CAMBRIDGE
Cambridge University Press
978-1-108-94867-8 — Climate Change and Human Behavior
Andreas Miles-Novelo , Craig A. Anderson
Excerpt
More Information

1 Introduction

Although one may be inclined to view climate change as the impending demolition of Earth, we eschew such a pessimistic view. Instead, we adopt the view espoused by the famous British science-fiction author Douglas Adams and advise everyone, "don't panic." Although Adams would suggest that we each carry a towel to help combat our individual and collective anxiety, there is perhaps a more approachable alternative for those of us looking for hope – and that is to become informed of the problem(s) and potential solutions at hand and to spread awareness of these to others. A later section of this Element outlines how human psychology can be used to combat climate change and its impending threats, but for now, readers should note that no matter how dire or urgent the circumstances may seem (and they are, indeed, both dire *and* urgent), remember that even though human nature has gotten us here, human ingenuity can help heal our planet while making it safer and more humane for its inhabitants (Homo sapiens and other species alike).

First, we highlight the urgency with which humans must act. We devote little time explaining *why* or *how* scientists know that rapid global warming is indeed happening, that it is man-made, and that the consequences are dire. Indeed, spending time defending the science of climate change may be part of why people, in general, haven't gotten over the hurdle of fully embracing rapid climate change as an existential threat. Social psychology has routinely shown that even if people can view an observable truth, if there is any attention given to the denial of it, or if there is a collective action to ignore or alter the truth, then humans will do so. A famous social psychology study (Asch, 1952/1972) looked at undergraduates giving feedback on the length of lines projected in a classroom. Asch demonstrated that by having all but one of the undergraduates in the room (i.e., confederates of the experimenter as "fake students" and one "real" student who was the participant) suggest that they thought a line that was clearly shorter than other lines in a group was not, many real participants would side with the incorrect but overwhelming majority. Similarly, much of social psychology has been devoted to studying the whys and hows of getting people to behave in ways that contradict their own beliefs and values and how group pressure and misinformation can distort perception and action in the most extreme ways (e.g., the Holocaust).

Understanding these basic effects of group dynamics makes it particularly alarming to learn of the amount of attention that climate change denialists receive. A recent study in *Nature Communications* reported that prominent climate change denialists received almost 50 percent *more* media coverage than top-tier climate scientists (Peterson, Vincent, & Westerling, 2019).

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-108-94867-8 — Climate Change and Human Behavior
Andreas Miles-Novelo , Craig A. Anderson
Excerpt
More Information

Although one may be swayed by a surface level defense of "well, both sides of an argument should receive equal representation," most thoughtful people (including some at the British Broadcasting Corporation) would agree that public news presentations of factual information: 1) should not give equal time to science denialists and conspiracy theorists as is given to actual expert climate scientists; and 2) the true scientific experts should be given much more media time and space but, further, 3) that this is not an issue of "both sides." Climate change is happening, and people (and governments) must act decisively and assertively to adequately address this crisis. Denial of not only climate change, but also of its severity and urgency, is simply a denial of the scientific truth; it is not a "different perspective" or a different interpretation of it. Psychological research has found that by positioning a claim that is false (such as climate change denialists do) with any sort of validity makes people more inclined to believe that there could be truth to the statements, even if this is later corrected by scientific fact. Indeed, even a purely hypothetical theory about how the world works, that is, a theory that the person knows they made up as part of a thought exercise, becomes resistant to change (e.g., Anderson & Kellam, 1992).

The immediacy of the threat of climate change cannot be overstated. One common threshold that scientists and most governments worldwide agreed on is the need to keep the global temperature rise under 1.5°C/2.7°F, and that to do so, we would need to reduce carbon emissions by 45–50 percent by 2030 and to achieve "net zero" emissions by 2050 (see Kyoto and Paris accords). However, not only do governing bodies keep missing these carbon emissions targets, they are, instead, blowing by them. Recent projections have noted that we have *already* failed to take the appropriate political and societal steps to achieve this goal (Pielke, 2019). New targets have been set, with many experts pleading to keep the temperature increase under 2 or 3°C (3.6/5.4°F). However, there is reason to believe that these goals may now be unattainable.

A recent report from David Spratt and Ian Dunlop (2018) details the possible outcome of this clear failure to meet the goals set by previous political gatherings. In their report, they detail how the 2015 *Paris Agreement*, while ambitious and productive, failed to account for all the environmental factors at play. They note that:

With the commitments by nations to the 2015 Paris Agreement, the current path of warming is 3°C or more by 2100. But this figure does not include "long-term" carbon-cycle feedbacks, which are materially relevant now and in the near future due to the unprecedented rate at which human activity is perturbing the climate system. Taking these into account, the Paris path would lead to around 5°C of warming by 2100. (p. 6)

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-108-94867-8 — Climate Change and Human Behavior
Andreas Miles-Novelo , Craig A. Anderson
Excerpt
More Information

A 5°C/9°F increase is something beyond any current mainstream rhetoric from nonscientists. Even if humans keep the temperature increase below 5°C/9°F, existential concern for the survival of our species starts well before then. The World Bank noted that a 4°C/7.2°F increase would be "beyond adaptation" (Spratt & Dunlop, 2018; Spratt, Dunlop & Barrie, 2019). More terrifying, as Spratt et al., 2019 note, is the idea of a runaway "hothouse Earth scenario," which they say could start at 2°C or even lower.

Spratt et al., 2019 describe this "hothouse Earth scenario" as "system feedbacks and their mutual interaction could drive the Earth system climate to a point of no return, whereby further warming would become self-sustaining." At this juncture, there is nothing we as humans could do to stop the temperature from climbing ever higher and for the planet to degrade past the point of sustainability.

So, what is being done to curb this horrifying reality? Most recently, American President Joe Biden noted in his climate plan a goal to invest almost $2 trillion dollars into cutting all carbon emissions by 2050. However, if the above scenario and projections are to be believed, cutting emissions by 2050 will simply be too late. Spratt et al., 2019 note that, at our current pace, we could reach a 1.6°C/2.9°F increase in global temperature by 2030 and that by 2050 we could already surpass 2.4°C, with a high likelihood of already reaching 3–4°C by 2050.

If this happens, the impact on human civilization would be devastating. Spratt et al., 2019 outline the likely consequences on Earth in 2050 and beyond. By 2050 sea-level rise would already surpass 0.5 meters (1.64 feet); by 2100, the sea-level rise would reach at least two to three meters, and possibly as high as twenty-five meters. By 2050, 35 percent of the land surface on the globe will be subjected to twenty or more days of "lethal heat conditions, beyond the threshold for human survivability"; this would affect more than 55 percent of the global population. Both the Jet Stream and the Gulf Stream would become severely destabilized, throwing off weather patterns necessary for basic ecological systems in Europe and Asia. North America would continue to experience increases in devastating droughts, wildfires, and other environmental disasters. Mexico and Central America would see annual rainfall decreases of 50 percent, allowing for semi-permanent El Niño conditions. Arctic ice would be all but gone, the Amazon region completely decimated, and coral reefs extinct. Water shortages would become the new normal, and large swaths of current tropical climates would become unfarmable and uninhabitable.

This all goes without saying that even if humans miraculously put a stopper in the drastic increase in global temperature, irreversible and incomprehensible damage has already been done. Even if we keep warming to around 2°C/3.6°F,

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-108-94867-8 — Climate Change and Human Behavior
Andreas Miles-Novelo , Craig A. Anderson
Excerpt
More Information

more than 1 billion people could become displaced (Miles-Novelo & Anderson, 2019; Spratt et al., 2019; Wariaro & Hoopert, 2018). Droughts, wildfires, water shortages, crop failures, and severe tropical weather events are already on the rise and becoming more frequent and extreme. We already have millions of species, including both plants and animals, on the brink of extinction, and many of our essential ecosystems are in extreme danger.

Even if we can save our planet, and our species, from the most extreme threats of rapid climate change, it cannot be done without radical changes to our society and to our psychology. These sudden climate changes are going to rapidly alter the way humans behave and interact with others. It will affect cognitive, emotion, and decision-making systems and put many countries in politically dangerous situations requiring the accommodation of massive numbers of displaced people.

2 The Climate Change–Violence Model

One important question for behavioral scientists is this: Can we predict, explain, and modify important changes in behaviors concerning the climate change crisis? Further, can the behavioral sciences be usefully employed to combat both climate change and the concomitant harmful effects on human behavior?

The Climate Change–Violence Model (see Figure 1; also refer to Miles-Novelo & Anderson, 2019)[1] highlights how rapid climate change would

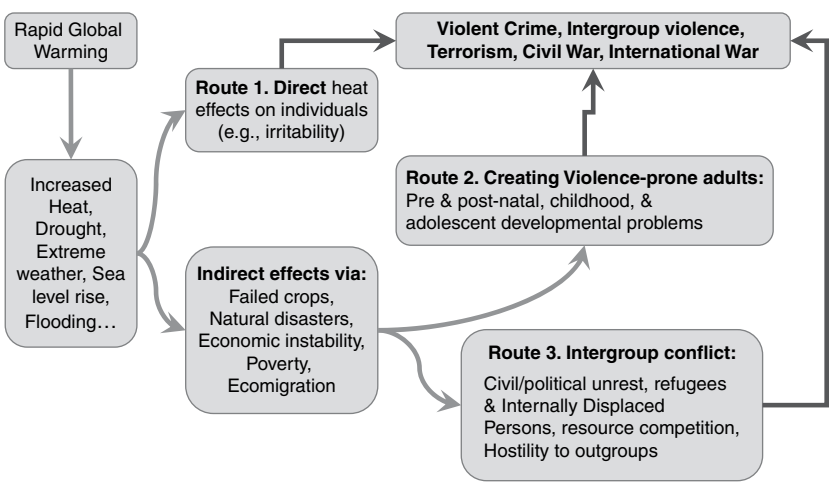

Figure 1 How rapid climate change increases violence

[1] Our team first addressed these issues in Anderson & DeLisi, 2011.

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-108-94867-8 — Climate Change and Human Behavior
Andreas Miles-Novelo , Craig A. Anderson
Excerpt
More Information

influence human aggression and violence. The model demonstrates that there are three major pathways through which rapid climate change will increase human aggression and violence through one direct and two indirect mechanisms. The direct mechanism is known as "the heat effect." This is the well-replicated finding that as people become "uncomfortably" hot, they become more irritable, perceive other people's behavior as more threatening and aggressive, think more aggressively, and behave more violently (Anderson, 2001).

The indirect mechanisms (from things such as failed crops, water shortages, mass migration, and political instability) stem from (a) developmental factors that will increase the likelihood of children becoming violence-prone adolescents and adults (e.g., malnourishment), and (b) factors that increase intergroup conflicts (e.g., mass migration).

In this Element, we broaden the model in beyond human aggression/violence, although that remains the most important behavioral impact. Rapid global warming affects behavior through three pathways: a direct path (how the environment affects individuals), a developmental path (water and food shortages, growing up in disaster-ridden areas), and a group-level path (fighting over resources, the acceptance or rejection of migrants). Using this framework, we consider previously established findings from psychology, as well as other fields such as anthropology, history, political science, and sociology to demonstrate the massive change humans will experience. We also use past research to show how societies can take effective and drastic action in the immediate future, as well as how to change people's attitudes about climate change, increase awareness of the threat that our species faces, and increase effective behaviors that reduce speed and amount of global warming, and decrease the expected surge in aggressive and violent behavior.

Definitions and Overview of Aggression and Violence

As behavioral scientists, we want to make sure that readers understand the scientific meanings of the terms we use, as they can be much more specific than the general public's use of these terms. We define "aggression" as *behavior that is intended to harm another human who wishes to avoid that harm*. This can come in many forms, including physical (such as punching someone), verbal (shouting a racial slur at someone), or relational (spreading false rumors about someone). "Violence" is defined as a *severe form of physical aggression*, behaviors that, if successfully completed, are likely to necessitate medical attention. Psychologists view aggressive behaviors as existing on a continuum, with violence being at the most extreme end of the aggression continuum. Decades of research support this continuum view, which benefits

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-108-94867-8 — Climate Change and Human Behavior
Andreas Miles-Novelo , Craig A. Anderson
Excerpt
More Information

from the ability to extract reasonably accurate predictions about violence from studies of less extreme forms of aggression.

Direct and Indirect Pathways

Our original model of climate change's effect on aggression and violence identified mechanisms by which rapid climate change will make people (and groups of people) behave violently and showed how those mechanisms interact with one another. It is helpful to recognize that many factors affect the likelihood of behaving aggressively or violently. There are hundreds (maybe thousands) of variables that influence how people behave in any given way in any given context. Psychologists often attempt to identify variables that have the biggest impact on specific harmful behaviors, variables called "risk factors." "Risk factors" in psychology are typically those variables known to increase the odds of someone acting in a particular harmful manner, in this case, those that increase aggression and violence. A thorough knowledge of risk factors for violence and of the likely consequences of rapid climate change on human environments allowed an examination of where these two sets of factors coincide.

Risk factors for aggression and violence occur at multiple system levels, including biological (e.g., genetic, pre- and postnatal nutrition), familial (e.g., structure, income, parenting style), and personality-level risk factors. Social psychologists (like us) also investigate group-level effects (e.g., intergroup conflict), and our background readings in history, sociology, and political psychology also make it relatively easy to include factors that are normally discussed by sociologists and other social science fields (see Pettigrew, 2021, for an excellent review of this multilevel perspective – which he calls "contextual social psychology" – in prejudice, racism, and conflict).

The basic question addressed in Figure 1 is this: In what ways does rapid global warming increase the frequency of and/or intensity to which human populations are exposed to known violence risk factors at any level of science? Further, are there ways in which global warming might increase exposure to violence risk factors or decrease exposure to known protective factors (and vice versa)?

We posited that this would happen both on an individual level (e.g., many individuals will be exposed to more "risk factors" that are likely to make them violent and aggressive) as well as on a group level (e.g., conflicts over water, land). Both types will be exacerbated as the climate continues to rapidly warm and to become more unstable.

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-108-94867-8 — Climate Change and Human Behavior
Andreas Miles-Novelo , Craig A. Anderson
Excerpt
More Information

The direct path that leads to increased violence and aggression is easy to observe and describe: the "direct" effect of increased heat stress on violent and aggressive behavior. This path is further examined later, but for now, simply note that there is excellent psychological and sociological evidence that when people are exposed to increased heat, they act more aggressively and violently.

The indirect paths manifest in two very different areas: individual human development (conception to adulthood) and intergroup interactions (small groups to nations). We call these pathways "indirect" because climate change itself is directly causing environmental events that *then* affect the growing individual and groups, rather than by having a direct causal impact on their physiology and psychology.

Developmentally, the changing climate can drastically alter aspects of human environments that are integral to healthy development. For example, increased droughts and famine increase chronic dehydration and malnourishment, both prenatally and postnatally, both risk factors for later aggression and violence in adolescence/adulthood. Weather disasters often pollute water and food supplies, making them less safe and potentially harmful to consume, and can also destroy communities and cause families to be broken up due to migration and forced relocation. Unstable living environments and broken families also are known risk factors for violence; they also have effects on future social perceptions, beliefs, and actions – such as making the acceptance of violent and extremist ideologies more likely.

At the highest level, these effects of climate change will increase the likelihood of group conflict. Mass migration resulting from climate change has already manifested in adverse outcomes for populations of people who have had to relocate, such as the Syrian civil war and refugee crisis (Miles-Novelo & Anderson, 2019). Additionally, increasingly popular far-right political ideologies (especially in Europe and North America) often are focused on migrants and on how they are not wanted in "our" country. As discussed earlier, rapid climate change already has forced mass ecomigrations, and soon, hundreds of millions of people will be forced to move as their homes are destroyed or made unlivable. If such anti-immigrant rhetoric persists and grows, resulting in even more harmful attitudes and behaviors toward immigrants, the ramifications and outlook for those needing a new home are potentially very dangerous. This has been seen worldwide, where aggressive stances towards immigrants are not limited to new immigrants but extend to current minority citizens as well.

Humans are, by nature, social creatures but they are also especially protective of their ingroups. In a world where resources become increasingly scarce and the physical environment becomes increasingly unstable, lashing out at outgroups is a tempting and probable outcome, one that could come at the expense

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-108-94867-8 — Climate Change and Human Behavior
Andreas Miles-Novelo , Craig A. Anderson
Excerpt
More Information

of millions of lives. Civil unrest and conflict will continue to grow as our world continues to slide into chaos, especially if there is not a strong and concentrated effort to be proactive in combating both climate change itself as well as harmful intergroup attitudes and behaviors. To combat this, a major effort must be made in the implementation of public policies designed to reduce prejudice and intergroup conflict. If we do not do so, violence such as that witnessed over the water shortages in India offers a harrowing warning sign for what is to come.

Although much of this Element explores the impact of climate change on human risk factors for violence, it delves more deeply than does past psychological research on other global warming influences on humans. For instance, heat stress doesn't only increase violent thoughts, emotions, and behaviors, it also has powerful effects on brain physiology. Developmental impacts of climate change are also broader than just increasing risk factors for violence, as they will affect overall mental health, well-being, intelligence, reproduction, and almost every other human behavior we can imagine. Group-level impacts can be expanded as well, as things such as housing crises and increased participation and sympathy for extremist organizations will continue to escalate.

3 The Direct Effects of Heat On Cognition and Behavior: Route 1

Human brains and bodies are incredibly sensitive to the environment. This is obvious. But as scientists learn about the human brain, the more we discover about how the environment can greatly alter brain development and also in how our environments change our behavior. This section describes a number of ways that heat itself is a remarkable brain-changing agent. It can make us more likely to become aggressive, become more reactive and less thoughtful in ongoing social interactions, can reduce cognitive capacities, increase stress, and even cause severe brain damage.

We suspect that these sorts of direct effect might seem minuscule relative to the overall threat of climate change. However, recall our previous elaboration on risk factors on human behavior, and think about how these effects will play a role in larger scale stressors, such as mass migration. These direct effects on our brains and behaviors certainly increase the risk factors for several adverse outcomes, and when we talk about some of the larger scale impacts of climate change on societies worldwide, the direct heat effects on individuals add to the severity of some of the more "indirect" societal impacts. Additionally, there is little one can do as mitigation of some of these direct effects, as the climate is simply going to become hotter in most (and maybe all) parts of the world. Earth will have hotter summers, more

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-108-94867-8 — Climate Change and Human Behavior
Andreas Miles-Novelo , Craig A. Anderson
Excerpt
More Information

people will experience heat exhaustion and stress, and there will be days that are simply too hot for our bodies to adapt to. This will happen and is happening now, so it is important to start with an understanding of how heat affects the brain and body.

The Effects of Heat On the Brain and Brain Function

Extreme heat effects on the brain carry severe consequences. It starts simply as our bodies beginning to feel tired and sluggish. As the body heats up, the brain recognizes this homeostatic imbalance and seeks to cool us down. One way of doing so is by literally forcing our body to slow down and run at a suboptimal capacity, especially if it detects that you are running low on survival resources (water, calories, etc.). Our brain seeks to find a way to achieve a state that is comfortable and in which it isn't consuming many of these resources that it may perceive as running low on or not readily available. This is your body telling you to "slow down," to find a more comfortable environment, and to replenish the resources it needs for survival.

This, of course, is coupled with other physiological changes such as perspiring, rapid heart rate, and increased oxygen flow (Kovats et al., 2008). By doing these things, the body (and brain) will cool down and be able to combat the overheating that is so dangerous to the brain. But perspiration and slowing down physical activities are often insufficient. If the body cannot adequately cool down, heat exhaustion begins to occur. The body continues to lose proper motor function, the heart continues to try to feed blood to the sweat glands, and one's respiration rate increases in part to help the heart pump blood more rapidly. For these reasons, physicians suggest sitting or lying down and to take deep breaths when one is beginning to feel heat exhaustion. One recent study (Massen, Dusch, Eldakar, & Gallup, 2014) showed that yawning could help people cope with overheating, as it forces the body to slow down and intake oxygen more efficiently, as well as slowing our heart rate. If the body cannot be properly cooled, it then begins a cycle that sends the brain and body into a frenzy (Kovats & Hajat, 2008).

What is happening neurologically is mostly determined by the hypothalamus (Boulant, 1981), which is the primary brain structure involved in thermoregulation. This part of the brain triggers the above-mentioned mechanisms used to cool off (or to heat up when too cold – such as shivering). While this is occurring, the brain is diverting resources from other areas of the brain and body to try to cool itself as quickly as possible. One side effect is that other parts of the brain are not running at full capacity. Motor functions deteriorate (triggering feeling tired and sluggish), effortful cognitive, emotional, and

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-108-94867-8 — Climate Change and Human Behavior
Andreas Miles-Novelo , Craig A. Anderson
Excerpt
More Information

decision-making processes become less efficient, and there is a severe weakening of impulse control (among other effects).

The psychological effects of heat stress include impaired attention span, poorer memory, and weakened ability to process new information (Walter & Carrarreto, 2016). Basically, the ability to perceive available situational information deteriorates, which can lead to more impulsive decision-making (Vrij, van der Steen, & Koppelaar, 1994). As you might guess, impulsive/reactive decision processes are strongly linked to heightened aggression and violence (Anderson & Bushman, 2002).

Wittbrodt et al. (2018) recently reported work that examined multiple effects of extreme heat stress and lack of water availability for rehydration. Visuomotor skills (skills that require vision and movement) were severely impaired by being overheated and dehydrated. They also found evidence suggesting that brain structures are actually changing when one is dehydrated.

Heat stress also leads to other impaired functioning. For example, Chang, Bernard, and Logan (2017) showed that inducing heat stress caused individuals to perceive risk-taking behaviors as less risky in a work environment. As the authors note, although we have a good conceptualization of how the brain reacts to being too hot, and we only know of some of the cognitive indicators that it is not operating properly. Thus, we need more research to fully understand the various cognitive impairments induced by heat stress.

But what happens when we suffer heat exhaustion at an extreme level, such as heat strokes? The answer to this is simply "not good." One common effect of heat stress and exhaustion is fainting. Although fainting itself is not particularly harmful (if one falls safely and is quickly tended to), there are other extremely destructive outcomes of an overheated brain.

One effect of heat stroke is that the blood–brain barrier becomes compromised (Yamaguchi et al., 2019). When that barrier breaks down, it allows a variety of substances into brain areas in which they shouldn't be found. This can cause inflammation and other potentially serious brain damage.

Strokes, in general, can be very dangerous for our brain's health and functioning, and heat strokes offer a variety of compounding variables that can increase the damage and severity that they cause. The typical rule of thumb is that having multiple episodes increases the odds of severe damage, as does prolonged exposure to the heat while suffering from a stroke. However, even a single event of a heat stroke or heat exhaustion can cause irreparable physical damage to our brain, such as eroding the cerebellum (Walter & Carraretto, 2016).

Heat strokes have been linked to many harmful effects, inducing short- and long-term comas, personality changes, seizures, and even death (Dematte et al.,

© in this web service Cambridge University Press www.cambridge.org