

Review

The Silent Killer: Consequences of Climate Change and How to Survive Past the Year 2050

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Abstract: There is strong scientific consensus that the climate is drastically changing due to increasing levels of carbon dioxide in the atmosphere, and that these changes are largely due to human behavior. Scientific estimates posit that by 2050, we will begin to experience some of the most damaging consequences of climate change, which will only worsen as the world becomes more populated and resources become scarcer. Considerable progress has been made to explore technological solutions, yet useful insights from a psychological perspective are still lacking. Understanding whether and how individuals and groups cope with environmental dilemmas is the first step to combatting climate change. The key challenge is how can we reduce a tendency to inaction and to understand the psychological obstacles for behavioral change that reduce climate change. We provide a social dilemma analysis of climate change, emphasizing three important ingredients: people need to recognize their own impact on the climate, there is conflict between self-interest and collective interests, and there is a temporal dilemma involving a conflict between short-term and longer-term interest. Acknowledging these features, we provide a comprehensive overview of psychological mechanisms that support inaction, and close by discussing potential solutions. In particular, we offer recommendations at the level of individuals, communities, and governments.

Keywords: climate change; social dilemma; temporal dilemma; human cooperation

1. Introduction

“We cannot compromise with the earth; we cannot compromise with the catastrophe of unchecked climate change, so we must compromise with one another.”—Gordon Brown, former UK Prime Minister [1].

Most people delay a visit to their dentist, most smokers take some time before they make a serious attempt to quit, and most people do not have the willpower to persevere in fitness and diets to minimize the risk of longer-term health issues. These examples present individual “traps” such that people find it hard to exercise restraint to bring about better outcomes for themselves in the future.

A more complex crisis is taking place now, only this time, it is on a much larger scale: climate change. It is not merely the conflict between short-term and long-term interest per se. Climate change is far more complex; it requires us to contend with the conflict between self-interest in the short-term and longer-term interests that concern all people involved, an undefined region, or more realistically, the world: all of us. Climate change is a social dilemma, in which a concern for long-term, collective interest is key to solutions we all embrace, especially in the future [2].

If periodic visits to the dentist are already a challenge, getting people to forego immediate self-interest and contribute to the reduction of climate change is clearly even more challenging. But importantly, in social traps (or large-scale social dilemmas), there is a rich psychology that can

help people make decisions relevant to climate change. The psychology extends to solutions that can be implemented at the level of individuals, communities, or governments.

Although there have been excellent reviews of the psychology of climate change, such work is relatively scarce, as most scientific research focuses on environmental aspects of climate change or technical solutions. Further, past work on human behavior has generally focused on behavioral change at an individual level, and less so at the community or governmental level.

The goal of the present article is to provide a review of the psychology of climate change. In doing so, our focus is threefold. First, we provide an introduction to the causes and consequences of climate change. Second, we address cognitions, feelings, and behavioral tendencies that people bring to bear on climate change dilemmas. Third, we examine potential behavioral changes that can be facilitated at the level of individuals, communities, and governments. Our guiding theoretical principle is that people face a conflict between short-term self-interest and longer-term collective interest, which, as noted earlier, is often referred to as a social dilemma. We illustrate that interventions at the level of individuals, communities, and governments are necessary. Unlike visits to dentists, it is not only the future that matters, it is the future that matters to all of us, and that can be most effectively influenced by collectivities rather than individuals.

2. A Shifting Macroclimate

Although natural climate change, such as natural changes in solar activity, does exist, 97% of scientists agree that climate change is overwhelmingly caused by humans, termed anthropogenic climate change [3]. For decades, humans have relentlessly burned fossil fuels, polluted with high-emissions vehicles, and cut down trees and forests. These activities increase the amount of carbon dioxide (CO₂) in the atmosphere, trapping heat like a giant blanket over the Earth.

Current CO₂ levels are around 410 parts per million (ppm) while CO₂ levels over the last one million years ranged from 172 and 300 ppm [4]. Increasing global temperatures and natural disasters will plague the Earth if we continue to contribute to climate change. High birth rates and an aging population increase the demand for valuable resources like land, water, and food, which can then lead to higher crime rates such as theft [5]. With rising seas and warmer temperatures, we will likely experience more floods and more droughts. These extremes will have deadly consequences for many regions around the world. We will also suffer from species extinctions, such as penguins and polar bears, whose natural habitats are directly impacted by rising temperatures. Climate scientists have predicted that the Arctic Ocean will be ice-free by the summer of 2050 [6]. Food shortages will likely be one of the most consequential for survival. As global temperatures increase, flowers and plants will begin to bloom sooner in the spring, so pollen production and bee pollination will be misaligned [7]. A mismatch of only a few days can have negative consequences for bees' health, thereby disrupting food production.

The National Aeronautics and Space Administration (NASA) argues that scientists have been predicting the causes and effects of climate change since the 19th century [3]. Although shocking, their data presents clear and unmistakable evidence that the climate crisis is real and urgent. Global surface temperatures have climbed by approximately 0.9 °C (1.62 °F) as of the late 1800s. Since the Industrial Revolution began, the acidity of the ocean has risen by about 30 percent. Over the last 50 years, the temperature of the top 700 meters (765.5 yards) of the ocean has increased to about −17.5 °C (0.4 °F). The sea level has also risen by about 20 centimeters (8 inches) over the last century, but the rate at which it has risen has doubled in just the past 20 years. The coldest areas of our planet are experiencing the largest changes. Between 1993 and 2016, Greenland has lost over 6.5 trillion tons of ice and Antarctica has lost over 2.9 trillion tons of ice, with the melting rate steadily increasing. The last five years have been the hottest since 1880 (the first year NASA has on record) and 2016 was the hottest year ever recorded in history. Even when presented with these data, many people are still reluctant to take a stand against climate change.

3. Climate Change's Consequences for Social Life

As the population becomes increasingly aware of climate change, many people are becoming uncertain about the future, especially those with children. The stress and anxiety concerning impending climate change can have severe consequences for mental health and quality of life. People with the fewest social and economic resources are the most vulnerable, as they often do not have access to mental health assistance and disaster relief. For example, in 2005, Hurricane Katrina ravaged New Orleans in the United States. Although the US is considered one of the richest countries in the world, this disaster disproportionately affected impoverished African-Americans. The government's evacuation plan expected everyone to drive out of the city. However, almost 45% of residents did not have access to a car, resulting in many of the lowest-income families being forced to weather the storm [8]. Moreover, because they were forced to shoulder the millions of dollars in damages to their community, they experienced even more poverty and mental health problems.

Other countries have also experienced serious hardships. Category 5 Hurricane Lorenzo reached record-breaking winds of 258 kph (160 mph) before making landfall in the United Kingdom in October 2019 [9]. In 2018, over 35,000 citizens fled Vietnam, one of the world's most vulnerable countries to climate change, displacing families and creating severe emotional distress [10]. The World Health Organization (WHO) estimates that about half of the world does not have access to adequate health services, which can have grim consequences when disasters strike [11].

Although the effects of climate change are not evident in all places around the world yet, it is most visible in areas such as Africa, Asia, the Andes, Australia, and Alaska [12]. The Pueblo Indian peoples refused to migrate when their community experienced a prolonged drought at the end of the 13th century, which ended in extreme famine and social conflicts among their members [13]. Some societies are reluctant to migrate from their home communities in fear that they will not find food or shelter, affecting their mental and emotional well-being as well as increasing financial stress. Many are afraid that they will not find external social or emotional support groups, creating a feeling of tremendous isolation and disconnectedness from other communities [14].

According to Bartlett [15], prolonged droughts in countries such as Zimbabwe severely impact children's growth. By contrast, greater precipitation and warmer temperatures increase the risk of malaria, affecting about 50% of the world's population. These extremes in climate conditions suggest that a balance is necessary for citizens' health and survival. However, health and survival are also affected by each country's economic and social policies. For example, military conflicts in Somalia are preventing people from migrating to safer areas. In Bangladesh, where citizens are able to migrate to escape increasing flooding on its coast, they struggle to manage poverty and human trafficking [14].

Even developed countries are sometimes unable to cope with the consequences of climate change. During the summer months in many parts of the world, thousands of people die from heat stress, especially children and the elderly. For example, during the week-long heatwave in July 2019 in the Netherlands, 400 more people died than in an average summer week, most of whom were over 80 years old [16]. As average temperatures continue to rise around the world, scientists predict the number of deaths will grow. Hyalomma ticks were recently spotted in specific locations in the Netherlands (i.e., Wageningen and Drenthe) where it was previously thought to be too cold for them to survive. This species of tick is known to carry the *Rickettsia aeschlimannii* bacterium, which causes a rare type of spotted fever, as well as more deadly diseases such as the Crimean-Congo virus, which has a 50% fatality rate [17].

These cases demonstrate how unevenly distributed the effects of climate change are in different parts of the world. Even though developed countries are often better able to cope with the consequences of climate change, they will not be exempt from its life-threatening effects. We must come together in solidarity now if we hope to successfully reduce the negative impacts of climate change.

4. Psychological Explanations for Inaction

Even from its early beginnings, psychological science has been concerned with behavioral change and action [18]. The discipline developed and grew in part because large-scale societal issues called for theoretical analysis to inform interventions. These developments have led to depth and breadth. Depth was sought to fully understand, for example, the processes underlying attitude formation and maintenance, or how people make decisions. Breadth was sought because many societal issues drew strong attention, from attitudes to ethnic minorities to how to promote behavioral change in response to the AIDS epidemic. (Not surprisingly, Covid 19 is now receiving incredible empirical attention.)

Rather than providing a theory of behavior change, we believe that for an interdisciplinary audience it is useful to provide an overview of a list of mechanisms and phenomena. In doing so, we do not claim to be exhaustive, but aim to provide a fairly comprehensive list of mechanisms and phenomena that are relevant to climate change, especially how they might block or inhibit action that is needed to reduce climate change. Further, although theory is not the ambition, the list is inspired by the theoretical description of climate change as a social dilemma, where three issues (alone and in concert) matter: (a) some realization that one's own behavior impacts collective outcomes; (b) the conflict between self-interest and collective interest; and (c) the conflict between short-term and longer-term interest [19].

4.1. Recognizing the Dilemmas

Countless reasons exist for why people refuse to take action against climate change. Understanding human behavior is at the core of psychology. Over the past few decades, researchers and psychologists have begun to study climate change from a psychological perspective, attempting to decipher why some people are so reluctant to take action. Figure 1 shows the increasing interest in climate change among scientists since 1975, which has grown exponentially over the last 20 years. Figure 2 shows the budding attention to climate change specifically in the psychological literature, which was almost non-existent before the year 2000.

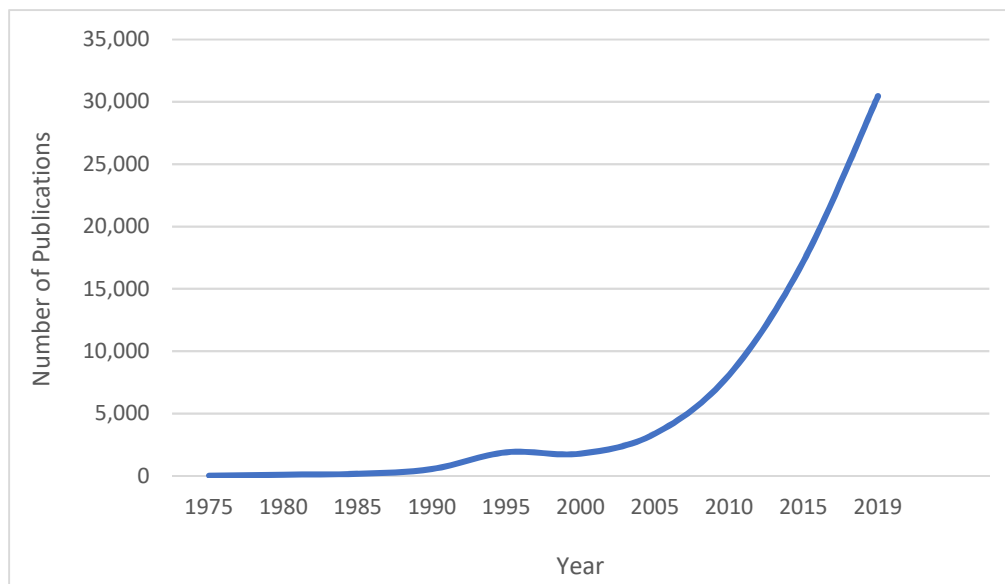


Figure 1. Number of publications with the term “climate change” appearing at least once between 1975–2019.

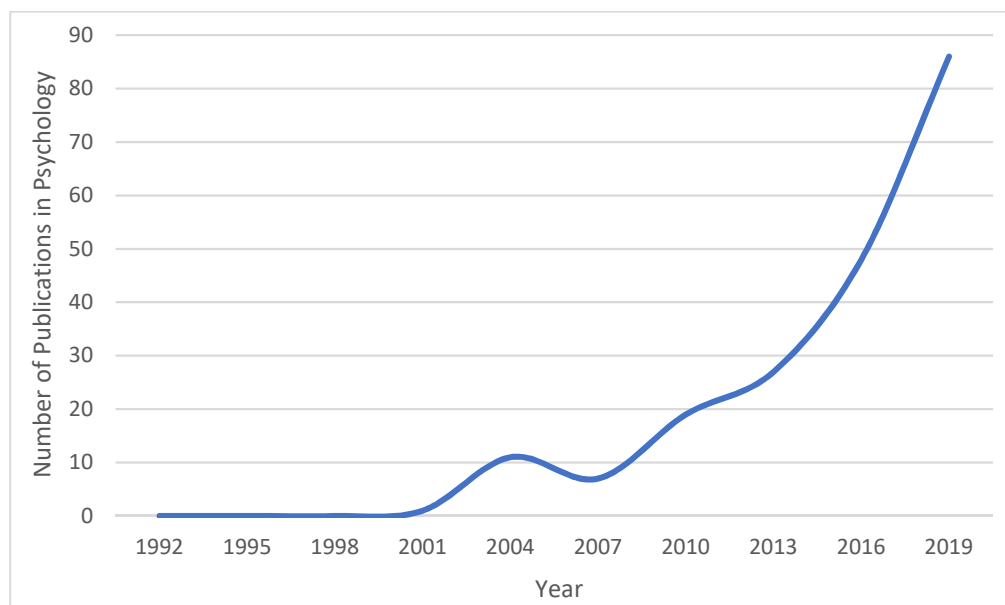


Figure 2. Number of publications in psychology with the term “climate change” appearing at least once between 1992–2019.

Psychology has been able to answer many questions regarding human attitudes and behaviors. It may be able to help us understand how humans approach and cope with climate change as well. Using social and temporal dilemma theories to evaluate and interpret climate change attitudes and behaviors can provide us with pivotal information to resolve this social crisis [2,20].

4.1.1. Social Dilemma

As noted earlier, we characterize climate change as a social dilemma in which people must choose between their short-term own self-interest and the longer-term interest of the entire population [19]. This approach goes together well with principles of evolutionary science. Indeed, in ancestral environments humans quickly learned to cooperate in small groups, as they were not able to survive on their own. For example, hunters were not always able to catch large game on every hunt, so they learned to hunt in groups and share their kill (with the expectation that each hunter will eventually share his own kill with the group when others leave empty-handed).

Based on evolutionary psychology, the group size effect, in which cooperation tends to decrease as the size of the group increases, suggests that even in today’s world, it is much easier for only a few people to work together and compromise during a task than it is for 100 people to cooperate [2,21,22]. Humans can be social with friends or on a sports team, but being social in large groups is much more challenging, requiring many more mental and emotional resources. In a world with a population of over 7 billion, cooperation in the fight against climate change is likely the largest social dilemma possible, especially when navigating through language and cultural barriers.

Cooperation at a macro level is complex, and engaging in behaviors that promote one’s own self-interest requires much less effort. As a case in point, De Groot and Steg [23] assessed three types of value orientation in relation to environmental concerns: egoistic, altruistic, and biospheric. Their study found that people who held more egoistic values were less likely to maintain pro-environmental attitudes and engage in environmentally-friendly behavior than people with altruistic or biospheric values. Other studies have revealed similar results [24,25].

The perceived loss of individual decision freedom is particularly challenging for people with a more egoistic value orientation, especially those living in individualistic societies. Hiscock, Macintyre, Kearns, and Ellaway [26] found that individuals often gain psychological and social benefits from

driving a vehicle. Even if people sometimes feel guilty about driving a vehicle that contributes to climate change [27], many are not willing to give up the autonomy that it provides. Being able to take a quick trip to the grocery store can be convenient to pick up forgotten milk or bread to cook a last-minute family dinner. Driving a vehicle, especially a high-end luxury brand, also provides individuals with prestige and status. Finally, it allows them to avoid discomfort from bad weather and any unwanted social interaction after a long day at work.

Other than the freedom that automobiles provide, transporting recyclables to community-sized containers can be troublesome if there are none nearby. It requires much less time and effort to simply throw waste into one rubbish bin near home than it is to separate items into multiple bins and transport them to large recycling containers, which may be five kilometers away in some areas. For many people, this dilemma between self-interest and the survival of society is likely the most difficult barrier to overcome.

4.1.2. Temporal Dilemma

Ancestral humans were also seldom capable of avoiding temporal discounting because immediate survival was the highest priority. Finding food and shelter and ensuring their offspring's survival was of upmost importance, so long-term planning was not usually feasible. This has shaped our preference for short-term rewards that benefit us immediately rather than waiting for a larger reward in the future.

Based on this inclination for short-term rewards, Zauberaman, Kim, Malkoc, and Bettman [28] examined differences in participants' perception of time and actual time. Albert Einstein once said "Put your hand on a hot stove for a minute, and it seems like an hour. Sit with a pretty girl for an hour, and it seems like a minute. That's relativity." Just as the perception of money or speed, humans' perception of time is nonlinear. It is extremely difficult for individuals to think about their lives just three years into their future, and this becomes exponentially more difficult when thinking further and further away from the present. Most people have a plan for what they will do tomorrow; most people cannot plan what they will do in 50 years.

For many people, their misperceptions of time make climate change seem "psychologically distant" [29]. They feel that the consequences of climate change will not occur any time soon, especially if they live in areas where the impacts of climate change are not evident yet, so they continue to contribute to the causes of climate change. Psychological distance can be extremely dangerous if people continue to ignore this impending disaster.

When it comes to climate change, individuals prefer to drive a car or fly in a plane on holiday because it provides a short-term reward, often without considering the consequences in the long-term. Corporations are also guilty of this type of behavior. Many companies, especially the mega-corporations, are focused on acquiring more wealth, often at the expense of our ecosystem. They continue to burn fossil fuels to make billions in profit, with little concern for the future of our planet. This temporal discounting is a significant contributor to the refusal to take action against climate change [19].

4.1.3. Complex Combination

Taken together, the combination of these dilemmas has created an impossible task. Jacquet, Hagel, Milinski, et al. [30] examined intra- and inter-generational temporal discounting. Using a collective-risk group experiment, they found that participants behaved more selfishly when they would not receive a reward for a few decades (representing intergenerational discounting) compared to not receiving a reward for seven weeks (representing intragenerational discounting). This study shows that motivation for cooperation becomes less likely for long-term rather than short-term gratification.

Mitigating climate change will require people to work together in large groups to prevent a catastrophe that will occur sometime in the indeterminate future. From a psychological perspective, this scenario defies our evolutionary DNA; it violates what we as humans have engrained in our psyche.

4.2. Other Obstacles for Action

Other psychological theories have been proposed to explain people's reluctance to combat climate change. These theories sometimes overlap with the social and temporal dilemmas of climate change, but they provide further insight into individuals' assessments and behavior patterns regarding this environmental crisis. Inspired by Gifford [31] and Steg and Vlek [32], we illustrate some of these theories as well as a few additional challenges that hinder many people from taking action.

4.2.1. Awareness

Although scientists have warned us about the consequences of climate change for decades, many people are still not aware of the danger it poses. About 65% of people living in Egypt, Bangladesh, Nigeria, and India have never heard of climate change, so they cannot be expected to take action [33]. These countries (with the exception of India) are also not contributing to climate change to the same extent as other countries. According to Oxfam International, the richest 10% of people in the world contribute 50% of the world's emissions, while the poorest 50% contribute only 10% of the world's emissions [34].

Many people in the US and Europe have been taught since grade school to "reduce, reuse, and recycle," yet many do not know how. Vrije Universiteit Amsterdam has conducted several surveys over the past year to better understand why many students do not recycle their waste, despite the fact that there are bins in multiple locations on campus. Many students simply do not know which items can and cannot be recycled, and as a result they simply throw their waste in non-recyclable bins instead. This behavior is mirrored in other communities as well.

4.2.2. Environmental Numbness

Poverty is also an enormous barrier that can cause a phenomenon known as "environmental numbness" [35]. People living in extreme poverty are in survival mode; they are often only able to focus on paying for groceries or monthly bills to stay alive. Thus, they do not have the mental capacity to be consciously aware of reducing their own emissions. They are also hardly in a position to reduce their emissions to begin with, as they usually cannot afford to buy an electric vehicle or solar panels for their homes.

Environmental numbness can also occur when messages about climate change are repeated in the same manner. Just as white noise in the background can be ignored after some time, repeated messages about a negative event eventually leads to inattention to the problem. For example, almost everyone in the US has seen the well-known ASPCA (American Society for the Prevention of Cruelty to Animals) commercial starring Sarah McLachlan, which portrays abused and mistreated animals and requests donations to their organization. While this touched every viewer's heart at first, many people began switching the channel or walking away when the commercial continuously appeared on their television because it triggered intense feelings of sorrow and depression. By repeating the same heart-breaking message to millions of people year after year, it actively worked against itself.

4.2.3. Confidence in Technology

Of those who are aware of climate change and could work towards mitigating some of its consequences, many put their faith in technology. Some trust that a scientist or entrepreneur will create the technology needed to fight climate change before disaster strikes. Others believe that the technology we currently have is able to manage extreme heat or other negative impacts [36]. While technology has aided us in some aspects of climate change, we cannot simply hope that someone will save us or put our trust in equipment that is clearly not doing enough.

4.2.4. System Justification Theory

Some people may refuse to take action because it violates the status quo [37]. According to system justification theory, some people are unwilling to “make waves” or change their behavior because they believe in the system in its present state. They also tend to reject changes imposed by “rebels” who resist the “natural order of things.” They may feel that the way the world currently functions should not be changed because it has been prospering as it is, with the notion of “if it ain’t broke, don’t fix it.” The problem is that it is broken; the system has not been working.

4.2.5. Habitual Behavior

People who maintain pro-environmental attitudes may not engage in pro-environmental behavior, as many studies have shown that attitudes do not always translate to changing behavior [38]. Perhaps this occurs because humans are creatures of habit. For example, people who habitually use swear words may eventually slip up in a formal office meeting in the presence of upper management. Even though they may know that habitually swearing is a bad habit, changing their behavior is difficult. Aarts, Verplanken, and Van Knippenberg [39] suggested three characteristics of a habit: an achievable goal, a satisfactory outcome, and a mental association with the behavior and the outcome. Habitual environmental behavior could be very advantageous once an association between behavior and satisfactory outcome is made. However, finding ways to imbed these habits into individuals is a difficult task.

4.2.6. Financial Investments

In 2016, US consumers purchased a record-high 17.6 million cars and trucks, with an average sale price of \$35,309 [40]. That is a substantial investment, especially considering the additional costs of automobile insurance and annual taxes. Even if individuals decide to take steps towards reducing their emissions, most people refuse to let their expensive vehicles sit in the driveway while they still spend money taking the bus to work. Additionally, trading in their vehicles for environmentally-friendly alternatives would mean a large financial loss as the value of a vehicle drops immediately after purchasing and driving it off the dealership lot.

Other costly investments may not be worth the money in the long-run. For example, installing solar panels on a home costs between \$10,836 and \$14,196 in the US even after tax incentives [41]. How long will it be before homeowners’ electricity savings break even? Will they need to be replaced before they see a return on this investment? Financial barriers can inhibit people who may want to take action but feel that the financial risk is too great.

4.2.7. Norms Remain Inactive

Lindenberg [42] established goal-framing theory, which describes how individuals’ goals and motivations shape or “frame” their behaviors, attitudes, perceptions, and potential alternatives. This theory identifies three goals that may influence environmental behaviors: hedonic (“to feel better right now”), gain (“to guard and improve one’s resources”), and normative (“to act appropriately”). When it comes to tackling climate change, if these goals are in line with one another, people are more likely to engage in environmentally-friendly behaviors, especially when it is considered the “norm.” However, these goals are often misaligned and as a result, people become less inclined to take action. For example, there is an enormous stigma associated with public transportation in some parts of the US. Many people assume that those who use public transportation are poor or lazy. Because of this, even people who could save money by taking the bus to work would rather drive a vehicle to fit the “norm” and maintain their self-image.

4.2.8. Optimism Bias

Psychologists have long understood that humans have a psychological tendency to rely on their own personal experiences when presented with conflicting information. This phenomenon may be exacerbated by optimism bias, in which people feel that their risk of experiencing something negative (like a cancer diagnosis) is low [43]. Since climate change is very abstract, especially for people living in areas that do not appear to be suffering from climate change, many people deny that it is occurring or that it will negatively affect them. According to American rock climber and author Conrad Anker, “If you compare Everest photographs in 1953 with its current state, things are melting. I imagine if I were a golfer in Indiana, I’d be hard-pressed to believe in climate change because nothing’s going on there. But when you’re up in the mountains and seeing the glaciers melt away, it’s an obvious physical manifestation of a warming planet” [44].

Personal experiences often create the most transformative behavior, but sometimes individuals do not act quickly enough. Weinstein, Klotz, and Sandman [45] found that people tended to discount the seriousness of their risk of radon exposure. Hatfield and Job [46] found similar results when examining other environmental hazards. People may not take action against climate change unless they feel that they or their relatives are under direct threat.

Just as life-long cigarette smokers often refuse to quit smoking until they are diagnosed with cancer (and sometimes they still continue to smoke), many climate change deniers may continue to deny it exists until they physically experience it themselves. This optimism bias can help people cope with anxiety or uncertainty about climate change, allowing people to reappraise these emotions and improve their mental health. However, this bias can also put their lives in jeopardy if they refuse to accept that there will be consequences for not taking action.

4.2.9. Bystander Passivity

Bystander passivity, which is illustrated by the social psychological theory of the bystander effect, may explain why some people are not willing to reduce their emissions [47]. Humans are social beings who incessantly compare themselves to others around them, evaluating what others are doing and mimicking friends, neighbors, and celebrities. When individuals believe others are not recycling and reducing their emissions, they may feel less social pressure to change their own behavior.

The myth of self-interest, which refers to the tendency to assume other people are more selfish than they actually are, may exacerbate this bystander passivity [48]. In the example above, they may underestimate how much their neighbors recycle if they never see a recycling bin outside of their home, even though the neighbors may be recycling regularly. If they are uncertain about their neighbors’ recycling habits, they will be less likely to recycle themselves [49,50]. On the other hand, if they are confident that many of their neighbors recycle their waste, they will be more likely to recycle.

This phenomenon was shown in Schultz, Nolan, Cialdini, Goldstein, and Griskevicius [51], in which homeowners adjusted their energy use to parallel the average energy use of others in their community, with some increasing and some decreasing their use. Such findings have also been demonstrated in experimentally controlled settings [52], showing that incidental increases in others’ noncooperation (i.e., increases in consumption from a limited resource) cause a decline in cooperation, especially among those who are otherwise inclined to save resources—people with prosocial value orientations. These so-called prosocials are prone to cooperate across a wide variety of social dilemmas, including resource dilemmas, but only do so if most or all contribute a fair share [53]. By contrast, people who are more proself-oriented have a tendency not to cooperate in large-scale social dilemmas, largely independent of what other people do.

4.2.10. Individual-Group Discontinuity Effect

Insko, Schopler, Pemberton, et al. [54] coined the individual-group discontinuity effect, which refers to the tendency of groups to be more competitive and less cooperative than individuals. This may

be because group leaders fear that other group leaders are more competitively motivated and intend to obtain an advantage, creating more suspicion and rivalry [19]. These competitive mindsets often lead to scapegoating, as national leaders blame each other for contributing to climate change too much or not doing enough to combat it.

4.2.11. Free-Riding

Psychology has shown how free-riding can discourage individuals from changing their behavior. When people feel that others are “free-riding,” or not contributing to resolving the problem, they begin to feel that they are wasting their time or resources and lose motivation to cooperate [55]. Smaller countries like Belgium may feel discouraged to take action against climate change when the US and China are contributing to the problem on a much larger scale.

Individuals often use large corporations as scapegoats for the climate crisis as well, viewing them as free-riders who generate large profits while expending little effort to reduce their carbon footprint. This asymmetry creates a collective action problem in which people and corporations unceasingly blame each other rather than work together to identify solutions. Many people have recently begun demanding that corporations take the first steps by reducing their waste or investing money into higher-quality technology before individuals themselves will begin taking action. Eventually, individuals will retaliate (in whichever manner they see fit) against corporations and other wealthy organizations if they continue to dismiss society’s environmental concerns, disregarding laws and their feelings.

4.2.12. Politics

Climate change has become a hotly debated political issue around the world, especially in the US. Some conservatives claim that climate change is a natural phenomenon and is not caused by human activity. Many concentrate only on the positive aspects of climate change, such as the potential benefits of a warming climate on crop production in some parts of the world [56] or that the economy would suffer greatly if they began taking action against climate change. They are notoriously known for being skeptical or even denying that climate change exists at all, while liberals tend to trust that scientists are reporting accurate and truthful information. While conservatives claim that scientists have their own political agenda, liberals argue that conservatives are being manipulated by their leaders, many of whom have their own money invested in oil and gas companies. Just as the tobacco industry denied the hazards of smoking for decades and resisted anti-smoking campaigns, oil companies and their investors organize climate change denial campaigns to sway public opinion.

4.2.13. Media

The media also play a vital role in public opinion [57]. Each news company decides which “facts” to present to their audience and who to host on their channels. They are essentially the gatekeepers of information to the public, but they can be greatly influenced by their own political agendas. For example, Fox News, which is widely known as a conservative news channel in the US, tends to host mostly conservative politicians who deny climate change.

This divide among the media is even clearer when covering Greta Thunberg, a Swedish 16-year-old who quickly gained international recognition for her environmental activism in 2019. Guests on Fox News have consistently berated and mocked her, with some accusing her of being a puppet exploited by the political left to push its own agenda [58]. Dunlap, McCright, and Yarosh [59] assert that only 43% of conservatives believe human activities have caused climate change, which is unlikely to change much for viewers who are only exposed to conservative media.

After Donald Trump popularized the term “fake news” in 2016, many people have also become more uncertain and distrustful of media outlets themselves. However, research has shown that much of the media associated with left-wing views are scattered across the center, center-left, and left, while media associated with right-wing views are highly skewed to the right, with center and center-right

news being almost non-existent [60]. In today's world of misinformation and sensationalist headlines across social media, it is understandable that people have become skeptical of news articles and biased news channels. The millennial generation grew up continuously being warned "do not believe everything you read on the internet." We have created a world in which we must always question everything, which is a wonderful attribute when used appropriately. However, when people use this to create divide and distrust of scientists, perhaps we should rethink the culture we have constructed.

4.2.14. Religion

According to the Pew Research Center [61], about 84% of the world population is affiliated with some religion. Because many religions emphasize a "higher power" (or multiple), many people feel that they cannot control their fate [62,63] or that God will protect them [64]. For example, Sanganyado, Teta, and Masiri [65] found that 45% of agropastoralists in Makueni District, Kenya reported that seasons with abnormally low rainfall were part of God's plan and that there was nothing they could do to change it. Thus, and in line with Schuman, Dokken, Van Niekerk, and Loubser [63], religious beliefs tend to be associated with a lower likelihood of taking action against climate change.

5. Recommendations: Where Do We Go from Here?

Drawing on psychology and other disciplines, the extant literature provides an impressive overview of models and phenomena that are relevant to climate change. However, moving beyond such insights, it is important to ask: where can these insights be fruitfully used to mitigate climate change? After all, climate change clearly has negative consequences for individuals, populations, and the ecosystem itself—if only abstract now, then certainly more concrete in the future. Using state-of-the-art technology, scientists are able to accurately calculate precise levels of CO₂ in our atmosphere and generate effective strategies to combat climate change. Experts have estimated that if individuals in the highest-emitting countries lowered their emissions by 25 percent, total emissions would only decrease by about 5 percent [47]. Thus, we need everyone's help; we need to use an interdisciplinary approach to work with scientists and experts in fields such as engineering, public policy, geography, natural science, health science, sociology, psychology, and many others. We must increase awareness, implement behavioral changes, and make the consequences of climate change less abstract and more concrete if we wish to succeed. Below, we adopt a multi-level approach to three categories of recommendations to reduce climate change: (1) the individual level; (2) the level of communities; and (3) the level of nations (or governments).

5.1. What Individuals Can Do

Individuals may use a variety of strategies to fight against climate change, including cognitive, behavioral, and social strategies. These strategies directly and indirectly influence individuals' goals and desires regarding climate change, including learning to successfully interact with and convince others of the dangers of warming temperatures and increasing natural disasters as well as reducing one's own carbon footprint. The key question is how people can be promoted to act in the longer-term collective interest.

Increasing awareness about climate change continues to be important. Awareness is a somewhat multifaceted concept, in that it may point to abstract knowledge about climate change. However, there is much more to it. They need to recognize the seriousness and urgency of the problem. Moreover, as much research on implementation has demonstrated, people also need to be aware of some concrete behaviors that help mitigate climate change. Finally, for behaviors that involve repetition and require endurance, it also helps if people have some plan as to how to sustain some behavior. Many psychological theorists have proposed that humans are social animals for whom it is essential that basic social needs of relatedness be met to secure a basic level of well-being [66–68]. Speaking with trusted friends and colleagues can help individuals develop new ideas and creative solutions to climate change as well as to sustain behavioral change. Community mentors can provide clarity

and valuable advice. Being involved in a close-knit community can alleviate some of the despair and hopelessness about the future. Taking advantage of humans' relatedness needs can help individuals overcome some of the barriers of climate change. Thus, awareness is often a necessary ingredient; it also takes concrete knowledge about what to change in our behavior, how to change it, and how to sustain. In each of these steps, social mechanisms can be crucial: other people may provide new ideas, other people may energize, and other people often convey norms from which one does not like to deviate. In this way, people also help to sustain behavioral change.

One critical issue causing climate change is overpopulation, which may be regarded as a social dilemma in and of itself. Given the trade-off between number of people and magnitude of natural resources, it is collectively rational to reduce overpopulation. Indeed, one of the most impactful behaviors is having one less child. With an increasing number of women joining the workforce and moving into cities away from extended family, many younger people are choosing to have less (or no) children. Paying for a child's daycare and eventually college is very expensive, especially in the US and UK [69,70]. Many millennials and other young people view children as too large of a responsibility, preferring pets to children due to the difficulty of obtaining a stable career or buying a house in today's world [71]. Although some view this as an extreme alternative, having one less child reduces one's contribution to climate change by almost 60 tons of carbon dioxide equivalent, while replacing light bulbs only amounts to less than 0.2 tons of carbon dioxide equivalent (at least in the Western world) [72]. Being realistic in light of the evolutionary need for reproduction, a start may provide information about the detrimental effects of large family size.

As another example, protesting about climate change inaction can be a great way to raise awareness and inspire others to get involved. Individually, citizens' concerns are often ignored or dismissed by corporations and governments. Madestam, Shoag, Veuger, and Yanagizawa-Drott [73] examined the Tea Party movement in the United States and found that protesting led to more Republican votes and a strengthening of their movement, which ultimately influenced policymaking. When climate change advocates are perceived as a minority, they do not have enough clout to generate large-scale changes. However, when thousands of citizens stand together in solidarity, they can gain majority influence and pressure corporations and governments to implement changes at a much faster rate, as we have seen with reducing smoking. By working together to create awareness, citizens will be better-informed and educated about climate change when heading to the polls. Voting for representatives who are adamant about resolving the climate crisis and who are willing to provide climate migrants with economic and other life opportunities will create a cleaner and safer world for everyone.

Maintaining realistic views is important to recognize the concrete consequences of climate change. Scheier and Carver [74] examined the effects of pessimism and optimism on physical and psychological functioning. Their data revealed many of the benefits of replacing catastrophizing attitudes with more optimistic attitudes. In regards to climate change, replacing negative mindsets such as "Climate change is going to destroy the world eventually anyway" with "I still have time to do my part to fight climate change by reducing unnecessary car trips" could bring the future closer to home, so to speak. Further, it is especially important that people make a start with some behavioral change. They may recognize that some changes help reduce expenses for oneself (e.g., to reduce the use of electricity) or help experience some positive features that one otherwise cannot see so clearly (e.g., working on a train and thereby creating free time to spend at home and with family and friends). Such a positive experience is one of the best predictors of behavioral change, including sustainable behavioral change.

5.2. What Communities Can Do

5.2.1. Local Environmental Groups

Local environmental groups are essential to spreading knowledge and awareness of climate change, and are in a position to appeal to citizens' sense of morality and the consequences of bystanding. English historian and author Sir Ian Kershaw wrote, "*The road to Auschwitz was built by hate, but paved*

with indifference” [47]. In this reference to Nazi Germany, Kershaw implies that people who are indifferent or refuse to take action regarding humanitarian crises are just as liable for its outcomes as the perpetrators. Just as Sinnott-Armstrong [75] demonstrated in his article, appealing to individuals’ morality may tap into individuals’ ethical values and integrity to incite changed behavior. Hosting local meetings to educate citizens about these impacts in their own neighborhood and how to reduce, reuse, and recycle properly may decrease some of the psychological distance created by temporal discounting. For example, by educating citizens about plastic waste, they can decide to continue to purchase disposable silverware (which they will then at least know how to recycle) or they can switch to using metal silverware, which has less of an impact on the environment and is less expensive over time.

Informing citizens about new legislation regarding green energy would allow them to take advantage of these incentives, such as tax breaks for purchasing electric vehicles. If citizens are not aware of this incentive, they will not be able to benefit from it. This can be especially helpful for people who do not use a tax advisor to complete their tax forms, as they are often unaware of the multiple tax relief opportunities offered by the government. Bringing awareness about the seriousness of climate change in their local environment (attitudes) at a town hall meeting could allow them to see that others are concerned about the consequences (normative) and are willing to take action (control), which would also likely reduce optimism bias. This can also create a sense of social responsibility and decrease their inclination for self-interest; providing that everyone does his or her part, they may be able to successfully reduce the effects of climate change across the world.

As noted earlier, one of the biggest hurdles in combatting climate change is persuading individuals to change their behaviors. Indian artist Janardhan Havanje created “Yoshi the Fish,” a 10 foot-tall (3 meter) by eight foot-wide (2.44 meter) fish sculpture designed to increase awareness of plastic pollution in the oceans and promote recycling behavior. The plastic inside the sculpture is easily viewable from a distance due to its transparency and beach-goers can discard their plastic waste into its gigantic gaping mouth [76]. These types of initiatives can be effective because they create a visible problem *and* solution. The large sculpture is impossible to go unnoticed, enticing people to do their part to save ocean life. Using the shape of a fish allows people to form visual associations between plastic waste and aquatic animals, generating empathy and compassion for marine life and perhaps then inspiring people to recycle at home as well. This is consistent with previous research showing that people invest more in reducing climate change if they hear the suffering of crickets following the depletion of natural resources [77]; here, too, making the abstract issue of climate change more concrete can be quite effective.

Finally, communities can repair some of the damage caused by climate change, and thereby communicate a strong (descriptive) norm in favor of reducing climate change. For example, multiple bushfires destroyed large parts of New South Wales and Queensland in Australia in November 2019. Dozens of koalas were injured from the fires and were sent to animal hospitals to recover. The fires burned their paws, hindering their ability to climb trees and forage. A group of Dutch knitters from the Quilt Shop 100 in the Netherlands donated over 400 pairs of knitted mittens for the wounded koalas to prevent them from incurring further injuries [78]. By taking this initiative, the community became much more aware of the destruction occurring across the world and it brought the outcomes of climate change directly into the knitters’ homes. These types of supportive community organizations are crucial to helping others overcome their local battles with climate change.

5.2.2. Educational Institutions

Educational institutions are the first step to increasing awareness. Teaching science-based class lessons and inviting expert scientists as guest speakers can help children learn early that climate change is a real crisis that will affect their quality of life in just a few years. Organizing field trips to illustrate the consequences of climate change could help make this crisis less abstract, such as using virtual reality to create a true-to-life setting [79].

Simple activities such as planting trees or gardens at schools would likely increase mental health and hope for the future. Organizing affordable activities like building a bee bath to help bees locate drinking water is fun for children and could educate them about the drastically decreasing bee population as well. These activities can also help young people by aligning the three goals of the goal-framing theory: building a bee bath may increase children's mood (hedonic), improve local food production by increasing bee survival (gain), and enable them to work as a collective (normative).

5.2.3. Media

Media outlets have become increasingly polarized over the past decades. A case in point in the US is the creation of Fox News in 1996, which took advantage of employing well-known celebrities to communicate to their conservative audience [80]. This has been exacerbated by social media, in which users form groups and follow accounts that reinforce their own beliefs, increasing political polarization rather than exposing them to other points of view [60]. Broadcasting companies and news outlets must acknowledge their own biases and use their platforms to communicate to their viewers in a non-partisan manner. They should also be prohibited from exchanging money or other favors with politicians, as these are often accompanied with quid pro quo expectations.

Media outlets can also use celebrities to increase awareness about climate change and encourage citizens to do more to reduce their carbon footprint. Some celebrities are loved and admired across the globe and could inspire many citizens to take action, as long as the same messages are not repeated too often. In the US, where public transportation is a class and status issue, an advertisement featuring Betty White asserting that public transportation is for everyone ("transportation for all") could increase bus and train use, which would reduce bystander passivity and begin to break citizens' habits of driving. If broadcasted on social media and multiple television channels (including Fox News), these types of messages would reach millions of citizens with diverse backgrounds and hopefully bring more awareness to individuals' behaviors that contribute to climate change. This would upset the status quo of driving by portraying public transportation as "part of the system" and prevailing over system justification as well.

Using social media to our advantage could motivate many people to take action and reduce bystander passivity, especially in younger generations. A few years ago, users took social media by storm with the Ice Bucket Challenge, in which users video recorded themselves while a bucket of ice-cold water was emptied onto their head to foster awareness of amyotrophic lateral sclerosis (ALS), a disease affecting motor neurons. Participants posted their videos on various social media platforms and encouraged others to donate and/or complete the challenge themselves. Similar social media challenges can be initiated to promote climate change awareness and increase environmentally-friendly behaviors in a fun and exciting way. Users would be exposed to countless videos of others recycling, bicycling, or taking public transport, likely with light-hearted and comedic tones. They would also see concrete evidence that people are truly taking action, defying the myth of self-interest. These challenges are successful because people gain pleasure from following the "cool" trend (i.e., engaging in normative behavior), gaining a following on social media, and having fun at the same time.

Psychological research has shown that even in today's world, humans are largely influenced by our evolutionary past. According to evolutionary psychology, kinship theory suggests that humans are altruistic towards their children (and other close relatives) because they receive an indirect fitness benefit [81]. Batson [82] suggests that portraying a child as both young and vulnerable can trigger empathy in adults, even if they are not related. Perhaps media outlets could host children to appeal to these kinship cues through their youth and vulnerability, triggering empathy for future generations and bringing attention to the intergenerational unfairness of leaving behind a destroyed planet. This could reduce some of the psychological distance caused by temporal discounting as well [19].

5.2.4. Scientists

Scientists have the knowledge and tools to conduct research and inform citizens about climate change. Scientists should be cautious when speaking to citizens; oftentimes it is not *what* they say, but *how* they say something that influences people. Science communicators must be able to read and understand their audience, depending on their age, location, and education level. Using appropriate channels to communicate the topic effectively is critical for audience reception [83]. For example, Bill Nye, one of the most influential scientific figures in the US today, spearheaded the notion that “science is fun” in generations of children with his popular television show “Bill Nye the Science Guy” in the 1990s. By making science enjoyable and exciting, he motivated millions of children who now attribute their scientific curiosity and successful careers to his whimsical approach to science. His incredible influence is still evident today, as millennials nostalgically embraced his return with his new Netflix show, “Bill Nye Saves the World” [84].

Combatting climate change requires expertise from various fields, so scientists must communicate and work with other academics, urban planners, and policy makers to initiate real change. Working with engineers and entrepreneurs to develop more sustainable, energy-efficient technology and testing its impact is also vital, such as creating more efficient wind turbines and nuclear power plants (although some debate the safety of nuclear power) [85]. Environmental scientists can also work with psychologists to evaluate citizens’ energy use and develop tools to promote environmental behaviors [32]. Money is an excellent motivator; providing individualized knowledge and solutions for each household can bring awareness to the costs of their contribution to climate change, which is crucial to initiate behavioral changes.

Climate change interventions in cities or small states can provide researchers with real data to uncover which tools have the greatest impact on environmental behavior, which groups should be targeted and how, and what concerns citizens have. Up to this point, much of the data we have were gathered through self-report questionnaires, which may not have adequate reliability and validity. Using foot-in-the-door techniques can increase behavioral plasticity and motivate individuals to take their first step towards reducing their carbon footprint, which may then set in motion other, larger behavioral changes with greater impacts. Researchers must examine these changes in behavioral determinants (such as costs and benefits) to fully comprehend whether the intervention was successful and why. Rather than measuring citizens’ expected changes in quality of life (as most prior interventions have done), they must also assess their actual quality of life before and after the intervention. Determining which behaviors are successful in various locations and under which conditions is essential to begin implementing effective tools and policies on a larger scale [32].

Just as community organizers should request feedback from citizens about their expectations and desires regarding climate change, scientists should inquire whether citizens feel that the interventions developed in their area are feasible and efficient. Data provides scientists with mass amounts of information, but it is also important to invite opinions and advice from citizens to determine how they feel about the future of climate change. For example, fisherman Charlie Phillips, who depends on quality water to make a living, believes fishermen and other people who work in these environments observe certain changes in the climate much sooner than scientists do. By the time scientists gather data and publish articles, they may be three or four years behind what fisherman and other workers have already realized [86]. In other words, insofar as it poses no threat to accuracy, time matters in climate change.

5.3. What Governments Can Do

Local and national governments must lead by example in the fight against climate change. One way to bring awareness to their citizens is to use wind and solar power to provide electricity for their own government buildings. Creating more public parks and other types of green spaces allows citizens to step away from polluted, overcrowded cities. However, there may also be more indirect, and perhaps more psychological paths, to behavioral change. Governments are in a perfect

position to offer prestigious awards for individuals and groups of scientists who commit to green behavior. Low-cost enticements such as granting a “cleanest city award” can bring awareness and motivate citizens to fight against climate change [19]. Prince William of the British royal family recently introduced the Earthshot Prize to inspire climate change activism. By introducing unique challenges, his hope is to develop technology, innovative ideas, and modern policies to begin repairing some of the damage caused by the climate crisis. This award can be granted to individuals, scientists, activists, businesses, and even countries. According to the website, “anyone who is making a substantial development or outstanding contribution to solving our environmental challenges” has an opportunity to win one of five awards every year for the next 10 years [87]. Prizes such as these can influence people to take action by rewarding them with public recognition and admiration (as well as a decorative plaque to show off to their friends).

One of the key challenges for governments is to manage social dilemmas, especially those that individuals cannot solve by themselves. Climate change is perhaps the prime example of this intricate social dilemma, in which being part of a large collective constitutes a barrier to the perception of efficacy. From that perspective, governments have a duty to foster better health for their citizens, from imposing seat belt laws in vehicles to requiring warning labels on cigarette packs. These laws have saved thousands of lives since being implemented. However, many people still smoke regularly and do not wear a seat belt. This may be because they feel that the government is infringing on their autonomy. Most people resent being told what to do, even if it is something they enjoy (like exercising). Humans have a basic need to feel in control of their own lives, so a loss of autonomy is often met with resistance. For example, Jakobsson, Fujii, and Gärling [88] found that people were not accepting of toll roads and other types of road pricing because they perceived them as unfair or as an infringement on their freedom. However, there are other ways to influence individuals’ behaviors, such as using more positive rewards and less punishments and costs.

Since many people are not compelled to change their behavior even with legal interference, monetary incentives are excellent motivators to successfully encourage individuals to reduce their emissions. For example, the Dutch government encourages citizens to bike to work (as an alternative to driving a car) by reimbursing employees 19 ¢ (tax-free) per kilometer [89]. By providing incentives such as these, people are much more likely to embrace this mode of transport to save (or in this case make) money and live a healthier lifestyle. Safety must also be considered when introducing these types of initiatives, which is why the Dutch government has invested billions of euros in bicycle infrastructure over the last few decades.

Of course, this is not always possible. Bicycling is less feasible in countries that are not as flat as the Netherlands. However, governments can still motivate citizens with other rewards, such as providing tax incentives for people who purchase an electric bicycle or for turning in their older vehicles to switch to public transport. Increasing train and bus services and expanding routes, as well as prohibiting vehicles from entering populated city centers, will also likely encourage more citizens to use public transportation. These types of incentives allow people to save money and fight climate change. Employing urban planners and other outside experts to build industries and communities closer together would encourage citizens to walk rather than to drive to food markets or shopping centers. These advisors tend to have longer time perspectives, so they are better able to build and plan for the future [90]. Walking to the grocery store also enables individuals to get some light exercise, spend quality time with family, and enjoy the outdoors when the weather is nice. Building industries and communities closer together would especially benefit elderly people and people with disabilities, who often have no viable options for long-distance mobility beyond driving a vehicle.

Installing community-sized recycling containers in more areas, especially in highly populated neighborhoods and near educational institutions, can promote and increase recycling behaviors. To have a significant impact, they likely need to be visible to passersby who are on foot, on public transport, and in a vehicle. Observing these large containers may increase individuals’ perceptions of recycling behavior in their area and influence them to begin recycling themselves, possibly overcoming

the myth of self-interest and bystander passivity. Perhaps electronically providing a meal voucher or discount to nearby restaurants for every kilogram of recycled material could also encourage citizens to recycle more.

Providing tax breaks to businesses using green energy, as well as companies and entrepreneurs who develop new technology, can redefine entire industries. The amount of CO₂ emitted during the production and distribution of smartphones, laptops, and other electronics is astronomical. The electronics industry is currently analyzing how to decrease these emissions to produce electronics more efficiently and reduce its carbon footprint, especially for consumer-driven economies such as the US [91]. Industrial hemp has also been shown to absorb more CO₂ than most other crops and trees and is now becoming increasingly popular as an alternative to plastics, textiles, and clothing. Luxury car manufacturer BMW has been replacing the plastic in many of their vehicles with hemp and other natural fibers for the last few years [92]. These businesses and manufacturers are revolutionizing conventional ways of life and paving the way to a promising future.

However, in some countries, such as Spain and Italy, governments no longer need to provide incentives to businesses using renewable energy because the cost of using wind and solar power is less expensive than coal- and natural gas-fired plants [93]. In these countries, governments are able to put this money to other use, such as providing more extensive public transportation. Penalizing corporations who refuse to use clean energy (barring that they cannot afford to upgrade equipment) and creating legislation regarding crimes of ecocide will force corporations to be held accountable for putting profit over the health and safety of citizens [94].

Enacting legislation that requires car manufacturers to reduce the amount of emissions from all of their vehicles every year without increasing their cost would significantly decrease pollution and increase air quality. Some affordable, fully electric vehicles have already been developed, thus the technology currently exists to meet these standards. Everyone has a social responsibility in this fight, even corporations. Designing aesthetically pleasing, safe, and reliable electric vehicles will create higher interest and demand for greener automobiles for years to come. Considering the strong relationship between oil prices and gross domestic product (GDP) around the world, reducing dependence on oil would greatly benefit global economies in the long run [95].

Last but not least, governments must ensure that their citizens are satisfied with the steps they are taking to combat climate change. Feedback from individuals and corporations is one of the greatest sources of information governments can use to maintain or promote well-being and health in citizens. They must be willing to engage with them, truly listening to and caring about their concerns and anxieties. And they must be willing to make changes and set their personal interests aside for the betterment of the world.

6. Concluding Remarks

An overview of psychological mechanisms that support inaction can make an average reader somewhat pessimistic about the human ability to cope effectively with climate change. Additionally, we have not even listed all mechanisms, such as those linked with emotions (e.g., shame, guilt, or regret) or anticipations thereof, in an attempt to be concise. Despite some discouraging information, we believe that from a social and behavioral science perspective, the reduction of climate change begins with getting a grip on psychological barriers—whether cognitive, behavioral, or social in nature—for behavioral change. Furthermore, part of the potential solutions is derived from increasing awareness and making the abstract and distal issue of climate change more concrete and closer to the self. Awareness is important, especially with respect to increasing it around the world, including countries in transition to growing economies. Awareness is in many ways a necessary ingredient, but far from sufficient for behavioral change. Clearly, for some more than others, reducing the costs of behavioral change (e.g., making training less expensive) is essential, as well as clues as to how to bring about behavioral change and how to sustain it.

For nearly any form of behavioral change, it is important to recognize that people are social animals. Indeed, one lesson from decades of research in psychology is that human behavior is strongly embedded in communities, be it neighborhoods, information groups, or networks of friends or professionals (e.g., scientists). These social networks may often help to convey clues for change, remove barriers to change, and provide the norms and sometimes support needed for sustainable behavioral change. Governments are in many ways in charge of the “boundary conditions” in terms of making behavioral change more feasible, more attractive, and more profitable for individuals and groups. Our closing remark is that we need individuals, communities, and governments around the globe to work together to start a climate change revolution. Although the effects of these strategies may be minimal at the individual level, collectively as communities and governments working together we translate small change into change with high impact; it often takes “cooperative” collectives and governments to bring about effective change in the short term. Effectiveness and timing matters, a lesson confirmed by the success and failure found in how the world is now in 2020 seeking to resolve the Covid 19 crisis.

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