human well-being and to the possible impacts of environmental degradation on place attachment and identity.

2. Compared to the focus on mitigation, psychological researchers have given relatively little attention to climate change adaptation responses. The possibilities for positive adaptations, and ways to encourage them, should be further explored.[95]

Promoting Interdisciplinary Collaborations

Given the complexity of global climate change and the many factors involved, interdisciplinary collaboration is needed to research human interactions with climate. Psychological research can contribute important information concerning individual and household level factors in socio-ecological systems. Additionally, psychology has been called a "hub" discipline: a field whose origins in physics, physiology, and philosophy allow it to straddle the lines between social and natural science and humanities. This may put it in a position to facilitate interdisciplinary collaborations more generally. Finally, the psychological perspective can also provide insight about organizational dynamics that can enhance the effective functioning of such multidisciplinary teams. To work effectively, these teams need to successfully confront challenges that may include defining the problem, explaining the relevant causal processes, and describing a solution or outcome in ways that are acceptable and comprehensible across disciplinary boundaries. Psychologists have examined the challenges and successes of multidisciplinary research teams and recommended processes to meet these challenges, including regular meetings of the whole team, time built in for team members to become familiar with each others' disciplinary approaches and vocabulary, and a clear organization to facilitate the complex coordination involved.[96] Several recent papers[7,97] make suggestions for both organizations and researchers to improve their integration of social science and humanities into climate change–related research, describing some of the

translational activities and institutional changes that are necessary. This may also require broader changes in the ways in which scientific research is organized and evaluated.

<u>Future Research Directions</u>

1. Researchers in organizational psychology and group processes should study the unique challenges faced by multidisciplinary teams trained in different methodologies, assumptions, and vocabularies in order to develop recommendations for effective practice.

2. Researchers in educational psychology should evaluate the relative merits of emerging training structures such as multidisciplinary degree programs and workshops as compared to traditional monodisciplinary programs.

Conclusion

The psychological perspective is uniquely placed to understand individual and household level factors in socio-ecological systems, and can provide important input towards a multi-level approach integrating natural sciences, social sciences and the humanities. Researchers concerned with understanding and responding to climate change typically acknowledge that multiple disciplinary approaches are necessary, but do not always act on this recognition. It is time to develop effective ways to integrate psychological research into these efforts. To successfully communicate about risk, change behaviours that contribute to climate change, understand the impacts of climate change, and facilitate adaptation, it is necessary to consider individual capabilities, cognitive processes, biases, values, beliefs, norms, identities, and social relationships, and to integrate understanding at this level into broader understanding of human interactions with a changing climate.

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Figure Legends

Fig. 1 A schematic model of the role of psychological processes in climate change.
The bi-directional arrow linking climate change to behaviour and the links between perceptions, behaviour, and well-being highlight the need to attend to individual-level processes.

Fig. 2 A simplified model of the way people perceive climate change. Cognitive and motivational biases moderate the relationship between direct and indirect experiences, on the one hand, and perceptions, on the other.

Fig. 3 Influences on climate-relevant behaviour. Principal influences on behaviour will differ depending on whether the behavioural decision is mindful or automatic.

Fig. 4 Mechanisms of climate change impact on human well-being.
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