

Climate change beliefs and attitudes relationship to informational influences and demographic factors

Tobias Karlsson

Tutor: Anna Levén

Examiner: Arne Jönsson

Copyright

The publishers will keep this document online on the Internet – or its possible replacement – for a period of 25 years starting from the date of publication barring exceptional circumstances.

The online availability of the document implies permanent permission for anyone to read, to download, or to print out single copies for his/hers own use and to use it unchanged for non-commercial research and educational purpose. Subsequent transfers of copyright cannot revoke this permission. All other uses of the document are conditional upon the consent of the copyright owner. The publisher has taken technical and administrative measures to assure authenticity, security and accessibility.

According to intellectual property law the author has the right to be mentioned when his/her work is accessed as described above and to be protected against infringement.

For additional information about the Linköping University Electronic Press and its procedures for publication and for assurance of document integrity, please refer to its www home page:

<http://www.ep.liu.se/>.

© Tobias Karlsson

Abstract

One of the biggest challenges for the modern society is that of climate change. Despite the growing accumulation of scientific evidence that points towards a strong need for action to be made regarding anthropogenic (human made) climate change, there is a lack of unity in what actions are needed and an outspread passivity amongst both establishments and the public. The reason behind this is attributed to lack of belief in anthropogenic climate change, and lack of pro-environmental attitudes amongst the public. Furthermore, these issues have been found to relate to identity related beliefs and attitudes that conflict with pro-environmental beliefs and attitudes, where political orientation has proven to be a strong factor. One way of dealing with these issues could be through informational influences. By presenting people to information shaped in different ways, one could increase the belief in anthropogenic climate change and pro-environmental attitudes. This study examined the relationship between three different informational influences, and its potential effect on climate change beliefs and attitudes. Furthermore, this study examined the relationship between demographic factors such as age, gender and political orientation with regards to their potential effect on climate change beliefs and attitudes. 449 participants completed a survey with intent to measure the potential effects informational influences and demographic factors had on climate change beliefs and attitudes. Despite that indications were found, no significant results could be identified for the informational influences. All demographic factors had some significant effect on climate change beliefs or attitudes, where political orientation was the strongest influencing factor. This relates to earlier research and further implications were discussed for future studies.

Table of content

Introduction	1
Problem	3
Purpose	3
Research question 1	4
Research question 2	4
Delimitation.....	4
Theory	5
Climate change.....	5
Skepticism and uncertainty of climate change.....	6
Knowledge deficit model	7
Cultural cognition.....	8
Motivated reasoning	9
Cognitive dissonance.....	11
Social influence	12
Scientific consensus as normative influence	15
Societal consensus as normative influence	16
Method	17
Participants	17
Material	17
Design.....	19
Procedure.....	20
Results	21
Research question 1.....	21
Research question 2.....	22
Bar graphs	24
Plot graphs.....	26
Histogram	32
Scatterplots	33
Discussion	37
Method	37
Results	37

General discussion.....	38
Conclusion.....	43
References	44
Appendix	47
Questionnaire	47

Introduction

The debate of anthropogenic (human caused) climate change has become a highly infected issue in modern society. Despite the growing accumulation of scientific evidence that points towards a strong need for action to be made, there is a lack of unity in what actions are needed and an outspread passivity and skepticism amongst both establishments and the public. These issues relate to forces that drive climate concerns into cultural landscapes of conflicting political and ideological views. It also relates to uncertainty in what behavioral change is needed and how one can stay committed to that behavior. The nature of the subject as one instilled with conflict polarize a great deal of people. The apathic relation one can interpret relates to the fact that most people do not feel motivated to get engaged in the process of creating a better (climate) future (Dunlap, 2013). These types of issues are common themes in the modern society and can be seen as root issues concerning most factions of progress, concerning both the individual and societies as a whole (Stoknes, 2015).

A popular approach to explaining the lack of concern and the existence of skepticism and uncertainty amongst the public is through the *knowledge deficit model* (Sturgis & Allum, 2004). The knowledge deficit model assumes that gaps between scientists and the public are a result of a lack of knowledge amongst the public. Furthermore, the model attributes skepticism and hostility towards science to a lack of understanding, which is based in a lack of knowledge acquiring. However, it does not seem probable that the lack of concern and engagement amongst the public is solely caused by a lack of information. Even though information can help people update their beliefs, if they lack knowledge, it does not seem probable to help in cases where people already consider themselves as holding a fair share of knowledge. Kellstedt, Zahran and Vedlitz (2008) found that members of the public with a higher degree of science literacy and technical reasoning capacities were among those whom cultural polarization was the highest. This suggests that the debate over climate change is not solved by simply feeding the public with more information. Furthermore, the political and ideological orientation of the person tends to affect their beliefs and attitudes regarding climate change. Kahan, Jenkins-Smith and Braman (2011) explained these findings by something they referred to as “cultural cognition”. This theory refers to the tendency of individuals to fit their perceptions of risk and related beliefs to the shared moral evaluations of

the cultural group they belong to. Furthermore, the ability to justify these beliefs and attitudes seems to be connected with their ability to create seemingly reasonable justifications for their opinions, which relates to a theory known as “motivated reasoning”. This is an effect that has been found amongst conservatives when it comes to climate change, where skepticism and uncertainty is much higher than amongst the average person, and where their ability to justify their beliefs and attitudes relates to how strongly they hold them and how well informed they consider themselves to be.

According to Estrada, Schultz and Silva-Send (2017) an important factor for which beliefs and attitudes one hold relates to a socializing process, which induces people's beliefs, attitudes and behaviors. Normative beliefs and behaviors seem to be strong indicators of how the public thinks and acts. So, to penetrate conflicting beliefs, attitudes and behaviors, one should look at using the power of normative influence. In a study by van der Linden, Leiserowitz and Maibach (2018) they found that by presenting participants to a normative belief, in the shape of the following scientific consensus statement: "97% of climate scientists have concluded that human-caused global warming is happening", they found that it reduced polarization between higher educated liberals and conservatives by roughly 50%, and subsequently caused the participants to update their beliefs to more closely fit the norm. They found that by just stating a normative belief, in the shape of a scientific consensus, it affected conservatives to update their beliefs and attitudes from being more skeptical to closer fit the scientific consensus. If the scientific consensus effect found by van der Linden et al. (2018) can be replicated, it might have a strong effect on the person's reevaluation of not just their beliefs but also their attitudes and subsequent behaviors. However, since one of the strongest socializing processes regarding beliefs and attitudes is that of political belonging (Kahan et al (2011), it is possible that a consensus that would state pro-environmental beliefs and attitudes across the political divide, could entail even stronger effects. If the same normative beliefs were expressed by the public, across the political divide, it seems probable that it would affect the subject in a similar vein. But that might entail that the societal consensus needs to be expressed in such a way that it does not conflict with values developed amongst those political groups. However, no studies have been made to see if this effect exists in the shape of a societal consensus.

Problem

Despite the growing accumulation of scientific evidence that points towards a strong need for action to be made regarding anthropogenic climate change, there is a lack of unity in what actions are needed and an outspread passivity amongst both establishments and the public. This relates to a lack of belief in anthropogenic climate change, and lack of pro-environmental attitudes amongst the public. These attitudes relates to certainty in the fact that climate change is happening, concern about the effects of climate change, and perceived ability to do something about climate change.

Purpose

The purpose of this study is to examine whether there is a measurable effect regarding beliefs and attitudes amongst people when they are presented to information that in different ways tries to influence them. This regards in the first condition (scientific facts) if people generally seem to update their beliefs and attitudes according to the scientific facts about climate change that they are presented to. This in line with the knowledge deficit model. The second condition (scientific consensus) regards if people generally updates their beliefs and attitudes of climate change according to the scientific consensus they are presented to. This in line with the discoveries of van der Linden et al (2018). The third condition (societal consensus) regards if people generally updates their beliefs and attitudes of climate change according to the societal consensus they are presented to. Since studies have found lack of support for the notion that scientific facts alone could help increase belief in anthropogenic climate change and increase in pro-environmental beliefs but van der Linden et al (2018) found support for this notion but concerning a strong (scientific) consensus. The relationship between scientific facts and scientific/societal consensus will be examined as well. Furthermore, other factors could affect climate change beliefs and attitudes, these regards factors such as gender, age and political orientation. Political orientation has been found to be a significant factor regarding climate change beliefs and attitudes in earlier studies, such as that of Kahan et al (2011). This will be examined in this study as well.

The purpose can be summarized into two research questions:

Research question 1: Does informational influences in terms of scientific facts, scientific consensus or societal consensus significantly increase belief in anthropogenic climate change and pro-environmental attitudes?

Research question 2: Does demographic factors (age, gender, political orientation) have a significant effect on beliefs regarding anthropogenic climate change and pro-environmental attitudes?

Out of these research questions three hypothesis where formulated.

H1: Informational influences in terms of scientific facts, scientific consensus and societal consensus significantly increase belief in anthropogenic climate change and pro-environmental attitudes compared to when no informational influence is given.

H2: Informational influences in terms of scientific consensus and societal consensus significantly increase belief in anthropogenic climate change and pro-environmental attitudes compared to scientific facts.

H3: Political orientation has a significant effect on beliefs of anthropogenic climate change and pro-environmental attitudes in the shape of increase in right-wing orientation leads to a decrease in beliefs of anthropogenic climate change and pro-environmental attitudes.

Delimitation

This study was limited to one semester and further results found from the survey were not examined in this study.

Theory

This chapter is divided into each relevant section as below.

Climate change

There is a growing body of scientific evidence for anthropogenic (human caused) climate change. NASA reported in 2017 that the planet's average surface temperature has risen about 0.9 degrees Celsius (°C) since the late 19th century, a change driven largely by emissions such as carbon dioxide (CO₂) into the atmosphere. Emissions caused mainly by human activities such as deforestation, land use changes, and the burning of fossil fuels. Furthermore, they reported that most of the warming has occurred in the past 35 years, with the five warmest years on record taking place since 2010, where 2016 was the warmest year on record so far. The Intergovernmental Panel on Climate Change (IPCC) reported in 2018 regarding the long-term warming trend since pre-industrial times, and described an observed global mean surface temperature rise for the decade 2006–2015 to 0.87°C (estimated between 0.75°C and 0.99°C) higher than the average over the 1850–1900 period. Furthermore, warming greater than the global annual average was reported of being experienced in many land regions and seasons, including two to three times higher in the Arctic, where the melting of polar ice accelerates the temperature increase. Warming was generally higher over land than over the ocean, which indicates that habituated areas are experiencing a stronger effect than non-habituated areas (NASA, 2017).

In a globally expanding survey by Pew Research (2015) they found a global consensus concerning that climate change is a serious problem, 85% found it at least a somewhat serious problem and a global median of 54% found it a very serious problem. 78% in a global median supported the limiting of greenhouse gas emissions as well. The concern was highest in Latin America and Africa, and lowest in US and China, something that coincides with the fact that these are the two countries that are responsible for the greatest annual carbon dioxide (CO₂) emissions. In the US a vast difference in attitudes could be found regarding partisanship, where liberals expressed far more concerns than conservatives. 68% of liberals found climate change as a very serious problem, while only 20% of conservatives found it a very serious problem. Connections between partisanship and attitudes has been found in other countries

such as Australia, Canada, Germany and the U.K. Furthermore, according to most respondents, confronting climate change will entail more than just policy changes, it will also require significant changes in how people live. A global median of 67% believe that in order to reduce effects of climate change, people will have to make major changes in their lives. A median of just 22% believe technology can solve climate change problems alone, without requiring major changes in people's everyday lives. Even in the U.S. 66% of the public believed that people will need to significantly alter their lifestyles (Pew Research, 2015).

In a survey sponsored by ABC News, by Stanford University's Political Psychology Research Group and Resources for the Future (2018) they found that trust in what scientists say about climate change ranged drastically amongst political orientation, 74% of strong liberals trusted in scientist while only 6% of strong conservatives shared that trust. Despite an outspread attitude that the government should be doing more about global warming (61%) and an outspread support in cutting emissions (over 70%), they found a lack of support for increased taxes regarding pro-environmental initiatives. A majority was also concerned about price increases entailed by pro-environmental initiatives. Furthermore, it is not clear how many of those who express concerns about climate change, that are altering their behavior in a more pro-environmental manner. Ultimately, there is a large part of the public that has low concerns regarding climate change and where other subject matters such as cost concerns seems to be in the way of an increase regarding pro-environmental behaviors. This relates to lack in certainty and concerns amongst the public as well as the establishments, where it seems that there is no strong homogenous consensus driven unity in beliefs and attitudes regarding climate change (Dunlap, 2013). One strong factor relating to environmental beliefs and actions comes from political orientation, where strong forms of skepticism regarding climate change exists amongst those who identifies themselves more towards the right-wing (Dunlap & Mcwright, 2008).

Skepticism and uncertainty of climate change

In the face of the perplexing issue of increased certainty and concern amongst the scientific community coupled with a lack of increase in certainty and concern amongst the public, Whitmarsh (2011) developed a survey to measure aspects such as concern, skepticism and certainty amongst the public and examine how it had changed over time. Whitmarsh (2011)

found that skepticism was strongly related to individual's environmental and political values, and indirectly related to age, gender, location and lifestyle. He found no relationship between perceived knowledge and certainty or skepticism. Furthermore, he found that denial of climate change was also less common than the perception that it has been exaggerated, which in turn caused skepticism and/or uncertainty. Based on studies by Whitmarsh (2011), Greenhill, Leviston, Leonard and Walker (2014) developed a survey to more directly measure the belief of the public. They used four different options which represent levels of either skepticism or uncertainty regarding anthropogenic climate change. They found further support for the survey questions originally developed by Whitmarsh (2011).

Knowledge deficit model

There is an apparent divide in beliefs, attitudes and behaviors amongst the public regarding climate change. This urges a question of why? There is a need to understand and explain why this is so one can approach the issue and try to solve it. A popular approach to explaining divide in beliefs, attitudes and behaviors amongst the public is through the *knowledge deficit model* (Sturgis & Allum, 2004). The knowledge deficit model assumes that gaps between scientists and the public are a result of a lack of knowledge amongst the public. Furthermore, the model attributes skepticism and hostility towards science to a lack of understanding, which is based in a lack of knowledge acquiring. As a remedy for this lack of knowledge, the deficit model suggests a one-way communication model where information is supposed to flow from experts to the public in an effort to change individuals' attitudes, beliefs and subsequent behaviors. Approaches to climate change communication that reflect the deficit model include websites, social media, mobile applications, news media, documentaries, films, books, scientific publications, technical reports and so on. The wide availability of tools for scientific communication has caused the traditional approach to spreading climate change awareness to have been built upon the knowledge deficit model (Suldovsky, 2017). The deficit model further suggests that increased focus on transferring knowledge should result in positive attitude and behavioral changes amongst the public. So, the model predisposes that knowledge acquisition help shapes what attitudes and subsequent behaviors that are being held. However, it also assumes that lack of knowledge helps shape beliefs (and subsequent attitudes and behaviors) which might be that of skepticism to scientific consensus. But when

one attributes skepticism towards science, it could also be based in acquisition of knowledge that speaks against the scientific consensus (Dickson, 2005).

Furthermore, it is not clear that this model holds a strong framework for promoting pro-environmental beliefs, attitudes and behaviors. The model has been criticized for being overly simplistic and inaccurately characterizing the relationship between knowledge acquisition and beliefs, attitudes and behaviors. In a study by Kellstedt et al. (2008) they measured the relation between public informedness (perceived knowledge), confidence in climate scientists and *self-efficacy* (self-efficacy refers to a person's beliefs in their capabilities to organize and execute courses of action required to produce given accomplishments). They found that more informed respondents felt less responsible and showed less concern for global warming. Respondents with high confidence in scientists also showed less concern for global warming than those with lower confidence in climate scientists. These are quite surprising results that goes against the expected relationship stated by the knowledge deficit model.

Cultural cognition

According to Kellstedt et al. (2008) a reason for the surprising relationship between informedness and felt responsibility could be that the information that is being shared and acquired is often of a theme of debate and conflict. Most people get their information from the media, not from scientific journals. This leads to the issue being treated as a political or ideological one, which in turn polarize a great deal of people, and the debate steers away from the core issue, which is that of how one should deal with anthropogenic climate change, instead the debate regards if climate change exists and if something should be done about it. As an example, several surveys, such as that by Pew Research Center (2015) have found that US Conservatives are far more skeptical of climate change than US Liberals. Most US citizens also think that the news media is biased when covering issues, which strengthens the opposing beliefs and polarization (Dunlap & Mcwright, 2008).

In a study by Kahan et al. (2011) they found that despite acquisition of scientific information, members of the public disagree about facts that the scientific community largely agree on. Kahan et al. (2011) explained this finding by a theory they refer to as "*Cultural cognition of risk*". This theory refers to the tendency of individuals to fit their perceptions of risk and related beliefs to their shared moral evaluations of assumedly dangerous activities. This can

be explained as the risk assessments and beliefs that are being shaped concerning subjects such as climate change, are rooted in the shared beliefs amongst peers as well as other cultural groups they see themselves belong to. These shared beliefs and subsequent behaviors then become socially beneficial within the group, despite how they relate to communities or forces that exists outside the group.

Furthermore, they found that cultural cognition shapes the perceptions of scientific consensus as well. As an example, if a person with strong beliefs against climate change is confronted with scientific information, they tend to overestimate the information they already have gathered and dismiss the information that does not fit with their stand. These beliefs are subsequently strengthened within the group who shares them. This indicates that the perception of the consensus could then be radically different from how the actual scientific consensus is. This can explain the current state of opposition to pro-environmental measures amongst, for example, many US conservatives. Kahan, Peters, Wittlin, Slovic, Ouellette, Braman and Mandel (2012) examined this subject further and found that members of the public with the highest degrees of science literacy and technical reasoning capacities were not those most concerned about climate change but instead among those where cultural polarization was the highest. This finding could be explained in more detail by something referred to as *motivated reasoning*.

Motivated reasoning

Kunda (1990) was one of the first to present the notion of *motivated reasoning*. He proposed that motivation affect reasoning through reliance on a biased set of cognitive processes, i.e. the strategies used for accessing, constructing and evaluating beliefs. Motivation enhances use of those beliefs and strategies that are considered most appropriate, which could relate to aspects such as consensus amongst friends, family, science and so on. However, the motivation to arrive at particular conclusions enhances use of those strategies that are considered most likely to yield the desired result. Kunda (1990) found considerable evidence that people are more likely to arrive at conclusions that they want to arrive at but found that their ability to do so was constrained by their ability to construct seemingly reasonable justifications for these conclusions. In a study by Washburn and Skitka (2018) they found that both conservatives and liberals engaged in motivated reasoning and denied correct

interpretations of scientific information when that interpretation collided with their personal beliefs and attitudes. This means that both liberals and conservatives denied scientific claims when it conflicted with their preferred conclusions. Washburn and Skitka (2018) suggested that these motivational processes underlie personal and politically biased differences in interpretation of subjects such as climate change.

Motivated reasoning can be related to the discoveries of Kahan et al (2011) and together be referred to as “motivated cognition” (cultural cognition and motivated reasoning). As stated, there can be several biases involved in the processing of climate change information. These regard how the searching of information can be biased in the shape of the sources one gathers the information from and regards how biased assimilation can generate culturally valenced *availability effects* on perceptions of information and expert views. The availability effect refers to what prior knowledge a person has available and relies on when confronted with new information. This prior knowledge is used when people decide whether the new information possess any truth or expertise. So, people who are being dealt the same information can come to radically different conclusions based on prior knowledge and how they assimilate the new information with the knowledge they hold from earlier. On this account, what most scientists believe is another empirical fact no different from any other that bears on a disputed question of risk, such as the risk of climate change, could be interpreted in many ways regarding one's predisposed beliefs and attitudes. As such, according to Kahan et al (2012) scientific information alone cannot be expected to counteract the polarizing effects of “motivated cognition” because if apprehension occurs, it will likely occur through the same social psychological mechanisms that shape individuals' perceptions of any other type of information.

Furthermore, if the instruments used to feed the public with the facts are not trusted, the skepticism of the sources that spreads the climate concerns could infect the issue itself with skepticism, causing stronger anti-environmental beliefs and attitudes. As mentioned, the tactic based on the knowledge deficit model, is that of spreading information through any sources possible, this includes the use of sources which are prevalent in presenting biased information and politically or ideologically motivated information, or simply factually incorrect information. So, even if the information regarding climate change does not possess factual errors or biased conclusions, because the source which delivers the information tends to

deliver nonfactual or biased information it can affect the perception of all information that these sources deliver, strengthening the beliefs against the information shared. Because of the intangible nature of the proof of anthropogenic climate change, this could result in the need of far more apparent evidence of anthropogenic climate change, to convince those who have their beliefs and attitudes not even moved by expert sources. If this becomes even more of an outspread issue it could entail the passivity of climate action until it's evidently needed, and perhaps too late.

So, it seems that information acquisition does not always imply more pro-environmental beliefs and attitudes. Since it depends on which information that is being acquired, and through which sources it is being acquired from. But also, on how the information collected relates to the current beliefs and attitudes of the person and their ability to find reasons to dismiss information that does not fit in with their current beliefs and attitudes. This of course also relates to the behaviors that are being hold by the individual. People tend to want to hold beliefs, attitudes and behaviors of a symbiotic nature. When acquiring new information, it is important that this information does not conflict with current information, especially if it is information that is important for the *identity* (the way people socially define themselves) of the individual. The way people want to hold their beliefs, attitudes and behaviors aligned is referred to as *the principle of cognitive consistency*, when something causes a conflict between our beliefs, attitudes or behaviors we feel something referred to as *cognitive dissonance*.

Cognitive dissonance

The Cognitive Dissonance Theory was first introduced by Festinger (1957). The theory suggests that we have an inner drive to hold our attitudes, beliefs and behaviors in a symbiotic relationship, as opposed to holding conflicting attitudes, beliefs or behaviors. This is known as the principle of cognitive consistency. When there is an inconsistency between attitudes, beliefs or behaviors people seem to produce a feeling of mental discomfort. This often leads to an alteration in one of the attitudes, beliefs or behaviors to reduce the discomfort and achieve a consistent cognition.

McLeod (2018) exemplified this with that of a smoker, which holds a behavior (smoking) that is not compatible with their belief about smoking (smoking causes cancer). This is an example

of a person that holds a cognitive dissonance. There are generally three ways in how people tend to address this discomfort. These regards changing the behavior (in this case, to stop smoking), changing the beliefs (acquire information that helps reduce the cognitive dissonance) or changing the attitude (in this case, for example, ignoring the belief one holds and put focus on the pleasure it gives to smoke). However, these changes do not guarantee that the dissonance is dealt with, these are rather steps people often take to reduce the dissonance experienced.

This framework could be applied regarding environmental attitudes as well. As an example, Eva learns about climate change and its potential devastating effects, this causes her to update her beliefs and attitudes about climate change. However, these beliefs and attitudes do not cause her to change her behaviors in a way that is more pro-environmental. When confronted about this, Eva feels dissonance, since changing one's behaviors often takes more effort than changing one's beliefs or attitudes, this could cause Eva to update her beliefs and attitudes in a way that justifies her behaviors. However, there is a possibility to use the need for cognitive consistency to increase pro-environmental beliefs and attitudes as well, this through something referred to as social influence (Gehlbach, Robinson & Vriesema, 2019)

Social influence

According to Estrada, Schultz and Silva-Send (2017) there is abundant evidence that social influence research is relevant to and informative in increasing engagement in pro-environmental beliefs, attitudes and behaviors. Knowledge acquiring can be seen as one variable in causing a change in people's environmental attitudes and behaviors. However, as mentioned earlier, it is not guaranteed that the information has a positive effect. First off, the information needs to be of a nature that does not invite conflict or debate, this might not feel too difficult of a step to achieve, however, to create a space where information is shared freely of political, ideological or other types of biases seems to be harder then what people originally have thought. If this step is achieved the information also needs to override information that is already held by the person. This has proven to be difficult when it comes to people who hold strong personal and identity related beliefs. These are beliefs which have been mentioned as those affected by what Kahan et al (2011) refers to as cultural cognition and what Kunda (1990) refers to as motivated reasoning, i.e. "motivated cognition". These concepts relate to

identity related beliefs and attitudes, which suggests that there is a form of socializing process that shapes one's cognition of climate change. This could be a process where one finds information online or amongst friends etc. However, this information shapes the person's perception of climate change, and the motivation for that specific perception, i.e. which information people embrace, relates to the identity of the person. Furthermore, the ability to justify these beliefs are related to how strongly one can motivate them, which in turn relates to how much information the person perceive itself as possessing. This can be conceived as penetrating a brick wall, in cases where there is a strong force of opposition to the information spread elsewhere, such as the opposition to climate change awareness, which is a form of social movement like any other social movements. In this case one must somehow penetrate the perception of all these people. Finally, if one succeeds in changing the beliefs of the person, one still needs to get the information to be of impact for the person and override feelings related to uncertainty in what one considers one can do against climate change and the lack of behavioral commitment once a person attempts to live in a more pro-environmental manner.

Estrada et al (2017) think that for climate change information to have a positive effect on one's beliefs which in turn can impact attitudes and behaviors, it requires a socializing process (*social influence*), where one can reach not only people's beliefs but also their identity and self-efficacy. Abrams and Hogg (1999) defined social influence by any change which a person's relations with other people (individual, group, institution or society) produce on his intellectual activities, emotions or behaviors. Furthermore, Deutsch and Gerard (1955) explained *social influence* by two psychological needs that lead humans to conform to the expectations of others. These are our need to be right (*informational influence*) and our need to be liked (*normative influence*). Informational influence can be explained as when one accepts information from another as evidence about reality. Normative influence can be explained as when one conforms to the expectations of others (Estrada et al, 2017).

As an example, take Tom, a US democrat. It is likely the information Tom holds is shared with people who Tom identifies with. This often means people close to Tom and people who share Tom's beliefs and values in other matters. If the people who Tom identifies with hold strong pro-environmental attitudes and behaviors, it is very likely that Tom holds these environmental attitudes and behaviors as well. The more unity in beliefs, attitudes and

behaviors exist across the spectra from those close to Tom, to those who for example live in the same location as Tom or share the same political orientation, the stronger the influential and normative influence would be. Furthermore, it is likely that Tom's self-efficacy increases when he sees people around him partake in pro-environmental behaviors. Through the process of social influence, these shared beliefs and attitudes could develop into normative behaviors in the social group Tom belongs to, once someone takes the first step and gets the collective to follow. These are examples of in-group normative influence, which derives from a "community" that shapes and enforces Tom's beliefs, attitudes and behaviors, and as long as influence from elsewhere does not interfere with the perception Tom has shaped, it is likely the engagement of Tom will grow as the engagement of the "community" grows. So, in the case of Tom, the socializing process shapes the identity of Tom as one who holds pro-environmental beliefs, attitudes and behaviors. In fact, social influence often structures behaviors in a form of social hierarchy of what behaviors one should engage in. If everyone from your closest circle, such as friends and family, to the more far out reaching circle, such as those who share the same geographical location or political orientation, all share a consistent behavioral norm, such as recycling, it would work as a strong motivator and reminder for one to partake in the same behavior. It seems that the socializing processes regarding everything from friends and family to political orientation or geographical location is a strong motivator for a person's beliefs, attitudes and behaviors. It would become a case of "everyone is doing it, so I guess I have to as well", in cases where resistance to behavioral commitment exists (Gehlbach et al. 2019).

However, despite climate change being a concern amongst a majority of people both in US and Europe, there is an outspread disagreement about what actions to take and the normative behavior tends to be that of a passive stand. There are few strong "communities" that partake in pro-environmental activities even if there are many people that are concerned and feel they want to do something about climate change. The subject of climate change is also one of debate and disagreement which cause polarization and a strong disparity in beliefs. In summary, the informational influence tends to vary, and the normative influence is generally weak regarding pro-environmental behaviors, which also relates to what one feels one has to give up on to achieve a pro-environmental result. But what if one could instill norms amongst people, reaching across common dividers of opinions such as political and ideological

motivators, if this would be possible it is likely this would help shape a more streamlined and scientifically consensus driven discussion of climate change, which then could help the process of behavioral commitment amongst the individual, and perhaps lead to more unified actions amongst societies as well.

Scientific consensus as normative influence

In a study involving 6000 US citizens, by van der Linden et al. (2018), they found that higher education coupled with a more conservative ideology resulted in less acceptance for climate science, confirming the hypothesis of motivated reasoning and cultural cognition, i.e. “motivated cognition”. However, when presented to a scientific norm; “97% of climate scientists have concluded that human-caused global warming is happening” they found that both liberals and conservatives updated their beliefs according to the scientific norm, with the effect being strongest amongst conservatives. This study suggests that communicating facts does not necessitate issue polarization. It seems that the scientific norm, which is an example of *authoritarian influence*, can counter beliefs caused by effects such as “motivated cognition”. Earlier studies do not support the notion that feeding people more facts effectively change deep-rooted beliefs. However, when one communicates the scientific norm, it seems to affect even deep-rooted beliefs and attitudes, which can subsequently affect behaviors as well. So, if simply giving people scientific information does not help, for example, in case of those affected by motivated reasoning or cultural cognition biases. It seems that if one instead let people know about the scientific consensus, it seems to have an impact, and subsequently shift the person's perception of climate change. This could be explained by the fact that the norm helps set standards against which people evaluate the appropriateness of their beliefs and attitudes and subsequent behaviors. This goes in hand with the idea that social influence plays a strong role in affecting environmental beliefs and attitudes, which in turn could affect behaviors as well. Scientific consensus is an example of an authoritarian influence, since it is the case of the experts' collective informational influence. If this consensus is stated, it could be understood as setting a normative focal point regarding what to think of climate change (Cialdini, 2007). However, looking at the strong effect of social influence, if one's identity related beliefs and attitudes are strong enough, it is likely that not even the expertise derived from the scientific consensus is enough to alter a person's perception, in this case a stronger form of influence could be needed.

Societal consensus as normative influence

Norms play an important role for people's identity and how they get by in everyday life. In-group norms is an especially strong heuristic that guide people and help shape their identity (Terry & Hogg, 1996). As noted, conservatives tend to be more skeptical of climate change information. Since scientific norms should derive from nonpartisan scientists it should be a norm that overrides ideas of political motivation. However, there are those skeptical of scientific norms as well. For example, there are ideas that the whole scientific world is somehow milking the concern of climate change for personal interests. Or simply that the case of climate change is exaggerated. In this case nonpartisan societal views, which specify in-group norms, such as "97% of conservatives and liberals alike support the notion of human caused global warming" could yield stronger effects concerning the update of one's beliefs, attitudes and subsequent behaviors. Norms of a less authoritarian sort could also feel easier to relate to and could then have a stronger effect even for those who are not skeptic of scientific consensus. However, few, if any, earlier studies have examined how societal consensus is perceived and what effects it might have regarding climate change beliefs and attitudes. Since political orientation seems to be a strong factor regarding individuals development of identity, which in turn seems to have a big effect on the individuals perception of subjects such as that of climate change, stating that a majority believe in anthropogenic climate change, regardless of political orientation, could affect subjects to update their beliefs to fit more accordingly to the presented societal norm, if they feel it does not heavily conflict with their perception of what their ingroup believes regarding climate change.

Method

Below follows the method of the study.

Participants

449 participants were recruited (47% female) through social media and the Amazon Mechanical Turk service. Age ranged between 18-72, $M=38$ $SD=12$. Political orientation ranged between farthest-left (with a score of 3) to the farthest-right (with a score of 21), 3-21, $M=12$ $SD=5$. The original sample consisted of 502 participants but 52 were excluded since they either did not fill in the entire questionnaire or they answered the questions incorrectly. From the Amazon Mechanical Turk service, one bot were identified and subsequently removed.

Material

A questionnaire that differed based on three different experimental conditions and one control condition (control, scientific facts, scientific consensus and societal consensus) was used. The questionnaire in full can be found in the appendix section. The scientific consensus and societal consensus was based on the study by van der Linden et al. (2018) and a survey from Pew Research (2018), it was constructed with intent to conceive a message of a strong consensus across the scientific community in the case of the scientific consensus, and across the political spectrum in the societal consensus condition. The control condition gave the participant no information. The scientific facts condition gave the participant information on climate change, taken from NASA (2017).

The scientific facts condition stated the following:

In 2017 NASA released the following information:

The planet's average surface temperature has risen about 1.62 degrees Fahrenheit (0.9 degrees Celsius) since the late 19th century, a change driven largely by human-made emissions into the atmosphere. Caused by for example deforestation, land use changes, and burning fossil fuels. Most of the warming occurred in the past 35 years, with the five warmest years on record taking place since 2010. 2016 was the warmest year on record.

The scientific consensus condition stated the following:

According to a recent globally extensive poll, a vast majority (97%) of climate scientists have concluded that human-caused global warming is happening. Furthermore, climate change is considered a high priority concern among scientists. Where much research is related to the development of renewable energy and in how to get the world engaged in environmental sustainability.

The societal consensus condition stated the following:

According to a recent globally extensive poll, a vast majority (97%) of people believe that human-caused global warming is happening. Furthermore, climate change is considered a high priority concern across the political spectrum. Where a majority of the respondents, regardless of political orientation, found it important to support the development of renewable energy and to get engaged in environmental sustainability.

The questionnaire contained questions regarding climate change attitudes, followed by demographics. The climate change attitudes segment contained one belief item (Q11 in appendix) followed by 18 attitude items (Q12-14 in appendix). These 18 attitude items were split in three sections, the first regarded self-estimated attitudes, the second regarded friends and family estimated attitudes and the third regarded shared political orientation estimated attitudes. The two latter sections (estimation of attitudes of friends and family and those with shared political orientation) together with one of the items (moral obligation) were not used in this study. Out of the six unique questions, four were used in this study and were based on the theory and regarded questions about belief, certainty, concern and self-efficacy (perceived ability). The further attitudinal items were trust in scientific consensus and informedness, they did not have a direct relationship to environmental beliefs and were therefore removed from this study.

The belief item was based on the study by Greenhill et al (2014) and Whitmarsh (2011). The ability (self-efficacy) item was based on the study by Kellstedt, Zahran and Vedlitz (2008) and Whitmarsh (2011). Further items were based on the study by Whitmarsh (2011).

The demographic section contained political measures based on the libertarian – authoritarian, egalitarianism – interventionism and leftwing – rightwing scale (Q15-16 in appendix), based

on a review by Curtice and Bryson (2003). This was followed by questions on nationality, gender and age (Q17-19 in appendix). For this study the nationality, libertarian – authoritarian and egalitarianism – interventionism items were not further examined. The leftwing – rightwing scale consisted of three items, these items regarded social policy, economic policy and general outlook.

The questionnaire was made with Qualtrics which is an online service for making surveys. Amazon Mechanical Turk was used to recruit participants by paying them 0.2\$ for completing the survey, a participant could only complete the survey once.

Design

The study followed a between group design which had three experimental conditions and one control condition, 0=control, 1=scientific facts, 2=scientific consensus and 3=societal consensus, so all in all it had four conditions. Further factors examined were political orientation, age and gender.

The experimental condition was a four-item categorical variable, gender was a binary variable 1=female and 2=male, political orientation and age were scale variables. Political orientation consisted of three measurements of self-estimated political orientation based on a left-to-right-wing scale. The three scales ranged from 1-7, where 1 was “very leftwing” and 7 was “very rightwing”. So, the political orientation scale ranged between 3-21 where 3 is the farthest left-wing and 21 is the farthest right-wing on the scale.

The first dependent variable, the belief item, was a nominal variable of four categories. The climate change belief item contained four groups, one containing those who believed climate change is anthropogenic (human caused), one containing those who believed climate change is not happening, one containing those who believed climate change is caused by natural fluctuations in Earth's temperatures and one containing those who did not know whether climate change is occurring or not.

To achieve linearity the belief item was “dummy coded” into two categories, these were regarding if one believed in anthropogenic climate change or not. So, a binomial logistic regression was subsequently performed to achieve a linear relationship between the dependent variable. The independent variables were two nominal and two scale variables which were all

included as predictors. The nominal variables were the four experimental conditions and gender. The scale variables, which were covariates, were age and political orientation. All independent variables served to identify important control variables as well as to indicate significant effects for further analysis.

A two-way MANCOVA was performed to measure the relationship between the remaining dependent variables by comparing their means which were on a scale level and were the following environmental attitudinal items; certainty, concern and ability. The independent variables were again based on the experimental conditions, gender, age and political orientation, which were ordered in fixed factors for the categorical variables (experimental conditions and gender) and covariates for the scale variables (political orientation and age). To examine significance further Chi-square tests and ANOVA's were produced.

Procedure

The questionnaire was taken online and included an informative text on content. The questionnaire then contained instructions followed by informed consent. If the participants agreed to partake in the study, they were presented with the first part of the questionnaire. In the first section, the participant was randomly assigned one of four conditions (one of the four conditions presented in the material section) which was distributed equally with roughly 100 participants per condition. When exposed to a potential condition (one being a control) the participant was given questions on climate change, with intent to measure the participants' climate change attitude, followed by the perceived attitude of its friends and family, and those who share its political orientation. After that section of the questionnaire was finished, the participant entered the demographic section, answering questions regarding political orientation, nationality, gender and age. After that section the questionnaire was finished and the participant was done, the participant was also given a chance to share any thoughts it had regarding the survey or likewise.

Results

This section aims to showcase the results of the two research questions, the three hypotheses and any further findings. The study examined the relationship between three different informational influences, and its potential effect on climate change beliefs and attitudes. Furthermore, this study examined the relationship between demographic factors such as age, gender and political orientation and their potential effect on climate change beliefs and attitudes.

The analysis was performed according to the method section and follows here. The model for the binominal logistic regression was significant, Nagelkerke's R-square=0.36. Box test was significant, $p < 0.01$, this indicates that Pillais trace was used for identifying significance. The model for the two-way MANCOVA was significant $F(5, 435) = 226,23$ $p < 0.01$. Box test was significant, $p < 0.01$, so Pillais trace was used for identifying significance.

Research question 1: Does informational influences in terms of scientific facts, scientific consensus or societal consensus significantly increase belief in anthropogenic climate change and pro-environmental attitudes?

H1: Informational influences in terms of scientific facts, scientific consensus and societal consensus significantly increase belief in anthropogenic climate change and pro-environmental attitudes compared to when no informational influence is given.

The informational influences were not significant as predictors regarding belief in anthropogenic climate change, $b=0.23$ $SE=0.10$, $p > 0.05$, and did not have a significant effect regarding environmental attitudes $F(15, 1311)=1,37$, $p > 0.05$. H1 could not be confirmed.

H2: Informational influences in terms of scientific consensus and societal consensus significantly increase belief in anthropogenic climate change and pro-environmental attitudes compared to scientific facts.

Scientific consensus, $b=0.20$ $SE=0,29$, $p > 0.05$, or societal consensus, $b=0.17$ $SE=0.29$, $p > 0.05$, did not significantly increase belief in anthropogenic climate change compared to scientific facts, $b=0.15$ $SE=0.28$, $p > 0.05$. Scientific consensus or societal consensus did not increase pro-environmental attitudes compared to scientific facts, $F(15, 1311)=1,37$, $p > 0.05$. H2 could not be confirmed.

Certainty	Condition 0	M=5,61	SD=0,13	Condition 1	M=5,91	SD=0,137
	Condition 2	M=6,00	SD=0,134	Condition 3	M=5,82	SD=0,136
Concern	Condition 0	M=5,43	SD=0,150	Condition 1	M=5,61	SD=0,157
	Condition 2	M=5,84	SD=0,154	Condition 3	M=5,48	SD=0,156
Ability	Condition 0	M=4,29	SD=0,154	Condition 1	M=4,50	SD=0,162
	Condition 2	M=4,67	SD=0,159	Condition	M=4,51	SD=0,161

Table 1. This table illustrates the mean and standard deviation for the four conditions (control, scientific facts, scientific consensus and societal consensus) for each attitudinal item.

The result regarding the relationship between belief and the informational influences is illustrated in figure 1. The result for the relationship between the informational influences and the environmental attitudes is illustrated in figure 3-5.

Research question 2: Does demographic factors (age, gender, political orientation) have a significant effect on beliefs regarding anthropogenic climate change and pro-environmental attitudes?

H3: Political orientation has a significant effect on beliefs of anthropogenic climate change and pro-environmental attitudes in the shape of increase in right-wing orientation leads to a decrease in beliefs of anthropogenic climate change and pro-environmental attitudes.

Political orientation was a significant predictor for belief in anthropogenic climate change, $b=-0.27$ $SE=0.03$, $p < 0.01$. $Exp(B)$ showed that per unit increase in political orientation, there was a 0.76 (24%) change in belief. For each increase on the scale in regards of right-wing orientation, there was a 24% decrease of belief in anthropogenic climate change (on average), as illustrated in figure 2. This indicates that the more right-wing one specified to be the more likely one was to not believe in anthropogenic climate change.

A Chi-square test of independence was calculated for the belief item and political orientation, which was significant, $\chi^2(18) = 116.99, p < 0.01$. This indicates that the observation made is significantly likely to occur if H0 can be rejected, which it could.

Political orientation, $F(5, 435)=24.47, p < 0.01$, was a significant model in the two-way MANCOVA. Political orientation was significant for the attitudinal items concern, $F(1)=60.23, p < 0.01$, and certainty, $F(1)=80.73, p < 0.01$, but not for ability (self-efficacy), $F(1)=2.03, p > 0.05$. Increase in right-wing orientation decreased the level of concern for climate change and certainty regarding being certain that climate change is happening, as illustrated in figure 6-8. This result indicates that H3 could be confirmed except in terms of self-efficacy.

Age was a significant predictor as well, $b=-0.02, SE=0.01, p < 0.01$. Exp(B) showed that per increase in age there was a 0.98 (2%) change in belief. Per one-year increase in age there was a 2% decrease of belief in anthropogenic climate change (on average), as illustrated in figure 7. This indicates that for increase in age there is a slight chance of decrease in belief of anthropogenic climate change. However, a Chi-square test of independence was calculated for the belief item and age, which was not significant, $\chi^2(53) = 60.34, p > 0.05$. This indicates that the observation made is not significantly likely to occur if H0 can be rejected, which it was.

Age was also a significant model in the two-way MANCOVA, $F(5, 435)= 4.97, p < 0.01$. Age had a significant effect in terms of self-efficacy, were younger people estimated higher levels of self-efficacy, $F(1)=4.32, p < 0.05$, as illustrated in figure 12. Once again, a chi-square test indicated non-significance, $\chi^2(318) = 350.18, p > 0.05$. So, the observation can not be assumed to occur even though H0 could be rejected in one case. All relationships are illustrated in figure 10-12.

Gender was not a significant predictor for belief, $b=0.27, SE=0.20, p > 0.05$, and did not have a significant model in the two-way MANCOVA, $F(5, 435)=2.05, p > 0.05$. However, one significant effect was discovered in terms of self-efficacy, $F(1)=4.34, p < 0.05$, were females estimated higher levels of self-efficacy, as illustrated in figure 5.

All demographic factors had some influence but the most influential factor of all was political orientation.

Bar graphs

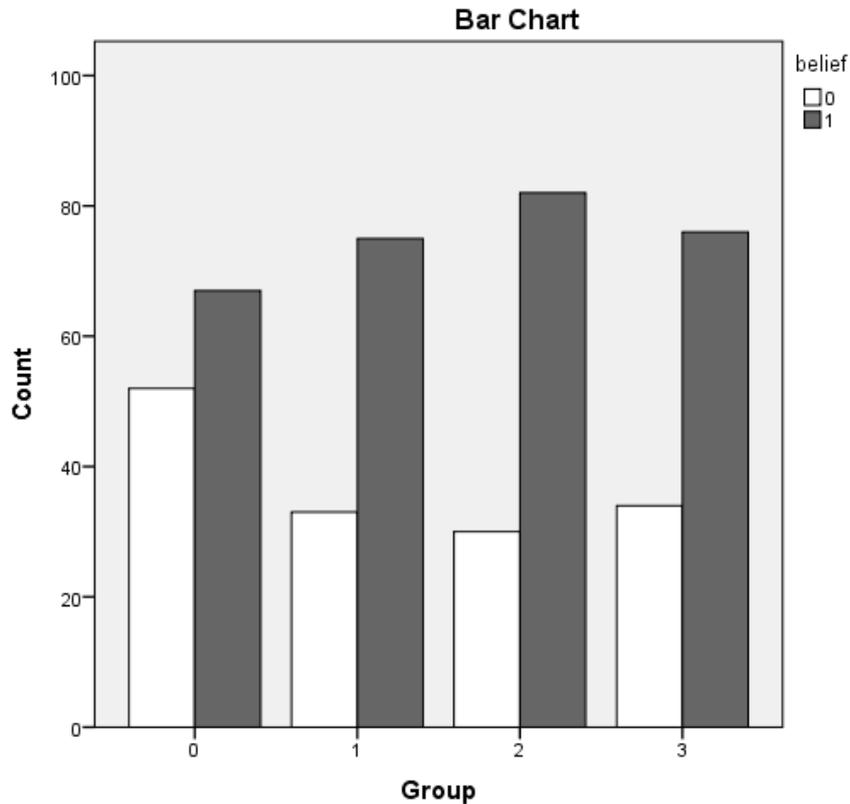


Figure 1. This bar graph shows the relationship between the four conditions, (group 0=control, 1=scientific facts, 2=scientific consensus, 3=societal consensus), and the belief item, (0=do not believe in anthropogenic climate change, 1=believe in anthropogenic climate change). Even if it's not significant, one can see that the control condition compared with the experimental conditions has a lower level of belief in anthropogenic climate change.

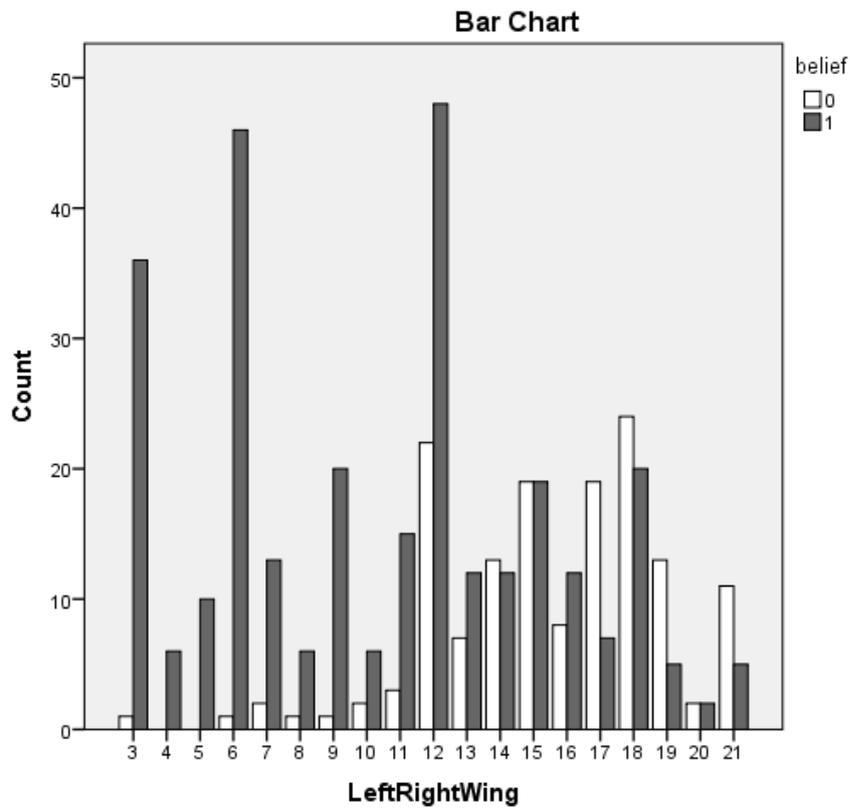
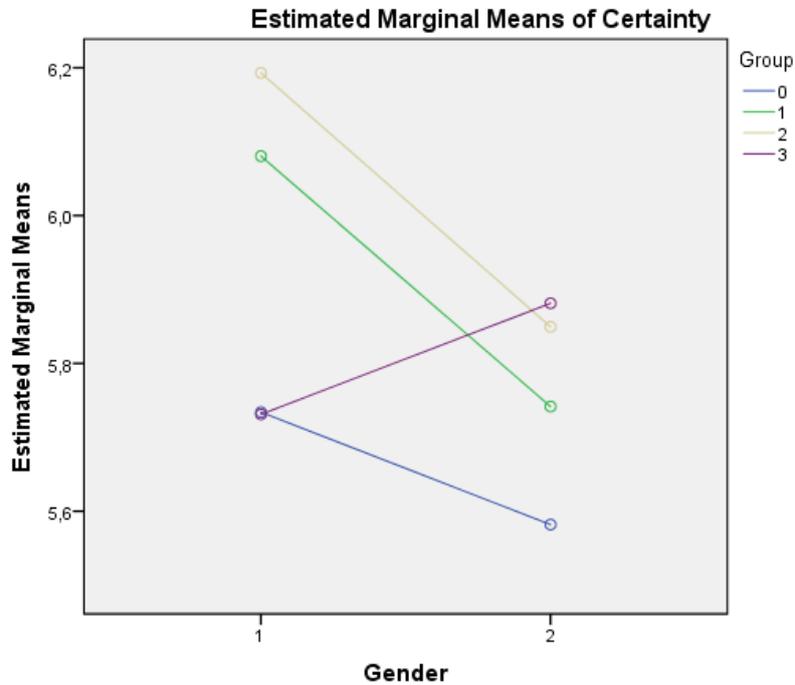


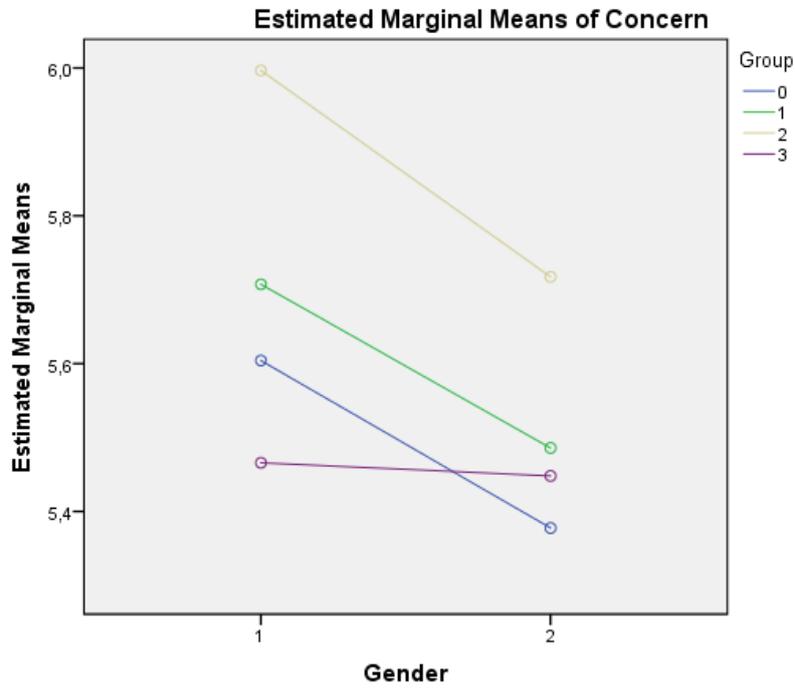
Figure 2. This bar graph shows the relationship between political orientation and the belief item. Chi-square and the regression indicated a significant relationship, $p < 0.01$, where the more right-wing orientated subjects had less belief in anthropogenic climate change on average.

Plot graphs



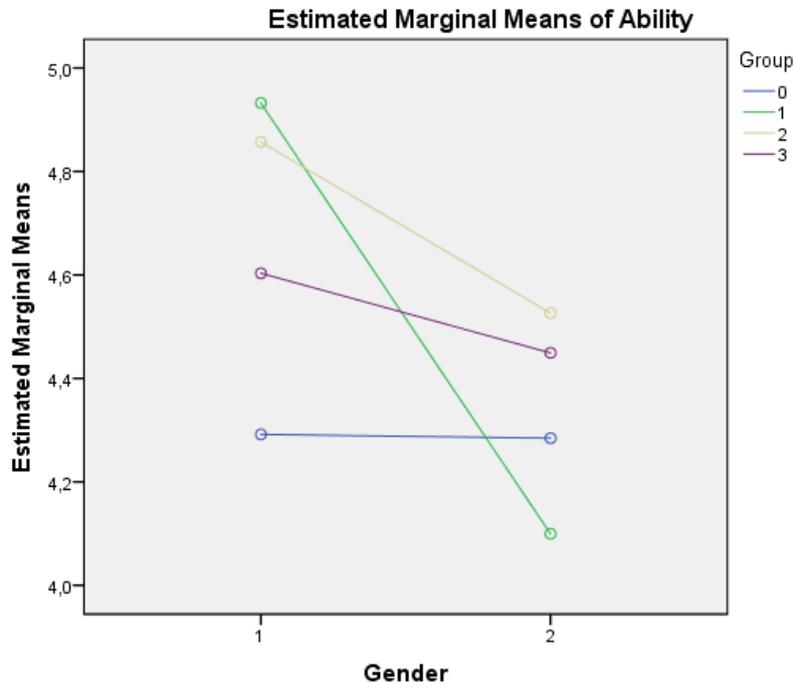
Covariates appearing in the model are evaluated at the following values: Age = 37,71, LeftRightWing = 12,06

Figure 3. This plot shows the relationship between the four conditions, gender (1=female and 2=male) and the attitudinal item certainty.



Covariates appearing in the model are evaluated at the following values: Age = 37,71, LeftRightWing = 12,06

Figure 4. This plot shows the relationship between the four conditions, gender and the attitudinal item concern.



Covariates appearing in the model are evaluated at the following values: Age = 37,71, LeftRightWing = 12,06

Figure 5. This plot shows the relationship between the four conditions, gender and the attitudinal item ability, $p < 0.05$ for gender.

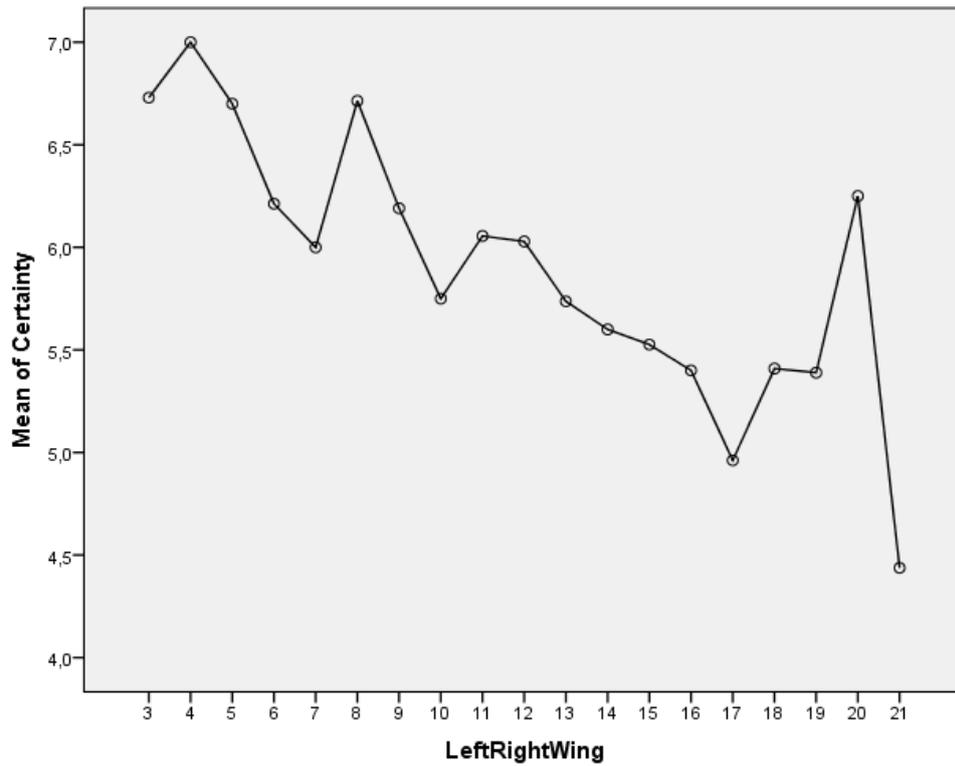


Figure 6. This plot shows the relationship between the left-to-right-wing scale (political orientation) and the attitudinal item certainty, $p < 0.01$.

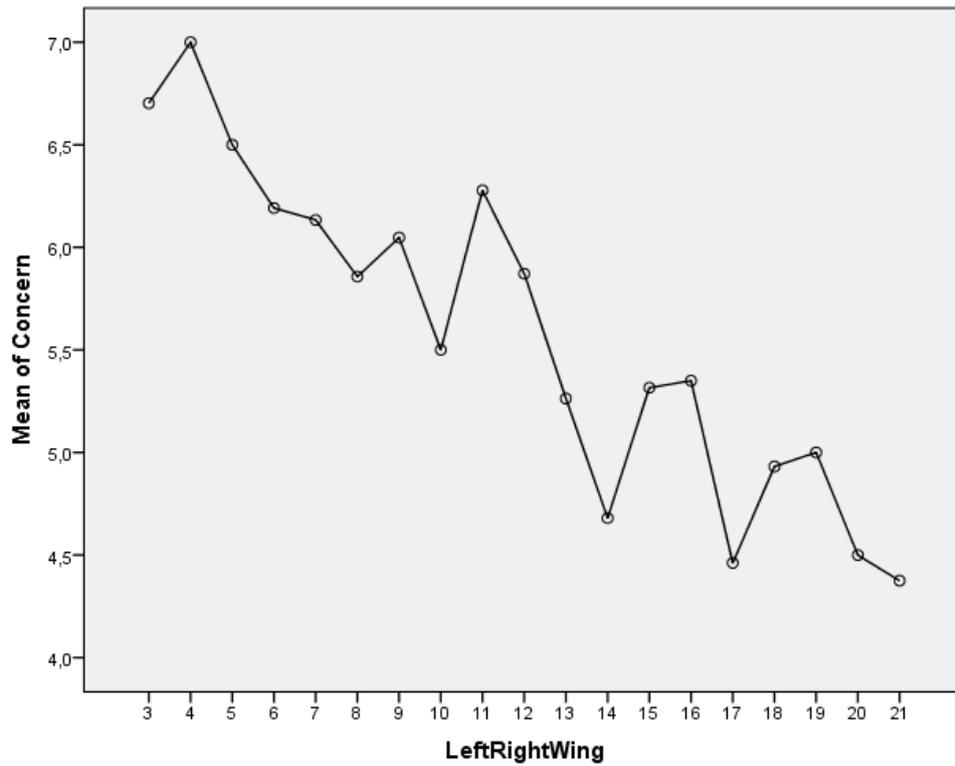


Figure 7. This plot shows the relationship between the left-to-right-wing scale and the attitudinal item concern, $p < 0.01$.

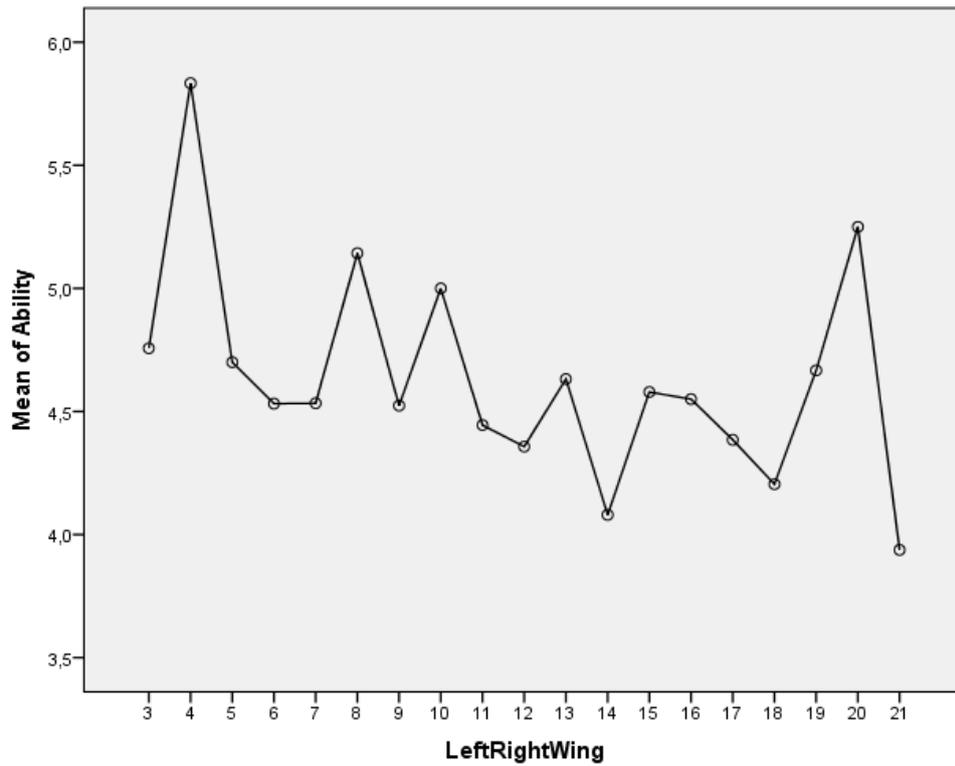


Figure 8. This plot shows the relationship between the left-to-right-wing scale and the attitudinal item ability.

Histogram

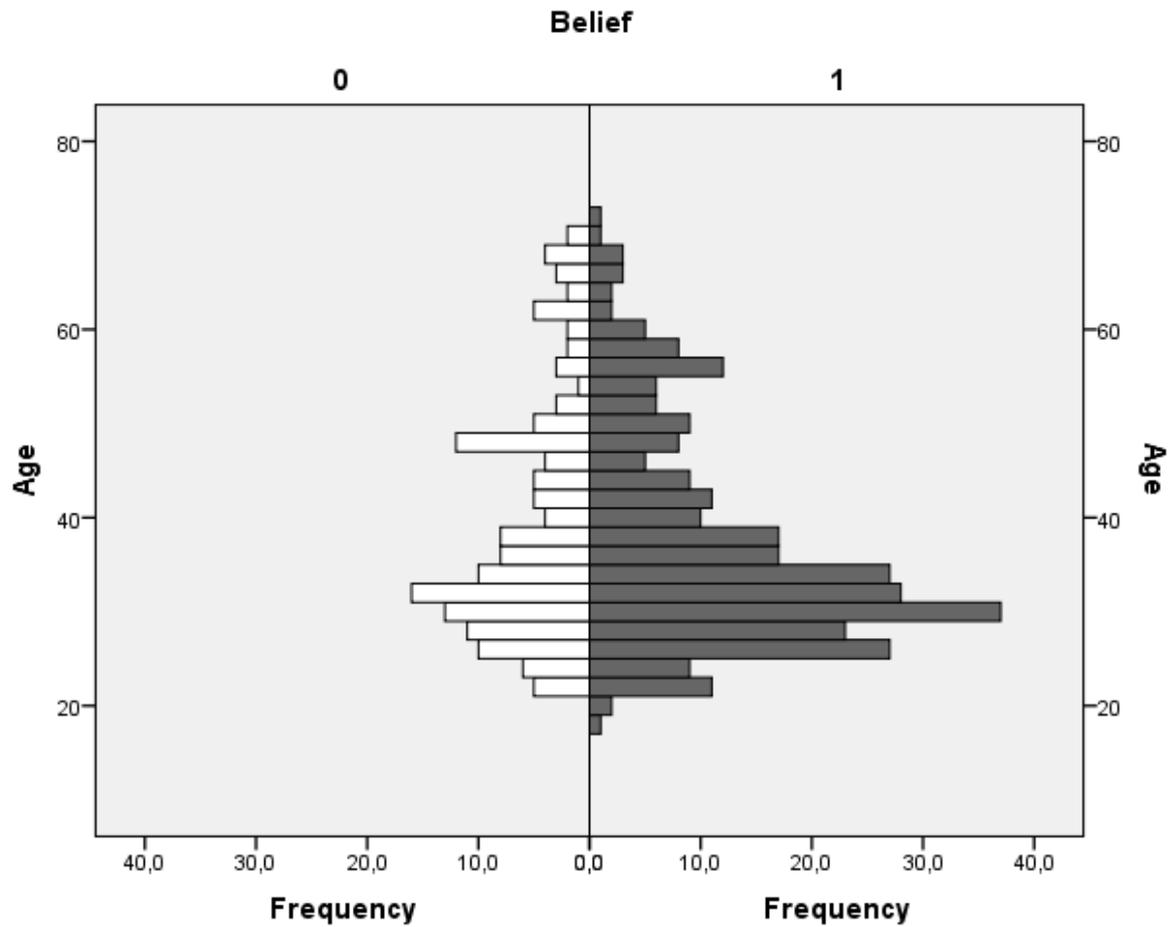


Figure 9. This histogram shows the relationship between age (18-72) and the belief item.

Scatterplots

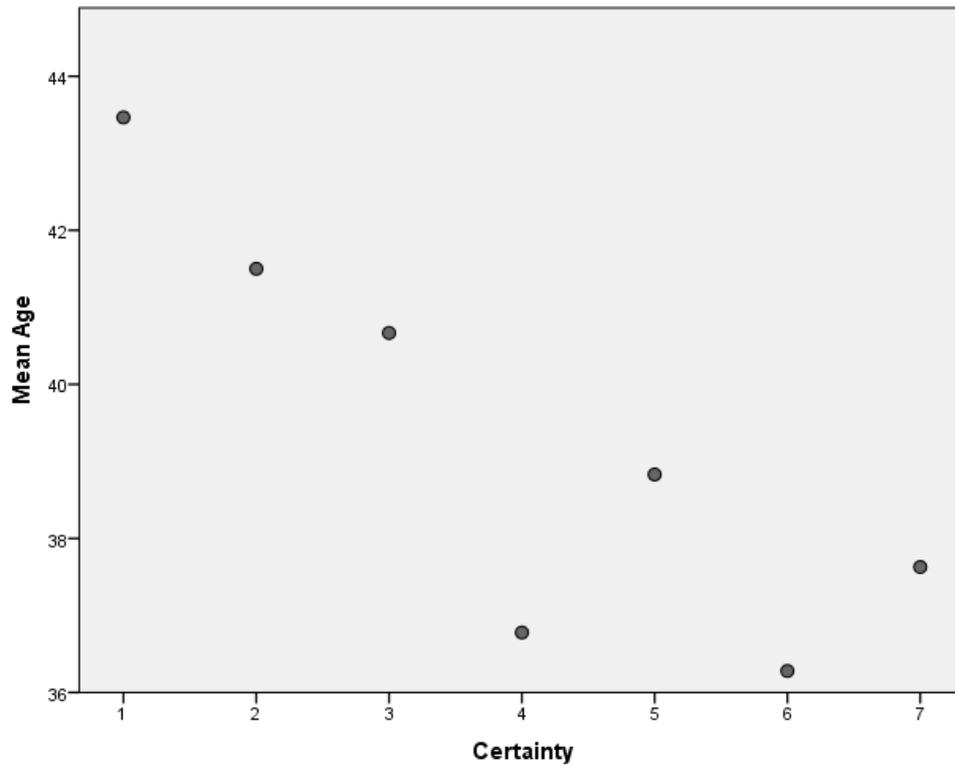


Figure 10. This scatterplot shows the relationship between age and the attitudinal item certainty.

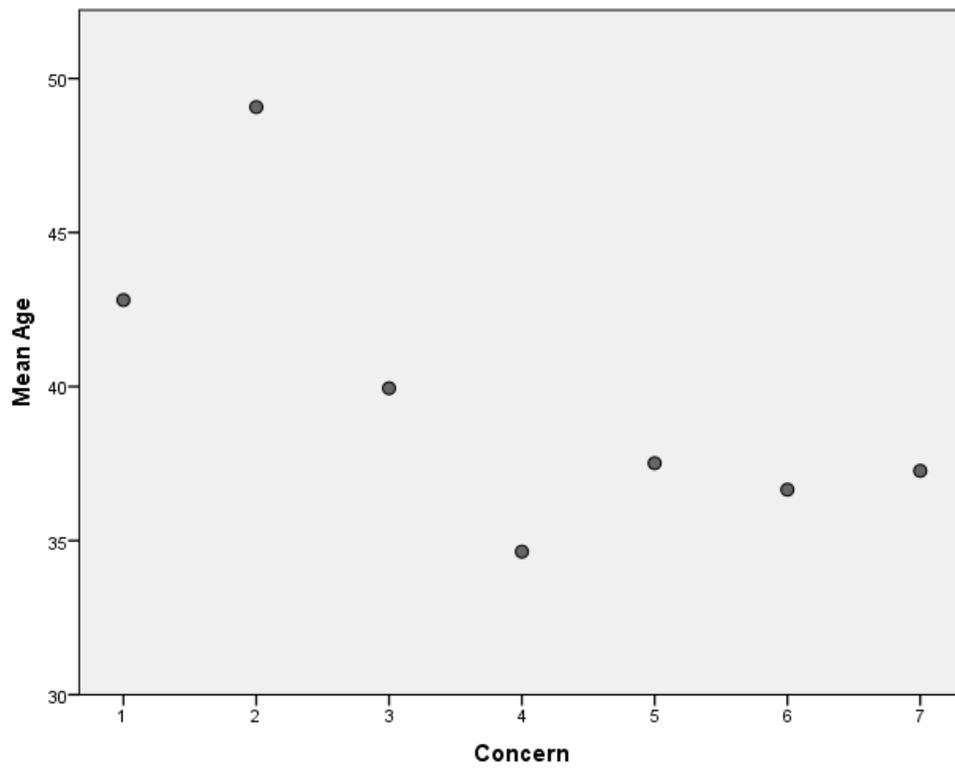


Figure 11. This scatterplot shows the relationship between age and the attitudinal item concern.

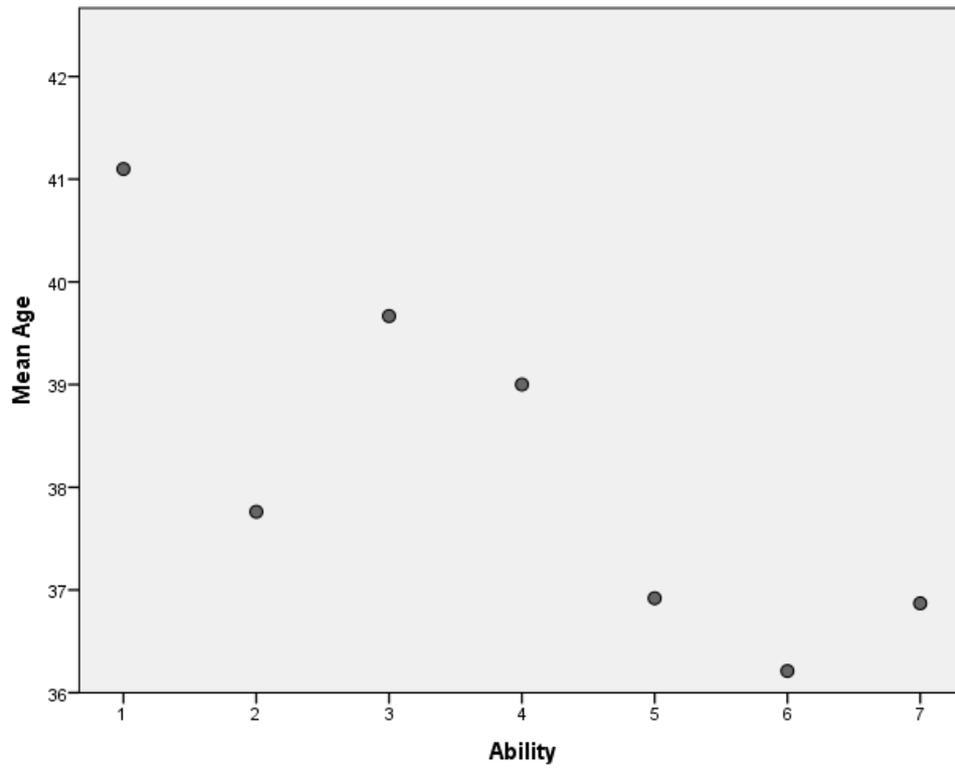


Figure 12. This scatterplot shows the relationship between age and the attitudinal item ability.

Discussion

Below follows a discussion of the central aspects of this study.

Method

The belief item and the attitudinal items were based on studies by Whitmarsh (2011), Kellstedt et al (2008) and Greenhill et al (2014). Since they were already validated items used in several earlier studies they were not tested for validity in this study. However, the certainty item and belief item could be considered as similar, since they both measure levels of certainty regarding climate change. However, regarding the certainty item, it was not specified that it regarded anthropogenic climate change, which the belief item did specify. As a result, one can be certain that climate change is happening, but also not believe that it is anthropogenic. The belief item was considered to be the primary measurement for this study while the attitudinal items were considered as secondary. However, since the attitudinal items measured aspects not covered by the belief item, such as concern and self-efficacy, they are considered as important to include for future studies. It is also important to specify between anthropogenic climate change and non-anthropogenic climate change for future studies.

Results

This study examined the relationship between three different informational influences, and its potential effect on climate change beliefs and attitudes. Furthermore, this study examined the relationship between demographic factors such as age, gender and political orientation with regards to their potential effect on climate change beliefs and attitudes.

Regarding the experimental conditions (informational influences) there were effects, however for the attitudinal items they were in most cases within one unit of measurement, and other factors such as age and political orientation narrowed their influence. Looking at the experimental conditions, there is for example an effect one can interpret regarding the scientific consensus condition, regarding the attitudinal item's certainty and concern as the highest levels were achieved within that conditioning. Even though there were effects measured regarding the experimental conditions, concerning belief in anthropogenic climate change and environmental attitudes, they were not strong enough to be significant, a larger

sample could have yielded significant results. Furthermore, when examining the variables in a binary regression excluding all covariates, the results were significant.

Age was a significant predictor in terms of belief in anthropogenic climate change and self-efficacy, however the large span of age made the significance of the observed values to be considered non-significant according to Chi-square. Still, examining the histogram and scatterplots, mean age especially indicates that increase in age lead to decrease in pro-environmental attitudes to some degree.

Gender was not a significant factor regarding belief, but one effect was measured regarding attitude, this was for self-efficacy. Females indicated a higher level of self-efficacy than males. In fact, females generally estimated higher on the scale when one examines the bar charts, but not to a significant degree regarding the other items, a larger sample might have yielded significant results.

However, the most influential factor in this analysis was that concerning political orientation. Regarding belief, certainty and concern there was a clear relationship indicating that the more rightwing one was the less belief, concern and certainty one held (on average). Even for self-efficacy, which was the only attitudinal item that lacked a significant effect, there is a two-unit difference between the far-left and far-right subjects, which goes in the same relationship as for the other items, with decrease in self-efficacy for increase in rightwing orientation.

General discussion

Regarding the discoveries of van der Linden et al (2018) where strong norms in the shape of scientific consensus had a significant effect regarding change in beliefs, despite political or other identity related beliefs, could not be found in this study and it was not found regarding attitudes either. Furthermore, comparing scientific facts with scientific/societal consensus, when examining the graphs, one can see that scientific consensus information had on average the strongest effect regarding increase in belief, concern, certainty and self-efficacy. However, it did not significantly differ from societal consensus information or scientific facts information. Reasons for this could be that individuals updated their beliefs to fit according to the information presented regardless if it was presented as consensus or factual, and in cases where the beliefs held was strong already it likely had a weaker effect. This could relate to the

fact that strong identity related beliefs are difficult to penetrate, which likely are strongly related to, as found in this study as well, political orientation. This goes in hand with the discoveries of Kahan et al. (2011) where strong beliefs and attitudes held are strongly related to identity and what he refers to as cultural cognition, which is the shared beliefs and attitudes of the group the individuals consider themselves as belonging to.

Furthermore, this study found no strong effects regarding the societal norm that specified that belief in anthropogenic climate change remained strong regardless of political orientation. Even though political orientation also in this study proved to be a strong factor. Reasons to why this is could be because it was not stated clearly enough that for example conservatives held strong pro-environmental beliefs and attitudes. People could also, for example, have not been persuaded by the text because they might not have felt it was a representative text that was presented to them, since it did not represent their perception of what the societal consensus is. There is a possibility that when a societal consensus is presented, people might be less likely to trust the outcome since one cannot control for how the sample was achieved. Instead, concerning for example scientific consensus, the sample is achieved based on being a scientist, and people might feel that a presented consensus of scientists should represent the scientific field in its entirety.

Political orientation proved a significant factor regarding belief, concern and certainty and the relationship indicated decrease in belief, concern and certainty per increase in right-wing political orientation, and this was an expected result looking at earlier studies and surveys. As an example, Pew research (2015) found that conservatives are far more skeptical of climate change than liberals. Most studies and surveys, such as those mentioned in this study, have indicated similar relationships between political orientation and climate change beliefs and attitudes. It seems naïve to ignore this factor if one wants to increase pro-environmental initiatives. Tactics to deal with this factor would then be needed to be developed further if people wish to not let climate change be affected by political motives.

Regarding the connection between political orientation, climate change beliefs and environmental attitudes, one can relate the results to studies by Kahan et al (2012), Kunda (1990) and Washburn and Skitka (2018). Furthermore, subjects who put themselves on either far-left-wing or far-right-wing also held the strongest beliefs and attitudes on average. This relates to how a strong political identity often relates to strong beliefs and attitudes. Even if

far-left- and far-right-wing individuals hold more knowledge and therefore are more confident in their beliefs and attitudes, it is more likely their strong beliefs and attitudes rather affect them in their perceived knowledge, and affect their confidence of opinion which is represented in their estimates. The use of motivated reasoning, i.e. reasoning affected by personal beliefs and attitudes is more likely when the identity strongly relates to one specific camp of attitudes and beliefs, which is caused through a phenomenon Kahan et al (2011) describes as “cultural cognition”, which has been mentioned in the theory section. To further explain, one can say that if people hold strong beliefs and attitudes about something, it is much more likely those beliefs and attitudes affect the perception of the amount of knowledge it holds and affect confidence in their beliefs and attitudes, since if they strongly believe in their perception they are also likely to believe that it is an informed and knowledgeable perception and that their stance is the “right” one, which in turn causes them to estimate with more confidence. This can help explain the phenomenon when polarized groups often becomes isolated from the scientific consensus since ideas and concepts are likely to develop within that group independent of support from consensus driven research. Since it rather derives from research or information that supports the consensus within that group.

As mentioned, there were effects regarding the informational influences, and comparing the sample here of roughly 100 participants per condition, to that of van der Linden et al (2018) with 6000 participants, it is understandable that effects found were significant in their case. However, it is not as understandable that the effect superseded the effects of political orientation, as stated in their study. Political orientation, which is strongly related to identity, proved to be a strong influential factor. It is important to be aware of the relationship between political motives and climate change beliefs and attitudes, if one wants to reach the identity of the individuals and try to influence them. Deep-rooted beliefs and attitudes are difficult to penetrate. Even though socializing processes as in social influence seems to be the most effectful way of reaching a person's identity, one need to relate to those beliefs and attitudes already held. If one wants to attempt to find common ground between those beliefs and attitudes held and those beliefs and attitudes one wants to instill. Because of the nature of conflict regarding the subject of anthropogenic climate change, being able to relate the problem to all people will not be easy unless specific measures are developed and implemented. These should regard building common ground amongst all people and focus on

finding different solutions to the same problem, rather than focus on what the problem is and if it exists.

Gender and age showed some effects regarding beliefs and attitudes. They had the strongest influence regarding self-efficacy, where younger females held the strongest sense of perceived ability to do something about climate change. However, self-efficacy was also the attitude that held the lowest average of all estimates. It is likely that ability, which relates to taking the step of behavioral commitment, is one of the more difficult attitudes to penetrate. In this case it is likely needed to be perceived as a normative notion, to believe that one personally can do something about climate change, for it to hold up as a strong attitude amongst people. Further studies should focus on social influence as a possible motivator to instill attitudes of this sort.

Conclusion

Despite some effects measured from informational influences in the shape of scientific facts, scientific consensus and societal consensus, this study indicated that political orientation or similar identity related factors overrides that influence regarding belief, certainty, concern and self-efficacy in terms of climate change. Age and gender also had effects, especially regarding perceived ability to do something about climate change, where younger females estimated with most confidence, and believed they could do something about it to the highest degree. However, self-efficacy was the lowest estimated attitude on average, and self-efficacy is evidently an attitude related to the normative percept. Political orientation was found to be a strong factor in regard to belief, certainty and concern in anthropogenic climate change. Where increase in right-wing orientation decreased belief, certainty and concern in anthropogenic climate change. Self-efficacy (ability to do something about climate change) was the only factor where a significant effect was not measured, this can be explained by the fact that it remained relatively low even amongst left-wing oriented individuals (on average). It would be naïve to ignore political motivation when dealing with the issue of climate change. Since it is likely difficult to isolate the issue from conflict, it might be a better idea to attempt to fuse pro-environmental beliefs and attitudes amongst the political divide, where conflicts focus on different solutions to the same problem, instead of focus on what the problem is and if it exists. Further research is needed to examine this issue.

References

ABC News, Stanford University's Political Psychology Research Group & Resources for the Future (2018) *Public Backs Action on Global Warming –but with Cost Concerns and Muted Urgency*. Langer Research Associates.

Abrams, D., & Hogg, M. A. (1990). Social identification, self-categorization and social influence. *European review of social psychology*, 1(1), 195-228.

Cialdini, R. B. (2007). *Influence: The psychology of persuasion* (pp. 173-174). New York: Collins.

Curtice, J., & Bryson, C. (2003). The measurement of socio-political orientations.

Dickson, D. 2005. The Case for a 'deficit model' of science communication. *Science and Development Network*.

Deutsch, M., & Gerard, H. B. (1955). A study of normative and informational social influences upon individual judgment. *The journal of abnormal and social psychology*, 51(3), 629.

Dunlap, R. E. (2013). Climate change skepticism and denial: An introduction. *American behavioral scientist*, 57(6), 691-698.

Dunlap, R. E., & McCright, A. M. (2008). A widening gap: Republican and Democratic views on climate change. *Environment: Science and Policy for Sustainable Development*, 50(5), 26-35.

Estrada, M., Schultz, P. W., Silva-Send, N., & Boudrias, M. A. (2017). The Role of Social Influences on Pro-Environment Behaviors in the San Diego Region. *Journal of Urban Health*, 94(2), 170-179.

Festinger, L. (1957). *A Theory of cognitive dissonance*. Stanford, CA: Stanford University Press.

Gehlbach, H., Robinson, C. D., & Vriesema, C. C. (2019). Leveraging cognitive consistency to nudge conservative climate change beliefs. *Journal of Environmental Psychology*, 61, 134-137.

Greenhill, M., Leviston, Z., Leonard, R., & Walker, I. (2014). Assessing climate change beliefs: Response effects of question wording and response alternatives. *Public Understanding of Science*, 23(8), 947-965.

IPCC, (2018): Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, Maycock, M. Tignor, and T. Waterfield (eds.). *World Meteorological Organization, Geneva, Switzerland, 32 pp.*

Kahan, D.M., Jenkins-Smith, H., & Braman, D. (2011). Cultural cognition of scientific consensus. *Journal of Risk Research*, 14(2).

Kahan, D. M., Peters, E., Wittlin, M., Slovic, P., Ouellette, L. L., Braman, D., & Mandel, G. (2012). The polarizing impact of science literacy and numeracy on perceived climate change risks. *Nature climate change*, 2(10), 732.

Kellstedt, P. M., Zahran, S., & Vedlitz, A. (2008). Personal efficacy, the information environment, and attitudes toward global warming and climate change in the United States. *Risk Analysis: An International Journal*, 28(1), 113-126.

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, 108, 480—198.

McLeod, S. A. (2018, Feb 05). *Cognitive dissonance*. Retrieved from <https://www.simplypsychology.org/cognitive-dissonance.html> 2019-03-15

NASA, NOAA Data Show 2016 Warmest Year on Record Globally (2017, January 18). Retrieved from <https://www.giss.nasa.gov/research/news/20170118/> 2019-03-23

Pew Research Center; Bruce Stokes, Richard Wike and Jill Carle. (2015). *Global Concern about Climate Change, Broad Support for Limiting Emissions*. Washington, DC: Pew Research Center.

Stoknes, P. E. (2015). *What we think about when we try not to think about global warming: Toward a new psychology of climate action*. Chelsea Green Publishing.

Sturgis, P., & Allum, N. (2004). Science in society: re-evaluating the deficit model of public attitudes. *Public understanding of science*, 13(1), 55-74.

Suldovsky, B. (2017, September 26). The Information Deficit Model and Climate Change Communication. *Oxford Research Encyclopedia of Climate Science*. Ed. Retrieved 18 Apr. 2019, from <http://oxfordre.com/climatescience/view/10.1093/acrefore/9780190228620.001.0001/acrefore-9780190228620-e-301>.

Terry, D. J., & Hogg, M. A. (1996). Group Norms and the Attitude-Behavior Relationship: A Role for Group Identification. *Personality and Social Psychology Bulletin*, 22(8), 776–793. <https://doi.org/10.1177/0146167296228002>

van der Linden, S., Leiserowitz, A., & Maibach, E. (2018). Scientific agreement can neutralize politicization of facts. *Nature Human Behaviour*, 2(1), 2.

Whitmarsh, L. (2011). Scepticism and uncertainty about climate change: Dimensions, determinants and change over time. *Global environmental change*, 21(2), 690-700.

Washburn, A. N., & Skitka, L. J. (2018). Science Denial Across the Political Divide: Liberals and Conservatives Are Similarly Motivated to Deny Attitude-Inconsistent Science. *Social Psychological and Personality Science*, 9(8), 972–980. <https://doi.org/10.1177/1948550617731500>

Appendix

Questionnaire

Start of Block: Consent

Q1

In this study, we examine how people think about climate change (such as global warming). For this purpose you will be asked to read a short text and answer a few questions, this includes some demographic questions.

Your data will be collected completely anonymously and will not be passed on to any third parties. The data will be used solely for research purposes. Participation in the study is voluntary and you are able to end your participation at any time.

The researcher and the online survey service will have no way of linking your data with your personal identity.

I have read and accept the terms and conditions listed above and consent to participate in this study (prerequisite for participating in the study).

Yes (1)

End of Block: Consent

Start of Block: Scientific knowledge

Q2

Please read the following information carefully before moving on to the questions. You are not able to go back once you move on.

-

In 2017 NASA released the following information:

The planet's average surface temperature has risen about 1.62 degrees Fahrenheit (0.9 degrees Celsius) since the late 19th century, a change driven largely by human-made emissions into the atmosphere. Caused by for example deforestation, land use changes, and burning fossil fuels. Most of the warming occurred in the past 35 years, with the five warmest years on record taking place since 2010. 2016 was the warmest year on record.

Source: NASA.GOV

Page Break

Q3 During what time period has most of the human caused warming occurred?

- Last 55 years (1)
 - Last 15 years (2)
 - Last 35 years (3)
-

Q4 Which year was the warmest on record (since the measurement started)?

- 2014 (1)
- 2015 (2)
- 2016 (3)

End of Block: Scientific knowledge

Start of Block: Scientific consensus influence

Q5

Please read the following information carefully before moving on to the questions. You are not able to go back once you move on.

-

According to a recent globally extensive poll, a vast majority (97%) of climate scientists have concluded that human-caused global warming is happening. Furthermore, climate change is considered a high priority concern among scientists. Where much research is related to the development of renewable energy and in how to get the world engaged in environmental sustainability. Source: Pew Research(*)

*Pew Research Center is a nonpartisan fact tank that informs the public about the issues, attitudes and trends shaping the world.

Page Break

Q6 What percentage of climate scientists support the notion of human caused climate change?

- 95% (1)
 - 96% (2)
 - 97% (3)
-

Q7 What is Pew Research Center?

- A nonpartisan fact tank (1)
- A partisan fact tank (2)
- A business company (3)

End of Block: Scientific consensus influence

Start of Block: citizen+political unified consensus inf

Q8

Please read the following information carefully before moving on to the questions. You are not able to go back once you move on.

-

According to a recent globally extensive poll, a vast majority (97%) of people believe that human-caused global warming is happening. Furthermore, climate change is considered a high priority concern across the political spectrum. Where a majority of the respondents, regardless of political orientation, found it important to support the development of renewable energy and to get engaged in environmental sustainability.

Source: Pew Research(*)

*Pew Research Center is a nonpartisan fact tank that informs the public about the issues, attitudes and trends shaping the world.

Page Break

Q9 What percentage of respondents supported the notion of human caused climate change?

- 95% (1)
 - 96% (2)
 - 97% (3)
-

Q10 What is Pew Research Center?

- A nonpartisan fact tank (1)
- A partisan fact tank (2)
- A business company (3)

End of Block: citizen+political unified consensus inf

Start of Block: neutral

Q11

End of Block: neutral

Start of Block: Climate Change Belief (adapted from Greenhill, Leviston, Leonard, & Walker, 20

Q11 Given what you know, which of the following best describes your thoughts about climate change? (choose one)

- I don't think that climate change is happening (1)
 - I have no idea whether climate change is happening or not (2)
 - I think that climate change is happening, but it's just a natural fluctuation in Earth's temperatures (3)
 - I think that climate change is happening, and I think that humans are largely causing it (4)
-

Q12 To what extent do you agree or disagree with the following statements regarding climate change?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I am certain that climate change is happening (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am concerned about climate change (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am well-informed about climate change (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel able to do something about climate change (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel a moral duty to do something about climate change (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I am
confident
in the
scientific
consensus
of climate
change
(6)



Q13 To what extent do you agree or disagree with the following statements, in terms of people close to you (such as friends, family etc.)?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	I don't know (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I think they are certain that climate change is happening (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think they are concerned about climate change (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think they are well-informed about climate change (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think they feel a moral duty to do something about climate change (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think they are confident in the scientific	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

consensus
of climate
change
(5)

I think
they feel
able to do
something
about
climate
change
(6)



Q14 To what extent do you agree or disagree with the following statements, in terms of people close to your political orientation?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	I don't know (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I think they are certain that climate change is happening (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think they are concerned about climate change (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think they are well-informed about climate change (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think they feel a moral duty to do something about climate change (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think they are confident in the scientific	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

consensus
of climate
change
(5)

I think
they feel
able to do
something
about
climate
change
(6)



End of Block: Climate Change Belief (adapted from Greenhill, Leviston, Leonard, & Walker, 20

Start of Block: Demographic

Q15 Please indicate how much you agree or disagree with the following statements

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
It is the government's role to redistribute income from the better off to the worse off (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is the government's responsibility to provide a job for everyone who wants one (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The law should always be obeyed, even when a particular law is felt to be wrong (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Censorship of films and magazines is necessary to uphold moral standards (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Major public services and industries should be in state ownership (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

People who propose overthrowing democracy should be free to stand in national elections (6)

Q16 Please indicate on the scale below how Left Wing or Right Wing politically oriented you are regarding the following questions (choose the middle option if you don't know)

	Very Left (1)	Left (2)	Somewhat Left (3)	Neither Left nor Right (4)	Somewhat Right (5)	Right (6)	Very Right (7)
In terms of social policy (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In terms of economic policy (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In terms of general outlook (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q17 Please state the country you are from (spent majority of time in)

Q18 Please state your gender

- Female (1)
- Male (2)
- Other (3)



Q19 Please state your age (in numbers)

Q20 Are you using the MTurk service? (If you don't know choose No)

- Yes (1)
- No (2)

Q21 If you have anything to add, feel free to do so here.

Display This Question:

If Are you using the MTurk service? (If you don't know choose No) = Yes

Q22 Your MTurk code is : $\${e://Field/mTurk}$

End of Block: Demographic
