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The Political Implications of Misunderstandings of the Mechanism of Climate Change

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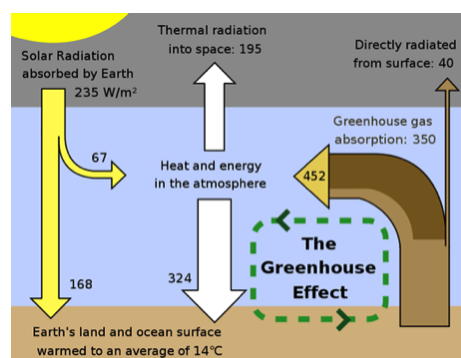
I would like to begin with an expert's opinion on the mechanism of global warming: "Having spent nearly 20 years as a research scientist at UCSD's Scripps Institution of Oceanography where global warming and climate change have been recognized since the 50s, [the] main causes are industrialization, human activities (e.g., use of gas) and overpopulation. Certain emissions caused by human activities have caused the "greenhouse effect" and have been shown (with excellent scientific evidence) to have affected the ozone layer and contributed to global warming."¹ It certainly sounds like this person has the credentials to get it right. Well, this expert, like many others, has it partially wrong. My name is Sarah Cohen, and with my mentor Michael Ranney, I have been studying the political implications of misunderstandings of the mechanism of climate change. Such scientific misunderstandings possibly form barriers to adaptation to climate change, which can be defined "any adjustment that reduces the risks associated with climate change, or vulnerability to climate change impacts, to a predetermined level, without compromising economic, social, and environmental sustainability" [3, p. 810]. After realizing that I, even as an environmental science major, had a flawed understanding of the mechanism of climate change, I began to wonder if increased knowledge of the mechanism is related to people's environmental policy beliefs. The theme of my thesis in environmental sciences therefore focuses on this relationship between people's voting tendencies and their scientific knowledge, in the hopes that this link may reveal a fundamental reason why society has thus far been unwilling or unable to address climate change, a subject which has attracted enormous attention [11, 1, 4]. In this talk, I will argue that it seems that knowledge about global warming's scientific basis is incredibly incomplete among people in San Diego and is not necessarily tied to belief in its existence, its anthropogenic origins, or the desire for more political effort on "green" initiatives. I will illustrate my findings that first, people

¹ In this paper, I will use the terms "climate change" and the more colloquial "global warming" as interchangeable.

are uncertain of the causes of climate change; second, that very few people are able to name and explain the mechanism, the greenhouse effect; and lastly, that more scientific knowledge about the mechanism does not necessarily accompany more “green” political attitudes. To clarify the relationship between a voter’s understanding of the mechanism and their political choices, I conducted a survey in San Diego in which participants provided both written accounts of climate change’s mechanism and quantitative Likert scale opinion ratings for the values of various environmental policy choices. To measure “green” policy feelings, I used the frame of desired “effort” on green initiatives [8] and then compared these feelings to the completeness of a person’s conception of the greenhouse effect.

Let us begin by examining what people know, or think they know, about the causes of global warming. Interestingly enough, as I bothered people, who were just minding their own business in parks, coffee shops, and classrooms in different parts of the city, I found that depletion of the ozone layer is, in fact, one of the most commonly cited mechanisms of global warming. However, depletion of the ozone layer in the upper atmosphere is, in fact, not really related to global warming. Ozone is a greenhouse gas, which means that it has the molecular structure needed to absorb infrared light. If you, like me, have attempted to repress all memories of chemistry class, infrared light is a relatively low energy form of radiation. Now would be a good time to explain the accepted scientific mechanism of climate change. So, here is the abbreviated version: The sun gives off radiation in all forms, ultraviolet (the type that gives me far too many sun burns), visible, infrared, etc.

Fig. 1: The greenhouse effect.



This energy reaches earth’s atmosphere. Some immediately is reflected off the atmosphere and back into space. The radiation that gets through, however, is absorbed by the surface of the earth. This energy later gets radiated up as infrared radiation, i.e., heat. Because infrared radiation is low energy, only some molecules have the ability to absorb it. For instance, elemental nitrogen, which is by far the largest component of our atmosphere, cannot absorb infrared light. However, molecules like CO₂, methane, and yes, ozone, can absorb infrared light, essentially trapping that heat in the atmosphere, where it bounces around a while before finally making it back out into space. This is the dreaded greenhouse effect, that phrase we often hear tossed around. However, it is important to remember that without the greenhouse effect, Earth would be just a cold lump of rock in space; we need the greenhouse effect to survive. It’s when the proportions get out of whack that it starts getting hotter. This is how global warming is supposed to work and will serve as the “100%” correct baseline of a

lay understanding of the mechanism.

But now we return to depletion of the ozone. In the written section of the survey, about 40% of people referenced depletion of the ozone in the upper atmosphere as the main cause of global warming. In the quantitative part of the survey (Figure 2), on the other hand, a huge majority of people clearly believed that ozone depletion was a big cause of climate change. This echoes the findings of previous studies [2]. In fact, depletion of the ozone layer in the upper atmosphere is a separate issue, and in some ways, ozone depletion would cause global warming to diminish, given that ozone (as a GHG) has that chemical ability to absorb infrared light. However, by referencing the ozone layer, most people do realize that global warming does have something to do with the atmosphere and molecules in the air. But, as they say, the devil is in the details.

People clearly conflate the ever-feared ozone hole with warming: as one participant recorded, “ozone layer damage → earth warming → pole melting → water/ocean level rises → wind decays → seasons change → vegetation decays.” Overall, however, in the written section of the survey, most people who responded to the question asking about how humans are believed to contribute to global warming at least knew some of the main causes, including, as one person so aptly put it, “driving hummers.” Many people listed pollution as a cause, and while this is partially true, pollution alone does not cause global warming. As we discussed, it is certain gases in pollution that matter. Some people were able to list industrialized meat as a major cause. To quote from Jonathan Safran Foer’s (2009) book, *Eating Animals*, “farmed animals contribute more to climate change than transport” [6, p. 58]. One gentleman told me how, in New Zealand a few years ago, sheep farmers were driving their tractors up to the capitol to protest a proposed tax on livestock emissions—certainly making news across the Pacific [5]. On the other hand, there still were a substantial number of people in San Diego who listed emissions from livestock as either “not a cause of climate change” or a minor cause (Figure 3). Not everyone is getting the same story.

Which brings me to my next point: Very few people surveyed were able to explain, or even to name, the mechanism of climate change—the greenhouse effect. Out of 275 surveys, only twelve people named the “greenhouse effect” and described it in varying degrees of correctness (from mostly right to in conjunction with depletion of the ozone layer), and three other people described it both thoroughly and correctly; some others knew that the mechanism had something to do with certain gases trapping heat.

Fig. 2: Depletion of ozone as cause.

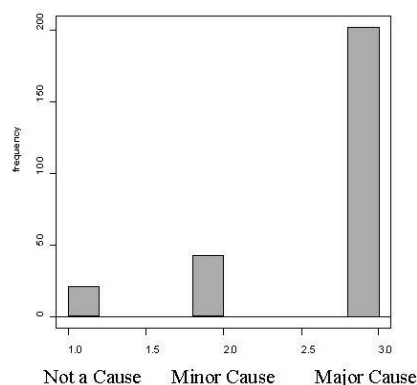
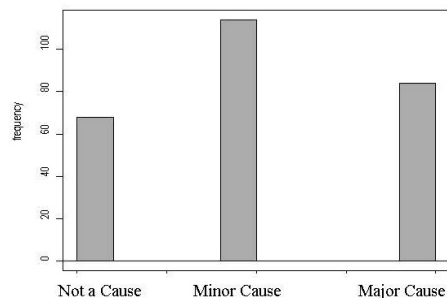
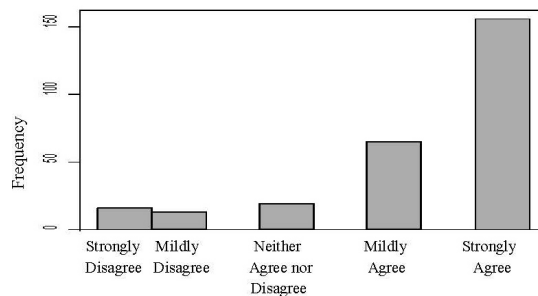


Fig. 3: Livestock as cause.

Even if people did not completely understand the mechanism, however, many people used the phrase “fossil fuels” or “greenhouse gases” in their description of how global warming works. Sometimes these phrases were used in a mostly correct context, and I quote a response: “scientists believe that human consumption of fossil fuels causes global warming.” Others were used in mostly incorrect contexts: “the greenhouse gases are destroying the ozone layer, which protects us from the light.” However, by using these phrases, people do seem to have some ability to use the vocabulary of the discourse of climate change, even if they lack the details. For many people, the level of knowledge about the mechanism of climate change is at most superficial. However, even if many people I surveyed did not fully understand the mechanism, a large majority believed that climate change was both occurring, and a significant result of human activities. By far, most people agreed with the statements, “I am certain that global warming (i.e., climate change) is actually occurring,” (Figure 4) and “human activities are a significant cause of global warming” (Figure 5). Still, a few people rejected climate change as untrue, but only one participant called it an outright hoax. Thus, most people I surveyed are genuinely convinced that climate change is a real phenomenon.

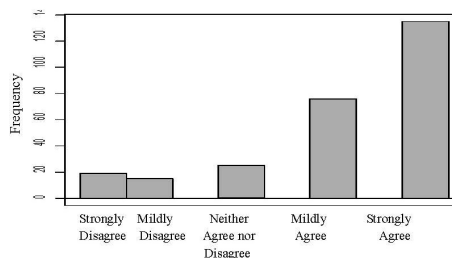
Fig. 4: Certainty of global warming’s reality.

But now we reach the main question of my project: are knowledge and political attitudes related (Figure 6)? This is going to take me a while to fully dive into, but we can take a preliminary look at how people felt about current environmental policy efforts. A section of my survey asked: “How much effort do you want the federal government to put into. . .” followed by a list of environmental issues that are part of government, such as “creating international treaties to lower greenhouse gas emissions” or “creating more public transportation.” In general, most people wanted either “a lot more” or “moderately more” effort for green initiatives, such as creating green job programs (the median response for this desired level of effort was “a lot more”). Related to people wanting more environmental policy efforts, the median score in response to the statement “I am satisfied with the federal government’s environmental policy efforts” was “I mildly disagree.”

There are a few preliminary connections between knowledge and attitudes. Importantly, the people who strongly disagreed with the reality of climate change generally wanted a lot less government effort on general environmental issues. For example, a gentleman with whom I talked at length about climate change seemed convinced that it was not “real,” having answered “strongly disagree” to the questions asking about both the anthropogenic nature of climate change and the existence of it. He believed, incorrectly, that scientists described the mechanism as, “heat is getting thru [sic] the ozone layer, and heat is not being dissipated fast enough that is generated beneath the ozone layer. I believe [this is] a false conclusion reached from a false premise.” He listed “a lot less” as his desired effort level for all the environmental measures, except for creating more nuclear power plants and developing more open space, for which he wanted a lot more. While his opinions were very strong and very clear, many other people’s opinions were not so blatant. It also appears that most people who do not believe in climate change have, like the rest of the people I surveyed, an incomplete picture of how global warming is supposed to work. Time will tell if people who knew relatively more about the mechanism wanted relatively more effort.

Now we will look at the people who knew the most about the mechanism. If you will recall, three people described the greenhouse effect thoroughly. Out of those, one person strongly disagreed with the statement “Human activities are a significant cause of global warming” (and wanted generally less effort on environmental issues). One man neither agreed nor disagreed (and wanted a mix of more and less effort on environmental issues). Finally, one participant strongly agreed (and wanted lots more effort on most environmental issues). Just by using these three people, it seems that perhaps the most complete

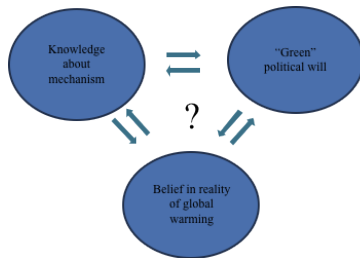
Fig. 5: Is global warming anthropogenic?



knowledge of the mechanism is not necessarily tied to certainty about the reality of anthropogenic climate change. I must do more analysis and coding to see how people with partial understandings of the greenhouse effect answered these questions; so far, however, it seems that the relationship between knowledge of global warming's scientific basis and belief in its anthropogenic origin is not at all simple, and neither is the relationship between knowledge about the mechanism and environmental political will.

So why does this all matter? If climate change is real, and if it poses a potential threat to our way of life, we need to make some changes. Some adaptation is taking place today, but the efforts are partial at best [7]. From discussions with people after they finished the survey, I heard many different opinions on what type of political action was needed. Some did not want to change the economy because they thought that the claims of scientists are not a good enough reason to alter their way of life. Some were ambivalent, thinking that things might not turn out that bad, so we should wait and see. Some, on the other hand, were convinced that we were already in too deep of trouble to pull ourselves out, and so it was hopeless to try anything political. One woman thought, to use her words, that we must “inspire” and “educate” people to change, for no one is going to want to address something that they think is hopeless or unreal or going to send their bank accounts into the red.

Fig. 6: What relationships are present?



This concept of education is key, and studying the connection between an individual's knowledge and environmental policy decisions has the potential to illuminate why adaptive laws have been so difficult to pass. Perhaps if people know more about why driving Hummers is bad, they will do it less. However, there are differing opinions on whether improved scientific knowledge actually begets altered attitudes about complex issues; some argue that the connection is minimal [9], while others posit that the link is solid [10]. Thus, if I find a correlation between more complete knowledge and more “green” political will, the case for the importance of better environmental education is bolstered; however, if there is no link, or even a negative one, different approaches must be considered to successfully enact “green” policy.

So, putting everything together, it seems that there is not yet a clear-cut relationship between knowledge about climate change and environmental attitudes, and if there is one thing I learned from this study, everyone has a valid reason for believing what they do (except maybe that one guy who told me that the ozone layer is imaginary—though for all I know, maybe God really did tell him that). From simple conversations with people, it seems that most are convinced that acting now environmentally would not be a horrible idea, but rather a reasonable plan to make the situation better for my generation and the ones that follow. As I continue to examine how people think about global

warming, I hope to discover more ways to inspire people to want to, perhaps not actually hug trees, but to at least think about it.

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