Ideological roots of climate change denial

Resistance to change, acceptance of inequality, or both?

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Abstract

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Climate change denial has been found to correlate with sociopolitical ideology. The general aim of the present thesis was to investigate this relation, and more specifically to 1) test the unique effects of intercorrelated ideological variables on denial, and 2) investigate the psychological underpinnings of the ideology-denial relation. This approach helps estimating what component of right-wing ideology better explains climate change denial; *resistance to change* (indexed by left-right/liberal-conservative political orientation, right-wing authoritarianism, and system justification), or *acceptance of inequality* (indexed by social dominance orientation [SDO]). In **Paper I**, SDO outperformed the effects of right-wing authoritarianism and political left-right orientation on denial (Study 1 and 2). Further, the SDO-denial relation was stable when denial scores were experimentally lowered by a newscast that communicated supportive evidence for climate change (Study 2). Thus, the following studies focused specifically on the SDO-denial relation by testing path models that also included other ideological variables (political conservatism, system justification, and endorsement of nature dominance), as well as personality variables (dominance, empathy, openness to experience, and anxiety avoidance) and/or gender. In **Paper II**, SDO and endorsement of nature dominance explained unique parts of climate change denial, and both of these variables mediated the effects of system justification and (low) empathy on denial. SDO mediated also the effect of dominance. In **Paper III,** focusing specifically on denial of *human-induced* climate change, SDO either partially or fully mediated the effects of political conservatism and gender across two cultural contexts (Brazil and Sweden). **Additional analyses** extended these results, by building on the model presented in Paper II. These analyses showed that SDO (and in some cases also political conservatism and endorsement of nature dominance) fully mediated the effects of gender and personality variables on denial, with one exception: Predisposition to avoid experiencing anxiety predicted denial directly, as well as through a link via general conservative ideology (system justification or political conservatism). In sum, the results indicate that denial is more strongly and consistently predicted by SDO than by the other included variables. Thus, endorsement of group-based inequality/hierarchies offers an important explanation for climate change denial.

Keywords: Climate change denial, ideology, political orientation, social dominance orientation, dominance of nature, personality, gender

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To the beautiful planet Earth.

List of Papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.

I   Häkkinen, K., & Akrami, N. (2014). Ideology and climate change denial. *Personality and Individual Differences, 70*, 62–65.

II   Jylhä, K. M., & Akrami, N. (2015). Social dominance orientation and climate change denial: The role of dominance and system justification. *Personality and Individual Differences, 86*, 108–111.

III   Jylhä, K. M., Cantal, C., Akrami, N., & Milfont, T. L. (2016). Denial of anthropogenic climate change: Social dominance orientation helps explain the conservative male effect in Brazil and Sweden. *Personality and Individual differences, 98,* 184–187.

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Contents

Abbreviations

SDO   Social Dominance Orientation
RWA   Right-Wing Authoritarianism
IPCC   Intergovernmental Panel on Climate Change

Introduction

"Climate change will amplify existing risks and create new risks for natural and human systems. Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development."

IPCC (2014)

"If we are to survive, our loyalties must be broadened further, to include the whole human community, the entire planet Earth. Many of those who run the nations will find this idea unpleasant. They will fear the loss of power."

Carl Sagan (1980)

Humans have a long history of utilizing natural resources and altering the environment. Consequently, our lifestyle has been causing global environmental changes for centuries (Lewis & Maslin, 2015). Practices such as agriculture, forestry, and the burning of fossil fuels have strongly affected the climate, vegetation, and animal populations, and some of these effects have been negative. One of the most important environmental issues of our time is that of anthropogenic (i.e., human-induced) climate change (Intergovernmental Panel on Climate Change [IPCC], 2014). According to climate scientists, the progression of anthropogenic climate change cannot be stopped or reversed any more at this point, but it can be mitigated by reducing greenhouse gas emissions. Such reductions are vital, because without sufficient mitigation efforts, humans may not be able to adapt to the long-term negative consequences of climate change (IPCC, 2014).

Majority of climate scientists agree that the climate is changing due to human influence and that mitigation efforts are needed (Anderegg, Prall, Harold, & Schneider, 2010; Cook et al., 2016; Doran & Zimmerman, 2009; IPCC, 2014; Oreskes, 2004). However, despite the extensive supporting scientific evidence, some individuals deny the seriousness or even the existence of human-induced climate change (e.g., Leiserowitz, Maibach, Roser-Renouf, Feinberg, & Howe, 2013). Cumulative empirical evidence shows that climate change denial correlates with right-wing/conservative sociopolitical ideology (e.g., McCright, Dunlap, & Marquart-Pyatt, 2016). This thesis aims to more systematically examine this relation.

Sociopolitical ideology can be considered a broad and complex phenomenon. However, it has been shown to include two underlying components: resistance to/promotion of change and acceptance/rejection of inequality (e.g., Jost, Glaser, Kruglanski, & Sulloway, 2003). Climate change denial could be described as a refusal to admit the negative effects that our contemporary lifestyle has on the climate system. Thus, is seems to reflect resistance to change and a motivation to protect the status quo (e.g., Feygina, Jost, & Goldsmith, 2010).

However, if this is the case, one might ask how some people can continue to ignore warnings about the dangers of climate change just out of a motivation to continue living as before. An important explanation for this could be that not all individuals consider themselves and their loved ones to be at risk (Milfont, 2010; Spence, Poortinga, & Pidgeon, 2012). Rather, they believe that climate change primarily affects people who are psychologically, geographically, and temporally distant from them. This perception is indeed accurate for some, since the negative impacts primarily affect disadvantaged people, future generations, and non-human animals (Althor, Watson, & Fuller, 2016; Hallegatte et al., 2016; IPCC, 2014; Springmann et al., 2016). When considering the fact that the primary cause of climate change is the lifestyle habits of past and current wealthy people, then those who are least responsible for it face the most serious risks. Thus, climate change could be considered yet another form of injustice to which disadvantaged populations are exposed (Schlosberg, 2013). Building on these analyses, the present thesis investigates the degree to which the relation between climate change denial and sociopolitical ideology reflects acceptance of inequality.

Climate change

The term 'climate' stands for the long-term average weather pattern in a particular area, and the term 'climate change' denotes any observed change in these weather patterns (e.g., increase/decrease in mean temperatures or precipitation). Some part of climate change is caused by natural reasons, while a part is caused by human activities. In this thesis, the term 'climate change' specifically signifies anthropogenic (i.e., human-induced) changes in the global climate system.

Scientific research findings as well as technical and socio-economic information related to global climate change are reviewed and assessed by the Intergovernmental Panel on Climate Change (IPCC). The IPCC was established in 1988 by the United Nations Environment Programme and the World Meteorological Organization, and thousands of scientists and experts worldwide contribute to its work. Based on the reviews, the IPCC summarizes the current state of knowledge about the causes and potential impacts of climate change.

Climate change is a complex phenomenon that cannot be explained and predicted with full certainty. However, many of the uncertainties are related to specific issues, such as the number of degrees by which the global mean temperature can be expected to rise within certain time frames. Importantly, despite the uncertainties and gaps in the present research findings, IPCC summaries suggest relatively high certainty in some general trends. For example, majority of research results suggest that global climate change is happening, and is caused to a high degree by human activities that emit greenhouse gases. These conclusions are also supported by studies that have directly surveyed the views of climate scientists or analyzed the findings reported in peer-reviewed research articles (Anderegg et al., 2010; Cook et al., 2016). In particular, it is estimated that approximately 97% of climate scientists agree today that the climate is changing due to human influence (for a review, see Cook et al., 2016).

Impacts of climate change

According to research results assessed by the IPCC (2014), anthropogenic climate change is a major environmental issue of our time. Besides being a serious threat to non-human animals and natural ecosystems, it is increasing-

ly threatening humans. More specifically, changing weather patterns and nature conditions negatively affect economic conditions, as well as the health and well-being of people. In addition, decreased availability of food, water, and other resources may strengthen or even initiate social conflicts and wars (IPCC, 2014).

The single most important cause of anthropogenic climate change is the emission of greenhouse gases, and particularly carbon dioxide (CO_2: IPCC, 2014). Thus, scientists have recommended that emissions of these gases should be substantially reduced. They also warn that, if left unmitigated, the long-term impacts of climate change may become too severe for humans to adapt. Although climate change is expected to affect all life on Earth, the most severe impacts of climate change are more likely to affect disadvantaged populations and individuals, non-human animals, and future generations (e.g., IPCC, 2014).

Climate justice

The benefits and risks of climate change are not equally distributed across populations (Banerjee, 2013; IPCC, 2014; Mohai, Pellow, & Roberts, 2009; Schlosberg, 2013; Schlosberg & Collins, 2014). Wealthy populations and individuals engage more in – and benefit to a greater degree from – practices that emit greenhouse gases. However, disadvantaged people, non-human animals, and future generations are at risk of facing the most negative effects of these practices (Althor et al., 2016; Hallegatte et al., 2016; IPCC, 2014; Springmann et al., 2016). This climate injustice has been shown to manifest at many levels.

To begin with, developing countries are more exposed to climate-related risks because they tend to be located closer to the equatorial areas where shifting temperatures have greater impacts (Althor et al., 2016; Schlosberg, 2013). Additionally, the economies of many developing countries depend greatly on agriculture, a livelihood strongly affected by changes in average weather patterns. Climate injustice also manifests at an individual level (Schlosberg, 2013). For example, disadvantaged individuals are more vulnerable to the negative effects of climate change due to their limited resources to adapt or relocate. These people have also been shown to face difficulties when requesting help during and after climate-related crises (see e.g. analysis of Hurricane Katrina: Bullard & Wright, 2009). What is more, besides reflecting and increasing the forms of injustice related to environmental conditions, climate change is also linked to economic injustice. For instance, it has been put forward that unmitigated climate change will develop new poverty traps and increase the gap between rich and poor (Burke, Hsiang, & Miguel, 2015; Hallegatte et al., 2016; IPCC, 2014). However, despite their greater exposure and vulnerability to a number of climate-

related risks, disadvantaged people tend to be excluded from climate-related negotiations and decision making (Schlosberg, 2013). Moreover, recent analyses suggest that in the IPCC summaries, which are directed at policy-makers, the poorest and weakest remain nearly invisible (Fløttum, Gasper, & Lera St. Clair, 2016).

Taken together, analyses thus suggest that climate change both reflects and increases injustice. To address this, an established scientific field focuses on analyzing climate change from a 'climate justice' perspective (see e.g., Chlosberg & Collins, 2014). Climate justice is the central framework of this thesis, as it provides one potential explanation for why some individuals may remain unconcerned and dismissive about the dangers of climate change.

Climate change denial

"It is the greatest scam in history. I am amazed, appalled and highly offended by it. Global Warming; It is a scam. Some dastardly scientists with environmental and political motives manipulated long term scientific data to create an illusion of rapid global warming."

<div align="right">John Coleman (2007)</div>

"This very expensive GLOBAL WARMING bullshit has got to stop. Our planet is freezing, record low temps, and our GW scientists are stuck in ice"

<div align="right">Donald J. Trump (2014)</div>

Despite extensive scientific evidence supporting the need to mitigate climate change, efforts to cut down greenhouse gas emissions have been insufficient thus far (e.g., Burck, Marten, & Bals, 2014). One reason for this is that some people dismiss the evidence that supports climate change (Ding, Maibach, Zhao, Roser-Renouf, & Leiserowitz, 2011; O'Connor, Bord, & Fisher, 1999; Ojala, 2013; Sibley & Kurz, 2013; Vainio & Paloniemi, 2011). Some deny the very existence of climate change, although it is more common to be unconvinced of certain aspects of it, such as the role that human activities play in causing climate change and/or the seriousness of the impacts (Leiserowitz et al., 2013; Poortinga, Spence, Whitmarsh, Capstick, & Pidgeon, 2011; Rahmstorf, 2004; Washington & Cook, 2011). One reason for the prevalence of denial is that doubtful messages are widespread in society (Antilla, 2005; Oreskes & Conway, 2010). Importantly, some organized campaigns intentionally produce and spread such doubt.

Campaigns against climate science

Since climate change is a long-term statistical phenomenon, observations and predictions regarding it are based on scientific analyses rather than on direct personal observations. Thus, not surprisingly, many of the dismissive discourses about the issue have focused specifically on casting doubt on climate science (Powell, 2011; Washington & Cook, 2011). Examples from history have shown that this kind of tactic provides an effective way to dispute undesirable scientific findings (Powell, 2011; Oreskes & Conway,

2010). As a famous example, the tobacco industry aimed to veil the connection between smoking and cancer by creating doubt and uncertainty on the issue, as illustrated by the quotation below:

"*Doubt is our product, since it is the best means of competing with the 'body of fact' that exists in the minds of the general public. It is also the means of establishing a controversy.*"

<div align="right">Tobacco industry executives' memo (1969)</div>

Strikingly similar campaigns have been used to dispute findings in climate science. Organized "denial machines" have been casting doubt on climate change to delay environmental action (Jacques, Dunlap, & Freeman, 2008; Powell, 2011; Oreskes & Conway, 2010). One of the tactics used by these 'denial machines' is to produce and spread counter-evidence for climate change. The sources of this counter-evidence tend to be pseudoscientific, meaning they appear to be scientific but do not actually meet scientific standards. In fact, it has been shown that a vast majority of the literature contradicting climate change is published outside mainstream scientific communities and the peer-review system (Dunlap, 2013; Oreskes & Conway, 2010). There also seem to be conflicts of interests that are not openly disclosed. The research field has links to political think tanks and is largely funded by companies that profit from coal burning and fossil fuel consumption (Farrell, 2016; Jacques et al., 2008). It is therefore questionable whether the studies and conclusions are indeed unbiased.

As another tactic to casting doubt, 'denial machines' target mainstream science (Powell, 2011). They commonly claim that the evidence for climate change is unreliable due to problems with the research methods used, the soundness of the scientific conclusions, and/or fairness in the peer-review system. Individual scientists have also been targeted. For example, scientists who publish and communicate evidence to support climate change have been accused of reporting distorted results due to personal, ideological and financial motives. In some cases, these scientists have even been targeted by hate campaigns and death threats (e.g., McKie, 2012).

These tactics have successfully influenced policy-makers' views and public opinion (Farrell, 2016; Jacques et al., 2008; Powell, 2011; Oreskes & Conway, 2010; Washington & Cook, 2011). However: the public has received relatively similar types of messages on climate change, yet the messages produced by the 'denial machines' influence some individuals more than others. Hence, an important question should be investigated: if 'doubt is the product', who is buying it?

Alarmism, skepticism, and denial

Before discussing climate change denial any further, it is important to consider the appropriateness of the terminology. Individuals, who dispute climate change, tend to label themselves 'skeptics' rather than 'denialists' and often use the term 'alarmist' when referring to those who agree that climate is changing (Washington & Cook, 2011). Through this terminology, the refusal to admit to the existence of climate change is conceptualized as a rational, fact-based, and non-emotional response in contrast to an emotional, irrational, and non-scientific belief in climate change.

The worst scenarios of unmitigated climate change can indeed be described as apocalyptic and frightening (Moser & Dilling, 2004), and it is easy to understand why these scenarios seem alarmist to those who do not agree that the climate is changing. A central question is however: is there reason to believe that these scenarios are alarmist or even exaggerated? When it comes to the reported conclusions from mainstream climate scientists, the answer seems to be 'no'. Indeed, climate scientists have been found to be too cautious, rather than alarmist, in their conclusions (Anderegg, Callaway, Boykoff, Yohe, & Root, 2014; Brysse, Oreskes, O'Reilly, & Oppenheimer, 2013). Moreover, analyses show that scientists who report evidence in support of climate change tend to use more cautious language compared to those who aim to dispute climate change (Medimorec & Pennycook, 2015).

As for the terms 'skeptic' and 'denialist', there have been lively debates over their appropriateness (see e.g., Dunlap, 2013; Poortinga et al., 2011; Washington & Cook, 2011). The term 'skepticism' refers to a doubtful attitude towards a claim (Merriam–Webster, n.d.). However, this does not refer to an opposing attitude towards a certain claim, but rather that the conclusion should rely on objective empirical evidence. As such, skepticism is an inherent and important part of science (see e.g., Normand, 2008; Zane, 2010). Therefore, truly skeptical individuals should test their predictions objectively and be open to challenging their assumptions and conclusions. There is little reason to claim that climate scientists would generally fail to do this. For instance, IPCC reports express scientific skepticism, as they aim to identify the gaps in findings and acknowledge the limitations of the research methods used.

Skeptical assessments of research methods and conclusions are an important and necessary component of scientific progress. However, certain aspects in the dismissive discourses about climate change suggest that 'denial' (or 'pseudo-skepticism') is a more appropriate term for the phenomenon than 'skepticism'. For example, the gaps and uncertainties in climate science are often treated as a basis for disputing the entire body of evidence supporting climate change (Washington & Cook, 2011). Interpreting scientific uncertainties as counter-evidence to the studied phenomena is not compatible

with scientific reasoning (Normand, 2008). Similarly, it seems unjustified to dispute the findings supporting climate change while non-critically trusting the contradictory findings. Moreover, many discourses against the existence of climate change do not tend to involve any openness to the supporting evidence, as the above citations from John Coleman and Donald Trump illustrate. Thus, it can be claimed that much of the criticism of climate science reflects not open-minded skepticism, but outright denial (Powell, 2011; Washington & Cook, 2011).

In conclusion, many of the current attempts to dispute human-induced climate change cannot be justified by referring to skepticism. Thus, the term 'climate change denial' (or briefly, 'denial') is used in this thesis. Importantly, I use the term as a label for the phenomenon in general rather than referring to specific processes within any given individual. Since there are many potential reasons to deny climate change, such specific processes may vary between individuals. For example, I acknowledge that denial does not necessarily imply a lack of belief in the issues: some individuals could actually believe in climate change, but deny it in an active effort to silence discussions on the issue. Likewise, denial could reflect skepticism for some, who have drawn their conclusions based on evidence that they sincerely perceive to best represent the reality. Indeed, as discussed above, there is widespread disinformation about climate change that appears to be reliable and scientific (Oreskes & Conway, 2010). Consequently, individuals may consider both denying and supporting evidence to be equally scientific, and therefore consider the issue to be unsettled. Finally, it could be suggested that relatively few individuals are definitively denialists, but that rather, they are unconvinced or uncertain (see e.g., Milfont, Milojev, Greaves, & Sibley, 2015; Whitmarsh, 2011).

Thus, I consider denial a variable ranging from low (no denial) to high, and skepticism as a separate variable that does not necessarily need to correlate with these scores. That is, individuals may score high or low in scientific skepticism regardless of their scores on denial. Moreover, I avoid using the term 'belief' when describing low denial because climate change is not a matter of belief. The majority of climate scientists agree that the climate is changing (e.g., Cook et al., 2016), and therefore, 'belief' could be a misleading term for low denial. Finally, it should be noted that I do not use the term 'climate change denial' in an evaluative sense when denoting denial among individuals. Although climate change denial is a problematic phenomenon at societal and global level because it is delaying environmental actions (Sibley & Kurz, 2013; Vainio & Paloniemi, 2011), denial may or may not be the result of immoral (e.g., in the case of emotional coping) and/or irrational (e.g., in the case of true skepticism) processes or motivations within a particular individual.

Psychological and demographic bases for climate change denial

Given the widespread evidence supporting climate change, it is important to ask where climate change denial comes from. Many potential reasons could explain it. Some individuals may initially be open to climate-related information, but then deny it as a means of coping with the negative feelings that arise, such as fear, anxiety or guilt (Ojala, 2012; 2013; Swim et al., 2009). The statistical and long-term nature of climate change introduces an additional challenge (Swim et al., 2009; Weber, 2010). Since the progression and impacts of climate change cannot be observed directly, laymen may find it hard to form an opinion on the issue. Consequently, they may draw erroneous conclusions about the climate based, for example, on their personal observations of the weather. Even when seeking to gain an objective scientific understanding of climate change, most people must rely on reports and other forms of communication from climate scientists and experts. These communications may be incorrectly interpreted (Budescu, Broomell, & Por, 2009). For instance, scientific uncertainties can lead individuals to underestimate the level of confidence in the findings and predictions, and to question whether climate scientists really agree on the issue.

A further difficulty comes from judging whether a given source of information is trustworthy. Most of the literature contradicting climate change has been published outside of scientific communities and the peer-review system (Jacques et al., 2008), but the public cannot be expected to be familiar with this observation. Thus, communications that deny or support climate change could appear to be equally scientific to the public. The crucial question is: on what basis do people decide which communication to agree with? As presented below, research results suggest that this decision is influenced by certain demographic and individual difference factors.

Demographics

Certain demographic factors have been identified as predictors of climate change denial. In general, denial tends to be more commonly expressed among individuals who are male, white, older, less educated, and low in socioeconomic status (Milfont et al., 2015; Poortinga et al., 2011;

Whitmarsh, 2011). As for the first three variables, it is possible that the results reflect perceptions of low risk, since older white males are unlikely to face the most serious consequences of climate change. However, when it comes to the latter variables, the results are harder to explain (see Poortinga et al., 2011). Individuals with low economic status and levels of education are more vulnerable to risks in general, and to climate change in particular. It would thus be more plausible to expect them to be more willing to admit and address the issue. However, it is possible that these individuals need to focus more on concrete, short-term threats (e.g., economic troubles), decreasing their focus on delayed and more complex threats, such as climate change (Poortinga et al., 2011).

Personality

Personality *traits* are internal properties that influence individuals' behavior (Larsen & Buss, 2010). As for the term *personality*, it can be defined as an organized set of traits and psychological mechanisms. Personality is moderately heritable, expressed early in life, and remains relatively stable throughout life (Bouchard & Loehlin, 2001; Larsen & Buss, 2010) Thus, it is associated with the ways in which an individual tends to react, feel, and behave in different situations.

Research on the relation between personality and climate change denial has been scarce thus far. To my knowledge, only two studies (Milfont et al., 2015; Sibley et al., 2011) have investigated the relation. The results of these studies indicate a negative correlation between denial and the traits 'openness to experiences' (hereafter denoted briefly as 'openness'), and agreeableness. These traits are part of the well-known five-factor model of personality (McCrae & Costa, 2008), as well the recently proposed six-factor model of personality (HEXACO: Ashton & Lee, 2007).

'Openness' captures an overall preference and openness to new experiences and ideas. Specifically, those who score high in this trait tend to be imaginative and creative, and enjoy exploring new and unusual ideas and experiences. Climate change is a relatively new concept that challenges the traditional ways of thinking about nature as a legitimate object of human dominance and alteration (see e.g., Feygina, 2013). It is also a complex phenomenon that cannot be explained and predicted with full certainty. As such, thinking about it may cause discomfort in individuals who avoid exploring ideas that are new and complex (cf. Sibley et al., 2011). Thus, individuals who score low in openness could be drawn to agreeing with the most definitive explanation that has been offered for climate change: "It is not happening at all".

More research needs to be conducted on the relation between personality and climate change denial. For example, the role of psychological tough-

mindedness should be investigated. Some support for such a relations exists, as the personality trait 'agreeableness' has been found to correlate negatively with denial (although to a lower degree than 'openness': Milfont et al., 2015; Sibley et al., 2011). This trait includes tendencies such as being altruistic, compassionate, warm, and cooperative. However, a closer look should also be taken at some more specific 'tough-minded' traits.

To begin with, 'empathy' could predict denial. In this thesis, empathy refers specifically to empathic concern, which can be defined as a predisposition to experience feelings of warmth, compassion and concern when observing another person's negative experiences (Davis, 1980). Empathy has been linked to environmentally friendly attitudes and behavior (e.g., Tam, 2013), and it could also correlate with climate change denial. That is, low empathy could decrease concern when witnessing or imagining the risks that climate change poses to many people and non-human animals. Consequently, it may allow individuals to keep demanding more evidence for climate change before admitting its existence and/or taking action.

Similar effects could be observed for the trait 'dominance' (i.e., being domineering), which denotes a predisposition to seeking power and to being controlling, dominant, and forceful in interpersonal relationships (Goldberg, 1999). Dominant individuals may actively deny climate change because they do not want to risk the power positions that they hold or aspire to hold in relation to other people and nature.

Finally, one more personality variable that could be related to climate change denial is the tendency to avoid experiencing negative emotions such as anxiety. Drawing from findings showing that climate change denial can be employed as a way of coping with climate-related anxiety, fear, and guilt (Ojala, 2012; 2013; Swim et al., 2009), it could be expected to be more common among individuals who are generally predisposed to avoiding thoughts that could evoke anxiety in them. To my knowledge, no studies have tested this proposal thus far.

Ideology

The term 'ideology' was originally introduced in the late eighteenth century by French post-enlightenment theorists. At that time, the term denoted the 'science of ideas'. Since then, various definitions of the term have been introduced, but they all consider ideology to be a set of ideas and beliefs (for a review, see Jost, Nosek, & Gosling, 2008; see also Merriam–Webster, n.d.; Mullins, 1972). In this thesis, *ideology* is defined as an internally coherent system of meanings, attitudes, values and/or beliefs about how the world is, or should be, structured.

An ideology provides a stable cognitive and evaluative framework. Hence, ideologies facilitate faster assessments of different phenomena and

provide guidance for choosing the most appropriate response option in a given situation (Jost, Federico, & Napier, 2009). Put another way, ideological positions have a functional importance as they guide actions and decisions. In addition to this, ideologies also have a psychological value, because they provide a sense of stability and predictability, socially shared identity and reality, and social belonging (Jost et al., 2009; Jost, Glaser, et al., 2003).

Some ideological variables are sometimes considered personality variables due to their consistent behavioral influence across different situations. However, they do not reflect individuals' own way of thinking and feeling; rather, they are an endorsement of socially shared world views and attitudes (Duckitt, 2001). Ideologies are, however, closely linked to personality, since certain traits and psychological processes result in a predisposition to adopting certain ideologies (e.g., Duckitt, 2001). Supporting this, a large percentage of genetic variance in ideology has been traced to genetic variance in personality (Kandler, Bleidorn, & Riemann, 2012). Evidence also shows that although levels of agreement with ideological attitudes may change due to social cues, the inter-individual rank order tends to be stable (Akrami, Ekehammar, Bergh, Dahlstrand, & Malmsten, 2009). However, socialization and life events seem to play a role as well. For example, demographic factors such as gender, age, ethnicity, and socioeconomic status correlate with ideological views (e.g., Pratto, Sidanius, Stallworth, & Malle, 1994).

As a further clarification regarding the effects of social cues and personality on ideological views, ideologies have been shown to be dynamically produced by both influences (Jacquet, Dietrich, & Jost, 2015; Jost et al., 2009). Firstly, social and situational factors (e.g., exposure to ideological messages, threatening situations) influence ideological stances. Secondly, psychological factors (e.g., personality traits, psychological needs) make individuals more or less prone to adopting a particular ideology. These factors also interact. Psychological factors guide individuals when seeking understanding and knowledge, and when choosing discussion partners (e.g., Feldman, Myers, Hmielowski, & Leiserowitz, 2014). That is, individuals are attracted to information sources and people who confirm their initial ideological views. In addition, messages that are congruent with pre-established ideas and beliefs tend to be evaluated less critically (Taber & Lodge, 2006), and exposure to ideologically contradicting views are likely to evoke a sense of threat and negative reactions (Brandt, Wetherell, & Reyna, 2014).

These tendencies contribute to creating ideologically homogeneous information networks, 'echo chambers', where specific views are repeatedly communicated, legitimized and promoted (Jasny, Waggle, & Fisher, 2015). These 'echo chambers' strengthen individuals' initial views and provide a sense of understanding and certainty. The existence of such homogenous networks *per se* does not need to be a negative issue. However, in political communication the consequences may be negative, particularly if individuals

are not reflecting on the one-sidedness of the messages to which they are exposed (Jasny et al., 2015).

There is considerable empirical evidence showing that ideology, and most importantly sociopolitical ideology, is a central predictor of climate change denial (e.g., McCright et al., 2016). To begin with, the majority of research contradicting climate change has been linked to conservative political think tanks, most notably to the Republican Party in the US (Jacques et al., 2008). This contradicting information is also more readily adopted and communicated by right-leaning politicians, media, and bloggers (Feldman et al., 2014; Jacquet et al., 2015; Jasny et al., 2015). Not surprisingly then, a growing body of evidence suggests that climate change denial is more common among conservative/right-wing individuals when compared to their liberal/left-wing counterparts (e.g., McCright et al., 2016), and that this divide has been increasing in the last decade, at least in the US (Dunlap & McCright, 2008). In addition, certain ideological variables that do not directly capture political orientation *per se*, but are nonetheless more readily adopted by right-wing individuals, have also been linked to denial (see below). Finally, recent research has demonstrated that political identification and orientation are stronger predictors of denial than some other variables that could be suggested to play a central role, such as gender, education level, and subjective knowledge about climate change (Hornsey, Harris, Bain, & Fielding, 2016).

In sum, extensive literature shows that climate change denial is not only more common among right-wing individuals, but is also largely constructed by them (e.g., Jacques et al., 2008). Based on this, it can be concluded that although the psychological reasons behind denial may vary, sociopolitical ideology seems to hold a central role. These findings are also important when considering that ideological views are predicted by demographic and personality factors (e.g., Sidanius & Pratto, 1999). Ideology could potentially help explain why some of the demographic and personality variables presented above are correlated with denial.

Examining the ideological roots of climate change denial

Ideological variables

Political ideology is a wide and complex construct, but it has been suggested to include two core components: *resistance to/acceptance of change* and *acceptance/rejection of inequality* (Jost et al., 2009; Jost, Glaser, et al., 2003). That is, right and left-leaning individuals tend to differ in their support to such policies and practices that promote/attenuate societal change and inequality. More specifically, when compared to left-wingers, right-leaning individuals express more support for policies that maintain and promote inequality and established social arrangements. For instance, right-wing individuals tend to disapprove of issues such as abortion, immigration, and gender-neutral marriage, while left-wingers often oppose, for example, a free-market economy and harsh punishments for criminals.

As presented in the previous chapter, extensive research has found right-wing/conservative political views to predict environmental attitudes and climate change denial (e.g., McCright & Dunlap, 2011; McCright et al., 2016; Milfont et al., 2015; Poortinga et al., 2011; Whitmarsh, 2011). However, from the current state of knowledge, it is unclear what component of sociopolitical ideology better predicts denial: resistance to change, acceptance of inequality – or perhaps some more specific component. This thesis aims to enhance understanding of the ideology-denial relation by investigating the unique effects of four variables measuring sociopolitical ideology. The first of these variables is *(right-wing/conservative) political orientation*. Two of the variables – *right-wing authoritarianism* and *system justification* – measure general acceptance of the current societal arrangement (note that these arrangements also include prevalent hierarchies), while also capturing certain specific psychological tendencies. The fourth variable – *social dominance orientation* – specifically measures attitudes towards group-based inequality and hierarchies.

These variables are intercorrelated (Aspelund, Lindeman, & Verkasalo, 2013; Federico, Hunt, & Ergun, 2009; Jost & Thompson, 2000; Wilson & Sibley, 2013) and they tend to predict similar outcomes in social (Duckitt, Wagner, du Plessis, & Birum, 2002; Jost & Thompson, 2000) and environmental contexts (Feygina, 2013; McCright & Dunlap, 2011; Milfont, Rich-

ter, Sibley, Wilson, & Fischer, 2013). However, despite the similarities, they are conceptually distinct, as will be presented below, and thus they are related with certain outcomes due to partially differing reasons. In what follows, the ideological variables are first presented separately, after which their conceptual similarities/differences and relations to climate change denial are discussed.

Resistance to change

Political orientation

Political orientation refers to policy preferences related to social and economic issues. Political orientation is argued to be a multidimensional and complex construct, but it can be captured surprisingly well by a one-dimensional right-left scale (for reviews, see e.g., Jost, 2009; Jost et al., 2009). A single item on which participants position themselves on a scale ranging from left to right tends to correspond well with real-life views on various political matters.

In societies in which right-wing policies (e.g., free market economy) characterize the status quo, such as in many Western countries, right-wing orientation correlates with conservative ideology (Aspelund et al., 2013). Therefore, left-right orientation and liberal-conservative orientation are treated as synonyms in this thesis. However, since the left-right scale is a more common measure for political views in Sweden (where most of the studies for this thesis have been conducted), the term right-wing orientation will be used more frequently than conservative orientation.

Right-wing authoritarianism

The theory of right-wing authoritarianism (RWA) was developed by Altemeyer (1981; 1998), and it builds on research that has aimed to explain how normal individuals are, in some situations, able to commit troubling and even horrible acts when ordered to do so by authority figures. RWA is a construct that captures the tendency to accept and obey authority figures. More specifically, it is an attitudinal cluster that includes three intercorrelated facets (Altemeyer, 1981; 1998).

The first facet, *authoritarian submission*, measures readiness to accept and follow established authorities. This readiness is at least partly underpinned by a tendency to perceive the world as a dangerous place where strong leadership is needed to maintain security and prevent chaos (Duckitt, 2001). High scores in the submission facet imply an inclination to legitimize the authorities' entitlement to dictate correct ways of thinking and behaving. Thus, it correlates with the facet *authoritarian aggression*, which captures

readiness to punish and aggress towards those whose lifestyle and values are not approved by the authority figure. As an example, RWA individuals are prone to committing – or at least legitimizing – aggressive acts towards groups such as homosexuals, criminals, and activists, who are perceived as a threat to traditional societal conventions. The third facet, *conventionalism*, captures the commitment to traditional norms and lifestyles. This also implies that the term RWA does not refer to political right-wing orientation (Altemeyer, 1998). Rather, it refers to a right-wing orientation in a psychological sense. More specifically, high-RWA individuals endorse the authorities that have an established position in their lives, and most often also in society overall. Consequently, RWA tends to correlate with political right-wing orientation in countries that have a right-leaning status quo, while the correlation vanishes or transforms in countries with a left-leaning status quo (Aspelund et al., 2013).

System justification

System justification theory was developed to explain the tendency to legitimize and protect societal structures even when such structures are not beneficial to individuals and/or their in-group (Jost & Banaji, 1994). The theory builds on social identity theory, which postulates that individuals are motivated to justify and approve themselves as well as their in-group and its members (Tajfel & Turner, 1979). This enables them to feel good about themselves based on their individual and group identity. In other words, individuals engage in both ego justification and group justification in order to maintain high well-being and self-esteem. In system justification theory, Jost and Banaji (1994) theorize that individuals also have a psychological need to see the overarching social system as fair, desirable and natural. This means they are motivated to support and defend the status quo, including the prevailing social, economic and political practices, institutions and norms.

System justification satisfies three kinds of basic motivational needs: epistemic (i.e., uncertainty reduction), existential (i.e., threat management), and relational (i.e., coordination of social relations: Jost & Banaji, 1994). To protect a positive image of the system, individuals use various psychological strategies, such as rationalization and victim derogation. For instance, those who are less well-off in the system are considered responsible for their own fate rather than victims of a problematic system. As a result, moral outrage and guilt over the unfair treatment of disadvantaged people decreases, and it becomes easier to live in an unjust society. System justification also reduces frustration when individuals themselves face obstacles in society. Consequently, they may continue to endorse the status quo even if they are personally harmed by it (Jost, Pelham, Sheldon, & Sullivan, 2003).

Much of the research on system justification focuses on explaining attitudes towards inequality. However, the concept and related scales capture

acceptance of the status quo as a whole (e.g., "Sweden is the best country in the world to live in"), and as such, index a general resistance to admitting to a need for societal changes. On the other hand, in times of societal change, system justification motives lead individuals to accept the new societal arrangements (Kay, Jimenez, & Jost, 2002). Thus, like RWA, system justification does not conceptually include an inclination to support right or left-leaning political views. Rather, the observed links with political orientation depend on the context in which studies are conducted. However, certain phenomena are present in most – if not all – societies, such as hierarchically organized social orders, and practices that involve the use of natural resources.

Acceptance of inequality

Social dominance orientation

Societies consist of hierarchical layers, where some people enjoy more privileges and respect than others (Sidanius & Pratto, 1999). Individuals tend to have uneven access to, for example, power positions, social approval, economic resources, and well-being. Even though some hierarchies may depend on individual characteristics, such as high intelligence or athletic abilities, hierarchical positions are often allocated based on group membership. Countless criteria have been used to divide people into such hierarchical groups, many of which are quite arbitrary and socially constructed. For example, in all societies, men and adults tend to be ranked at higher power positions than women and children. Additionally, group-based hierarchies can be based on cast, religion, ethnicity, or any other salient characteristic (Sidanius & Pratto, 1999).

Building on these observations, Sidanius and Pratto (1999; Sidanius, 1993; Pratto et al., 1994) developed the Social Dominance Theory, which identifies the mechanism through which group-based hierarchies are produced and maintained in a society. According to Social Dominance Theory, some statements about inequality/hierarchies are commonly spread and believed in a society (Pratto et al., 1994). Such statements are called legitimizing myths and can be divided into two categories: *hierarchy-enhancing legitimizing myths* that promote hierarchies and stabilize oppression, and *hierarchy-attenuating legitimizing myths* that promote equality and support social change. According to Social Dominance Theory, group-based hierarchies can continue existing in a society due to public agreement on the hierarchy-enhancing statements.

The predisposition to endorse hierarchy-enhancing or attenuating myths varies between individuals, and this predisposition is called 'social dominance orientation' (SDO: Pratto et al., 1994). Specifically, SDO is defined as

"the degree to which individuals desire and support group-based hierarchy and the domination of 'inferior' groups by 'superior' groups" (Sidanius & Pratto, 1999). As such, SDO is a conservative and system-justifying ideological variable. However, when compared to the general conservative variables, SDO captures more specific attitudes (i.e., hierarchy-related statements).

SDO has been suggested to include two distinct dimensions: justification of prevalent hierarchical structures (i.e., a form of system-justification) as well as promotion of hierarchies that benefit one's in-group (i.e., group-justification: Jost & Thompson, 2000; Kugler, Cooper, & Nosek, 2010). More recently, an alternative two-dimensional structure has been theorized and tested by Ho et al. (2012; 2015). Ho and coworkers suggest that SDO includes one dimension reflecting a milder/subtle form of hierarchical thinking, while the other dimension has stronger/aggressive connotations. Despite the proposed two-dimensional structure of SDO, the dimensions are highly correlated. Thus, the concept tends to be treated as one-dimensional in most research.

Ideological variables and climate change denial

RWA, system justification, right-wing/conservative political orientation, and SDO are intercorrelated (e.g., Jost & Thompson, 2000; Wilson & Sibley, 2013). This is expected, since they are conceptually linked. They all involve a tendency to resist at least some form of system change, as well as a tendency to accept the prevailing inequalities in a society. For example, conservatism and SDO have been suggested to be system-justifying ideologies, and system justification and RWA both include acceptance of established authorities (e.g., Altemeyer, 1998; Jost, Glaser, et al., 2003; Jost & Thompson, 2000).

As will be presented below, all of these ideological variables have been connected to climate change denial in previous research. However, given their overlap, it should be tested whether they might uniquely predict climate change denial. Only a few studies have investigated this question thus far. In one study, SDO was found to be a better predictor of denial compared to RWA (Milfont et al., 2013). Another study focusing on the denial of environmental problems found that system justification partly mediates the effect of political conservatism (Feygina et al., 2010).

Knowledge of the unique effects of ideological variables would provide important understanding of the psychological bases for climate change denial. This knowledge could also help to clarify the mechanism through which demographics and personality variables predict denial. More specifically, certain demographic (e.g., gender) and personality (e.g., openness) variables that have been connected to climate change denial (Poortinga et al., 2011;

Milfont et al., 2015) are also correlated with some of the ideological varia-
bles (e.g., Sidanius & Pratto, 1999). Thus, it is possible that ideological
views help explain why demographic and personality variables predict deni-
al. In what follows, the relation between the four ideological variables and
denial is discussed, with a specific focus on the two core components of
conservative ideology: resistance to change and acceptance of inequality.

Resistance to change

Conceptual link to environmentalism

Three of the ideological variables – conservative/right-wing political ideolo-
gy, RWA, and system justification – measure a general resistance to chang-
ing the social status quo while also capturing some more specific psycholog-
ical tendencies (see above). At the environmental domain, RWA has been
found to predict low environmental concern, supportive attitudes towards
nature utilization, hostility towards environmentalists, as well as climate
change denial (Milfont et al., 2013; Milfont & Duckitt, 2010; Schultz &
Stone, 1994). Similarly, political conservatism and system justification have
been connected to anti-environmental attitudes and denial of environmental
problems (Feygina et al., 2010; Poortinga et al., 2011).

Conceptually, these variables do not need to correlate with climate change
denial. In fact, it can be suggested that if the established authorities and the
system in general were to support environmental actions, authoritarian and
system-justifying individuals would be prone to doing so as well. Likewise,
if environmentally friendly actions were traditionally prevalent in society,
conservative individuals (but not necessarily right-wingers) would probably
endorse them. In support of these suggestions, some evidence shows that
authoritarian submission could increase acceptance of pro-environmental
action (Reese & Schiller, 2012). Also, Feygina et al. (2010) demonstrated
that if environmentalism is framed as patriotic and supportive of the status
quo, the correlation between system justification and environmentalism
shifts from negative to positive. Similar results have recently been reported
by Wolsko, Ariceaga, and Seiden (2016), who found that if climate change is
portrayed as a moral matter that is more closely linked to conservative val-
ues (i.e., obeying authority, defending the purity of nature, and demonstrat-
ing patriotism), pro-environmental attitudes increase among political con-
servatives.

However, our current lifestyle is largely built on practices that negatively
affect the environment, for example through CO_2 emissions and the exploi-
tation of natural resources (Feygina, 2013; Lewis & Maslin, 2015). It can
therefore be claimed that environmentally detrimental practices are an inher-
ent part of contemporary societies, which could explain why political con-
servatism, RWA, and system justification predict acceptance of such practic-

es. These same reasons could also explain why conservative ideologies predict refusal to admit the negative effects of our lifestyle on the environment and people (cf. Feygina et al., 2010). Additional explanations can be found when considering the personality traits that predispose individuals to adopting conservative ideology, as will be discussed next.

Personality explanations

Low openness to experience

Adherence to ideologies provides a sense of social belonging, understanding, and certainty, and thus helps to manage uncertainty and related negative emotions. It has been put forward that conservative ideologies may be particularly effective in this sense, because they offer relatively simple, stable, and certain frameworks for explaining and predicting different phenomena and life events (e.g., Jost, Glaser, et al., 2003).

In line with this, right-wing ideology correlates with uncertainty-avoidance and the need for cognitive closure. This means that, compared to left-wingers, right-leaning individuals tend to be more prone to avoiding open-ended solutions and explanations (Federico, Ergun, & Hunt, 2014; Jost et al., 2007). Moreover, right-wing attitudes correlate negatively with the personality trait 'openness' (Altemeyer, 1996; Carney, Jost, Gosling, & Potter, 2008; Ekehammar, Akrami, Gylje, & Zakrisson, 2004; Leone, Desimoni, & Chirumbolo, 2012; Nicol & De France, 2016; Sibley & Duckitt, 2008). Importantly, openness has also been found to correlate with climate change denial (Milfont et al., 2015; Sibley et al., 2011), and it is thus possible that right-wing ideology mediates this relation.

Need to manage negative emotions

Conservative ideologies have also been proposed as an effective way to manage negative emotions such as fear and anxiety (Jost, Glaser, et al., 2003). Supporting this notion, conservative ideologies are more commonly adopted by individuals who have stronger threat sensitivity, as observed through both self-report questionnaires and biological measures (see e.g., Jost & Amodio, 2012; Jost, Glaser, et al., 2003; Jost, Nam, Amodio, & Van Bavel, 2014; Oxley et al., 2008). Longitudinal and experimental studies also support this higher threat sensitivity: fearfulness at a younger age seems to correlate with a predisposition to developing more conservative views later in life (Matthews, Levin, & Sidanius, 2009). Moreover, experimental and real-life activation of threats has been shown to increase conservative attitudes (Akrami et al., 2009; Duckitt & Fisher, 2003; Jost & Hunyady, 2002; Milojev, Greaves, Osborne, & Sibley, 2015).

The role of threat sensitivity in climate change denial is challenging to explain. For example, although right-wing individuals generally tend to be more sensitive to threats (Duckitt, 2001; Jost, Glaser, et al., 2003), they

nonetheless report lower levers of worry and anxiety about climate change (Häkkinen & Akrami, 2014; McCright & Dunlap, 2011). Moreover, in an unpublished study, we have found that lower levels of climate-related anxiety mediate the relation between right-wing political orientation and climate change denial (Häkkinen & Akrami, 2014). Speculatively, these results might imply that denial is used as a coping mechanism among some right-leaning individuals.

More specifically, climate change denial could reflect a motivated effort to keep troubling thoughts about climate change out of the mind, with the purpose of preventing the negative emotions that might otherwise arise. Since it has also been suggested that conservative ideology functions as a buffer against negative emotions (Jost, Glaser, et al., 2003), it seems possible that conservative ideology correlates with a tendency to use climate change denial as a coping method. In indirect support of such emotional control, some evidence shows that conservative ideology, as measured by both RWA and SDO, correlates with a tendency to avoid experiencing and exploring emotions (Leone & Chirumbolo, 2008). Thus, there is a need to study whether a predisposition to avoiding anxious and negative emotions could underpin the ideology-denial relationship.

However, climate-related anxiety does not seem to be reactive, and general negative emotions and threat perceptions may not correlate with it. More specifically, climate-related worry does not correlate with a general tendency to worry, but rather with low openness (Verplanken & Roy, 2013). Considering that many people still perceive climate change as a distant threat, it is possible that the sense of threat is not activated without an active effort to imagine the current and future consequences. It is also plausible that individuals who are high in openness more actively seek out information about climate change, and therefore also experience more climate-related anxiety and worry. After all, it should be noted that climate change does not primarily threaten richer nations (IPCC, 2014) where much of the research about climate perceptions has been conducted. Considering that right-wing individuals are primarily sensitive to threats that specifically target their in-group or the societal order (Onraet, van Hiel, Dhont, & Pattyn, 2013), they may genuinely experience less concern and interest regarding climate change.

Acceptance of inequality

Conceptual link to environmentalism

When considering the link between conservatism and climate change denial, an important question remains to be answered: how can some people resist communications about the dangers of climate change motivated solely by a desire to protect the status quo? To answer this question, a closer look

should be taken at acceptance of inequality – the other central component of right-wing ideology. Before doing so, it should be noted that societies include hierarchical power structures and hence the three ideologies discussed above correlate with acceptance of inequality. However, the fourth ideological variable included in this thesis – social dominance orientation (SDO) – specifically captures acceptance of group-based inequality (Pratto et al., 1994).

Conceptually, SDO measures social attitudes (Pratto et al., 1994). However, it has also recently been linked to environmental attitudes and climate change denial (e.g., Milfont et al., 2013). These relations could still reflect social attitudes. Indeed, research has demonstrated that high-SDO individuals are prone to supporting anti-environmental actions if such actions benefit high-status groups (Jackson, Bitacola, Janes, & Esses, 2013; Milfont & Sibley, 2014). Additional support for the social explanations of the SDO-denial relation comes from analyses highlighting the social inequality component of climate change. More specifically, disadvantaged groups and nations have been predicted to face the most negative effects, even though they have contributed least to climate change (e.g., Schlosberg, 2013). Being inclined to accept unequal distributions of risks and benefits across social groups, high-SDO individuals should express less willingness to acknowledge the need for climate change mitigation.

It is possible, however, that the SDO-denial link reflects environmental attitudes. To begin with, hierarchy-enhancing legitimizing myths about human-nature relations are prevalent in human societies (Feygina, 2013; Milfont et al., 2013). Thus, high-SDO individuals, who are inclined to accept legitimizing myths that promote group-based hierarchies in the social domain, should similarly endorse statements that support hierarchical human-nature relations (Dhont, Hodson, Costello, & MacInnis, 2014; Milfont et al., 2013). Indeed, Milfont et al. (2013) have demonstrated that high-SDO individuals express more willingness to exploit and utilize nature, and less concern about environmental issues. High-SDO individuals could thus refuse to acknowledge human-induced environmental problems because they consider anti-environmental actions to be legitimate and desirable. In addition to these conceptual explanations, the personality underpinnings of SDO could explain part of the ideology-denial relationship, as will be discussed next.

Personality explanations
Acceptance of inequality could be explained in part by the same personality mechanisms as resistance to change, such as motivation to avoid uncertainty, threat, and negative emotions (Jost, Glaser, et al., 2003). For example, it could be suggested that established and stable hierarchies decrease social turbulence and provide a sense of certainty, stability, and safety. Some evidence suggests this, as the personality trait 'openness' is also connected to SDO (Ekehammar et al., 2004).

However, openness is not the most important predictor of SDO (but see Nicol & De France, 2016). In addition, SDO is not linked to higher threat sensitivity, but rather to a tendency to perceive social orders in terms of zero-sum competition (Cantal, Milfont, Wilson, & Gouveia, 2015; Duckitt, 2001). For example, SDO correlates with a tendency to perceive the world as a "competitive jungle" or a "dog-eat-dog world", where social hierarchies are inevitable and thus legitimate.

In terms of core personality, SDO has been linked to a "tough-minded" personality. For example, SDO negatively correlates with agreeableness and empathy (Duckitt & Sibley, 2010; Pratto et al., 1994; Sibley & Duckitt, 2008). Moreover, SDO positively correlates with being domineering (Grina, Bergh, Akrami, & Sidanius, 2016), Machiavellianism and psychopathy (Hodson, Hogg, & MacInnis, 2009), "personal power, meanness, dominance" and "exploitative manipulative amoral dishonesty" (Altemeyer, 1998). It thus seems that SDO is higher among individuals whose personality traits allow them to remain undisturbed when considering unequal power relations. As presented above, some evidence suggests that climate change denial correlates with agreeableness (Milfont et al., 2015; Sibley et al., 2011), and similar correlations can be expected with empathy and being domineering. Most importantly, however, SDO could mediate these correlations.

As for the demographic underpinnings, SDO scores tend to be higher among individuals who belong to high-status groups, such as males (Pratto et al., 1994; Sidanius & Pratto, 1999). When considering the ideological roots of climate change, it needs to be studied whether SDO mediates the gender effects (being male) on climate change denial.

Aims of the thesis

The major aim of this thesis was to investigate the relation between sociopolitical ideology and climate change denial. Previous research has shown that denial correlates with political orientation, social dominance orientation (SDO), right-wing authoritarianism (RWA), and system-justification (Feygina et al., 2010; McCright & Dunlap, 2011; Milfont et al., 2013). Although these variables are intercorrelated (e.g., Jost & Thompson, 2000; Wilson & Sibley, 2013), they are conceptually and empirically distinct. Thus, the *first aim* was to investigate whether these variables uniquely contribute to explaining climate change denial. With this approach, it can be estimated whether denial is better predicted by resistance to change, acceptance of inequality, or some more specific component, such as authoritarianism. It was expected that a general endorsement of the status quo – as indexed by political orientation, RWA and system justification – predicts climate change denial. However, the main hypothesis was that acceptance of inequality – indexed here by SDO – is the strongest predictor and/or mediates the effects of other ideological variables. This hypothesis is based on findings showing that while climate change is mainly caused by wealthy populations, it primarily affects disadvantaged people, future generations, and non-human animals (e.g., Schlosberg, 2013; see also Milfont et al., 2013). Accordingly, it can be theorized that even though climate change denial could be motivated by resistance to changing the status quo, it also involves acceptance of the unequal distribution of climate-related benefits and risks.

The *second aim* was to investigate the psychological underpinnings of the ideology-denial relation. To do this, the effects of ideological variables were tested simultaneously with variables that have been found (Grina et al., 2016; Jost, Glaser, et al., 2003; McCright & Dunlap, 2011; Milfont et al., 2013; Pratto et al., 1994; Sibley et al., 2011), or could be hypothesized, to correlate both with denial and sociopolitical ideology. In particular, we tested the effects of demographic (gender) and personality (empathy, being domineering, openness, anxiety avoidance) variables, as well as a variable measuring ideological attitudes regarding dominance of nature. Ideological variables, such as SDO, have been found to mediate personality effects on various attitudinal and behavioral outcomes. Hence, we tested a hypothesis that ideological variables mediate the gender and personality effects on denial.
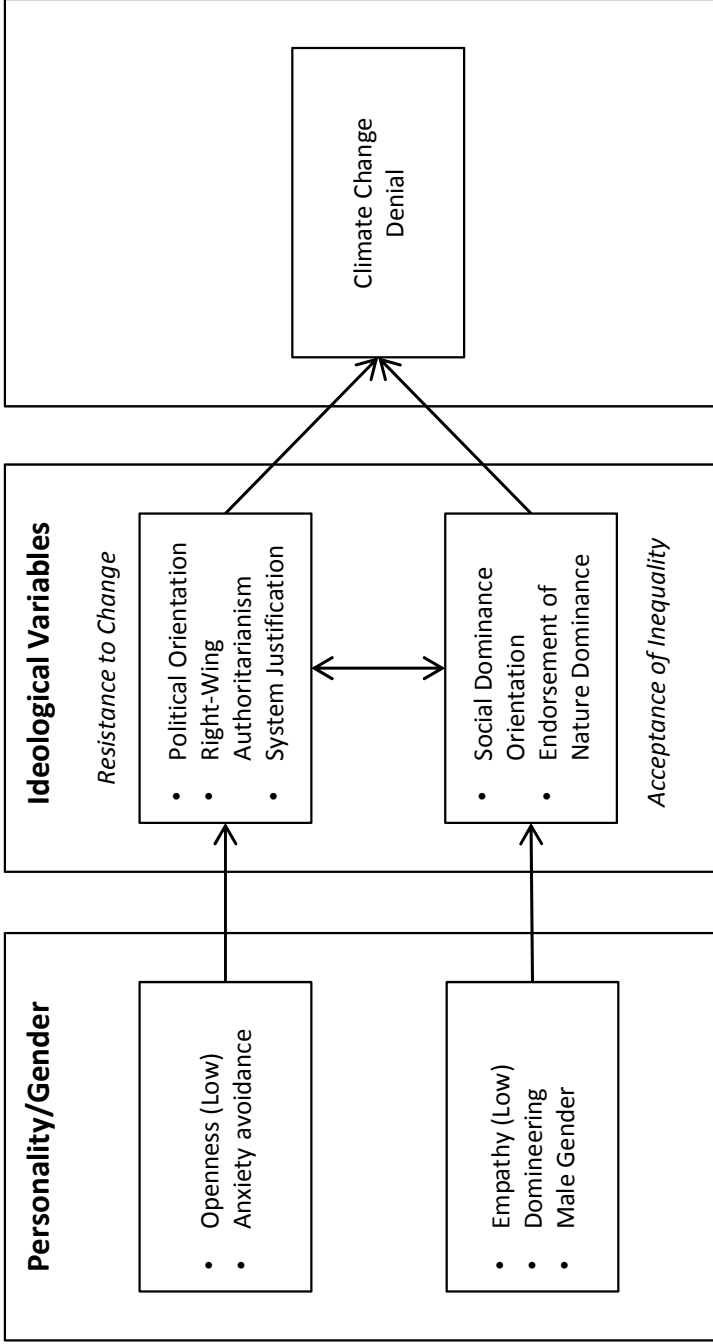
Figure 1. Hypothetical statistical relations between the variables, Papers I-III & additional analyses.

Methodology overview

Participants and procedure

All included studies were self-report studies (see Table 1 for measures). All studies were carried out on internet, meaning that the participants filled the questionnaires online instead of coming to a laboratory. Participants received explicit information that data was collected anonymously and that they were free to discontinue the study at any time without giving a reason for that.

Three of the studies were conducted in Sweden. In these studies, participants were recruited by announcements on an online recruitment platform *Studentkaninen* and on notice boards, as well as face-to-face on metro stations. The online questionnaires were filled through *SurveyMonkey* survey platform.

One study was conducted in Brazil. In this study, participants were recruited through online discussion groups, emails, and social media such as Facebook. Participants were also asked to send the survey link to their own contacts. The questionnaires were filled through *Qualtrics* survey platform.

Measures

Climate change denial

General Climate change denial

A 16-item climate change denial scale was developed by us, and it was used in Paper I (α_{study1} = .91; α_{study2} = .92), as well as in Paper II and additional analyses (α = .90). The scale was developed to capture different facets of denial, identified in previous research and analyses (e.g., McCright & Dunlap, 2011; Poortinga et al., 2011; Rahmstorf, 2004). Previous research suggests that different forms of denial are distinguishable, yet intercorrelated (e.g., Poortinga et al., 2011).

The scale more specifically measures denial of the reality of climate change, human impact on the changes, seriousness of the effects, importance of the problem, as well as scientific consensus on the issue (See Appendix A, item example: 'The seriousness of climate change is exaggerated in the media' and 'I believe that there is enough scientific evidence to confirm the

changes in Earth's climate' [reversely scored]). Items were responded to on a Likert-like scale ranging from 1 (do not agree at all) to 5 (agree fully).

Table 1.

Overview of variables included in Papers I, II & III, and additional analyses.

Variable	Paper I		Paper II	Paper III		Addit.
	Study 1	Study 2		Brazil	Sweden	
Climate Change Denial						
General	X	X	X			X
Anthropogenic				X	X	
Ideological Variables						
Social Dominance Orientation	X	X	X	X	X	X
Right-Wing Authoritarianism	X	X				
Political Orient. (Left-Right)	X	X				
Political Orient. (Lib.-Cons.)				X	X	X
System Justification			X			X
Personality						
Empathy			X			X
Domineering			X			X
Openness						X
Anxiety avoidance						X
Gender				X	X	X
N	135	101	221	367	221	221

Note: Same sample (N =221) in Paper II, Paper III (Swedish sample), and additional analyses

Anthropogenic climate change denial

In Paper III, the focus was specifically on denial of anthropogenic climate change. In the Swedish sample, two items were selected from the above introduced 16-item scale to capture specifically this form of denial: 'Warming of the Earth's climate is natural and does not depend on human influence' and 'Temperature on Earth varies due to natural reasons and human activity has nothing to do with this variation' ($r = .71$, $\alpha = .83$; $r_{\text{with 16-item scale}} = .79$). In the Brazilian sample, the two items were ($r = .69$, $\alpha = .82$): 'Global warming and climate change are a completely natural phenomena, unrelated to human actions', and 'Global warming and climate change are caused by human actions' (reversely scored).

Swedish sample responded to denial items on a Likert-like scale ranging from 1 (do not agree at all) to 5 (agree fully). Brazilian sample responded to items on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Thus, the 1-to-5 and 1-to-7 SDO metrics were converted

into percentage of maximum possible (POMP) scores (Cohen, Cohen, Aiken, & West, 1999) ranging from 1 (minimum possible score) to 100 (maximum possible score), to make denial scores comparable across samples.

Ideological variables

Political orientation

In Paper I, political orientation was measured by a single item where participants positioned themselves on a scale ranging from 1 (far to the left) to 7 (far to the right). In Paper III and additional analyses, the focus was on liberal-conservative orientation, which was measured by a 7-point scale ranging from 1 (very liberal) to 7 (very conservative) both in Sweden and Brazil.

Social dominance orientation

Two 16-item versions of SDO scale were employed across the studies: a widely used SDO_6 –scale (Pratto et al., 1994), and a newly developed SDO_7 –scale (Ho et al., 2015). As demonstrated by Ho et al (2015), these scales are highly correlated (rs = .88 - .95) and predict comparable outcomes. SDO_6 – scale was used in Paper I (α_{Study1} = .88; α_{Study2} = .90), while SDO_7 –scale was used in Paper II and additional analyses (α = .85). The scales include items such as: 'Some groups of people are simply inferior to other groups' and 'Group equality should be our ideal' (reversely scored). Participants responded to items on a Likert-like scale ranging from 1 (do not agree at all) to 5 (agree fully).

In paper III, the Swedish sample responded to the SDO_7 - scale (Ho et al., 2015). An almost identical scale (Ho et al., 2012) was used in the Brazilian sample, only the first item differs. To keep consistency across the samples, the first item was deleted in the analyses. Thus, a 15-item version of the SDO_7-scale was used both in Swedish (α = .84) and Brazilian (α = .85) samples in Paper III. Swedish sample responded to SDO items on a Likert-like scale ranging from 1 (do not agree at all) to 5 (agree fully). Brazilian sample responded to items on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Thus, in Paper III, which included both Swedish and Brazilian samples, the 1-to-7 and 1-to-5 SDO metrics were converted into percentage of maximum possible (POMP) scores (Cohen et al., 1999) ranging from 1 (minimum possible score) to 100 (maximum possible score), to make SDO scores comparable across samples.

System justification

An eight-item general system justification scale was adopted from Kay and Jost (2003; Paper II and additional analyses). Factor analysis of this scale revealed two factors; one reflecting endorsement of the Swedish society (item example: 'Sweden is the best country in the world to live in') and an-

other reflecting endorsement of the system/society in general (item example: 'In general, I find society to be fair'). The four items loading on the latter mentioned factor were used in the analyses. Also, one reversely scored item from the other factor was included in order to balance the scale (excluded items: 2, 3, & 4: see Kay & Jost, 2003: $\alpha = .68$).

Right-wing authoritarianism

A 15-item short-version of Altemeyers (1998) 30-item scale was used to measure RWA (Zakrisson, 2005) in Study 1 of Paper I ($\alpha = .76$). In Study 2 of Paper I, the scale was divided into pre- and post-measurement parcels (see below the method section of Paper I). The pre-measurement scale that was included to the analyses consisted of 9 items ($\alpha = .69$).

The RWA scale includes such items as 'Our country needs a powerful leader, in order to destroy the radical and immoral currents prevailing in society today', and 'Our society would be better off if we showed tolerance and understanding for untraditional values and opinions' (reversely scored). Participants responded to the items on a Likert-like scale ranging from 1 (do not agree at all) to 5 (agree fully).

Nature dominance

Endorsement of nature dominance (Paper II and additional analyses) was measured by combining items from two scales. To capture views on human-environment dominance, the three-item anti-anthropocentrism subscale of the New Environmental Paradigm-scale (Dunlap, Van Liere, Mertig, & Jones, 2000) was included. As to human dominance over animals, we added three items that were selected from the Human Supremacy Beliefs-scale (Items 1, 2, 4: Dhont & Hodson, 2014). Thus, the final scale consisted of six items ($\alpha = .77$), such as 'Humans were meant to rule over the rest of nature', and 'We should strive to more equality between humans and animals' (reversely scored).

Personality variables

Domineering

Dominance (i.e., being domineering) was assessed (Paper II and additional analyses) by a six-item domineering scale (http://ipip.ori.org/ipip/; Goldberg, 1999: $\alpha = .73$). Two of the items have been reversed in order to balance the scale. The scale consists of items such as: 'I insist that others do things my way', and 'I am not a person that makes demands on others' (reversely scored). The items were responded to on a scale ranging from 1 (do not agree at all) to 5 (agree fully).

Empathy

Empathy was measured (Paper II and additional analyses) by a seven-item empathic concern subscale of the Interpersonal Reactivity Index (Davis, 1980: α = .82). The scale included items such as: 'I would describe myself as a pretty soft-hearted person', and 'Other people's misfortunes do not usually disturb me a great deal' (reversely scored). The items were responded to on a Likert-like scale ranging from 1 (absolutely not true) to 5 (absolutely true).

Openness to experience

Openness to experience was captured (additional analyses) by a 10-item subscale from the 60-item HEXACO-PI-R scale (Ashton & Lee, 2009: α = .73). The scale includes items such as: 'If I had the opportunity, I would like to attend a classical music concert' and 'I've never really enjoyed looking through an encyclopedia' (reversely scored).

Anxiety avoidance

To capture a tendency to manage anxious emotions by avoidance (additional analyses), a four-item scale was developed by us (α = .60). These questions are: 'I avoid thinking about things that cause anxiety', 'I avoid thinking about problems that I can do nothing about', 'The best way to deal with negative feelings is to try to forget and move on', 'My best advice to someone who has anxiety is "forget and move on"'.

Experimental manipulation

To test the effect of climate-related communication on climate change denial (Study 2, Paper I), participants watched either a climate-related newscast or completed a word-sorting task before responding to the items measuring climate change denial.

Experimental condition: Newscast

In the newscast condition, participants saw a newscast that was originally shown in Swedish national television in September 2013. The length of the newscast is 2.46 minutes, and the focus is on the IPCC-report that had recently been published at the time. In the video, researchers communicate that the conclusions are now more certain when compared to the previous reports. They further emphasize the human impact on climate change, and the importance of mitigation efforts that would prevent a global temperature rise above 2 degrees Celsius.

Control condition: Word-sorting task

In the control condition, participants completed a word-sorting task instead of watching the newscast. The objective of this task was to determine which

one of four presented words is unrelated to the other words. Such words were selected that were considered to be emotionally neutral and unrelated to climate (e.g., digital, analog, clock, computer). The participants completed five sorting tasks in the control condition, each consisting of four words.

In order to control for possible effects that the word-sorting task could have specifically in the control condition, an additional task, again consisting of five sorting tasks consisting of four words, was completed in both conditions.

Ethical considerations

Participants conducted all studies online. Before starting the studies, they were informed in writing about the general aims of the studies. They were also informed that participation was voluntarily, no information about their personal identity would be collected, and they could discontinue the study at any time without giving a reason for that. After participation, they received debriefing in writing. They also were welcomed to contact the researchers in case they had comments or questions.

Since no personal data was collected, and the procedures did not include risk for physiological or psychological harm, ethical approval was not required. However, there are some ethical aspects that need to be considered. The studies included variables that can be experienced as sensitive, particularly political orientation. Individuals have a right to keep their political opinion private, and they may feel uncomfortable revealing these opinions even for research purposes. However, participants responded to the items anonymously, meaning that their responses cannot be connected to their personal identity. Thus, it is unlikely that participants experienced discomfort due to the items measuring political orientation.

Furthermore, it is of importance to consider how online participation may influence the participants. On the one hand, it provides an opportunity to easily discontinue study if participants lose their motivation to participate or feel any discomfort. On the other hand, this form of participation includes a written debriefing after participation. Thus, the researcher cannot know for certain if the study has caused discomfort, fear, anxiety, or other negative feelings. Such feelings are plausible in the present studies, as they addressed perceptions about climate change, which is a topic that can be considered as threatening. However, it is unlikely that the items would evoke more negative feelings than climate-related information that is constantly present in the society, for example through media. Also, participants were explicitly invited to contact the researchers in case they had any questions or comments.

Another concern in relation to the topic of the present studies is that, climate change denial is considered to be a global problem hindering climate change mitigation efforts. Research related to climate change denial may

strengthen views of climate change as a debatable issue where no right or wrong answers exist. In other words, there is a theoretical risk that such studies may have negative environmental consequences. However, it seems unlikely that the items would alter perceptions about the existence of climate change. Most scales used in research use balanced items where some items measure traits, attitudes, or behaviors that can be considered problematic. There is no reason to expect that the climate change denial items would change attitudes while others, such as social dominance orientation items, do not.

Paper I - Study 1

Background and aim

A number of studies have found that denial of environmental problems is related to social and political attitudes (e.g., Feygina et al., 2010; McCright & Dunlap, 2011; Milfont et al., 2013; Poortinga et al., 2011). However, being a relatively new research field, only a few of these studies have so far systematically investigated these relations. For example, most studies on environmentalism have focused on testing only the effect of political orientation, right-wing authoritarianism (RWA), system justification, or social dominance orientation (SDO).

Importantly, these ideological variables are intercorrelated (Aspelund et al., 2013; Federico et al., 2009; Jost & Thompson, 2000; Wilson & Sibley, 2013), and it is thus unclear if they uniquely explain climate change denial. Research that would test these relations simultaneously would help clarify the psychological underpinnings of denial by indicating which component of right-leaning ideology seems to be the best predictor. To address this gap in literature, Study 1 in Paper I tested whether right-left political orientation, RWA, and SDO would uniquely predict climate change denial.

Method

One-hundred-thirty-five participants participated in the study (18 - 61 years, M = 25.8, SD = 7.5, 68% women). Participants filled questionnaires measuring climate change denial (see Appendix A), social dominance orientation (Pratto et al., 1994), right-wing authoritarianism (Zakrisson, 2005), and political left-right orientation. Also, the questionnaire included measures not relevant to this study.

The scales were introduced in four alternative orders in order to control for possible order effects. That is, about half of the participants answered the denial items before the ideological variables, while the others answered them after. It took approximately 40 minutes to fill the questionnaires. Participants were rewarded with a cinema voucher (approximately 7€).

Results and comments

Climate change denial correlated with all ideological variables (see Table 2). To test the unique contributions of the ideological variables, we conducted a stepwise regression analysis in which all these variables were included as independent variables. The results showed that SDO was the strongest predictor of denial ($\beta = .46$, $p < .001$). Political orientation also contributed predicting denial ($\beta = .21$, $p = .007$), but the effect of RWA became non-significant ($\beta = .09$, $p = .28$).

These results imply that, among the included ideological variables, SDO (28 % variance explained) is the best predictor of climate change denial. RWA does not explain any, and political orientation explains some additional variance (4 %) above the effect of SDO.

Table 2

Bivariate Correlations (R) Between the Variables, Means (M), and Standard Deviations (SD), in Study 1, Paper I.

Variable	R			M	SD
	1	2	3		
1. Climate change denial	-			1.95	0.67
2. Right-wing authoritarianism	.33*	-		2.16	0.52
3. Social dominance orientation	.53*	.51*	-	1.86	0.63
4. Left-right political orientation	.35*	.12	.30*	3.14	1.39

*$p < .001$ (two-tailed).

Paper I - Study 2

Background and aims

The *first aim* of Study 2 in Paper I was to replicate the above presented findings showing that SDO outperforms RWA and political orientation in predicting climate change denial. More importantly, the *second aim* was to investigate the stability of the ideology-denial relation when climate-related communication was presented to participants.

This line of research contributes to further understanding about the sources of denial; that is, could the ideology-denial relation reflect social/situational (e.g., exposure to differing communication) or psychological (e.g., ideological motivations) influences. Both of these influences are plausible explanations for the higher denial scores among right-leaning individuals. Individuals on the right-wing side of political spectrum tend to be more exposed to more dismissive communications regarding climate change (Feldman et al., 2014). However, ideological stance has been shown to influence the way that climate-related information is processed (Hart & Nisbet, 2012; Zhou, 2016).

If the ideology-denial relation would vanish or significantly decrease after climate-related communication, it could implicate that the levels of denial depend at least partly on the communications that individuals are exposed. However, if the relation would strengthen, it could suggest that individuals become more extreme in their viewpoints after receiving climate-related information, indicating ideological polarization (e.g., Hart & Nisbet, 2012).

Method

Participants (*n* = 101, 60% women) were randomly assigned to two experimental conditions. In the newscast condition (*n* = 53), a climate-related video was shown. In the control condition (*n* = 48), participants conducted a word-sorting task instead of watching the video.

In order to control for the possible effects that experimental manipulation might have on ideological positions, we split RWA and SDO scales to three parcels and conducted pre- and post-measurements of these variables. With this approach, it could be ensured that any possible manipulation effects would depend specifically on changes in climate change denial and not, for

example, increase in RWA (see Fritsche, Cohrs, Kessler, & Bauer, 2012). Parcels 1 and 2 were filled before manipulation (9/10 items), and parcels 2 and 3 were filled after manipulation (11/11 items) for RWA and SDO respectively. No manipulation effects were found on RWA or SDO, and thus the pre-manipulation parcels were included to the further analyses.

Participants began the study by filling the scales that measure RWA, SDO, and political orientation. They then either watched the video (newscast condition) or completed a word-sorting task (control condition). After this, both groups completed a word-sorting task before filling the climate change denial scale. This was done in order to guard against any effects that the word-sorting task would have specifically in the control group only. Finally, the second set of RWA and SDO items were filled. Participants received a scratch card as a reward (3.5 €).

Results and comments

Initial analyses showed that the manipulation had an effect on climate change denial only [$t(99) = 2.69$, $p = .008$] (see Table 3). Denial was lower in the newscast condition than in the control condition, suggesting that the newscast effectively decreased the levels of denial. Further, denial correlated with all ideological variables, although the relation between denial and RWA did not reach conventional significance level in the newscast condition (see Table 3).

Table 3

Means (M), Standard Deviations (SD), and Bivariate Correlations (R) Between Ideology Variables and Climate Change Denial as a Function of Condition, in Study 2, Paper I.

Variable	M (SD)		R with denial	
	Newscast	Control	Newscast	Control
Climate change denial	1.79 (0.60)	2.19 (0.89)	-	-
Pre-manipulation				
Left-right political orientation	3.49 (1.56)	3.54 (1.62)	.31*	.38*
Right-wing authoritarianism	2.29 (0.62)	2.16 (0.52)	.20†	.40*
Social dominance orientation	1.79 (0.88)	1.79 (0.58)	.35*	.47*
Post-manipulation				
Right-wing authoritarianism	2.17 (0.59)	2.13 (0.56)	.34*	.45*
Social dominance orientation	1.93 (0.90)	1.98 (0.70)	.36*	.58*

*p < .05 (two-tailed), †p = .08 (one-tailed).

We then conducted hierarchical regression analysis where denial was placed as a dependent variable, and independent variables were experimental condition (Step 1) and the tree ideological variables (Step 2). The results showed

significant effects of condition and SDO only (see Table 4). Similarly as in Study 1, the effect of RWA vanished when SDO was controlled for. In addition, this time also the effect of political orientation became non-significant. In further analyses we introduced the condition by ideology interaction terms (Step 3). No significant interaction effects were found, and the main effects of ideological variables were unaffected. Taken together, these results imply stability in the ideology-denial relation. More specifically, it seems that the level of denial can be altered by climate-related communication, but individuals stick to their ideological rank order.

Table 4

Summary of Hierarchical Multiple Regression Analysis Predicting Climate Change Denial in Study 2, Paper I.

Variable	ΔR^2	β
Step 1	.07 **	
Experimental condition (EC)		−.26 **
Step 2	.19 ***	
EC		−.24 **
Left-right Political orientation (PO)		.13
Social dominance orientation (SDO)		.32 **
Right-wing authoritarianism (RWA)		.07
Step 3	.03	
EC		−.25 **
PO		.08
SDO		.41 **
RWA		.25
EC × PO		.05
EC × SDO		−.11
EC × RWA		−.24
Total R^2 = .29*** (N = 101)		

Values for two outliers ($z > 3$) on SDO and one on RWA were replaced with mean.

**$p < .01$ (two-tailed), ***$p < .001$ (two-tailed).

Paper II

Background and aims

The results of Paper I indicate that SDO is a key sociopolitical ideological predicting climate change denial (see also Milfont et al., 2013). Therefore, Paper II aimed to investigate the psychological underpinnings of the SDO-denial relation. To do that, we tested models including variables that previous research has identified as predictors of SDO, or both SDO and environmentalism. Specifically, we explored the effects of relevant core personality traits (i.e., empathy and being domineering), as well as two additional ideological variables (i.e., system justification and endorsement of nature dominance).

The *first aim* of Paper II was to map the relations between the three included ideological variables. To begin with, SDO can be described as justification of hierarchical status quo (Pratto et al., 1994), while system justification captures justification of status quo in general (Jost & Banaji, 1994). A model that includes both of these variables helps to clarify if denial reflects justification of the status quo in general or justification of hierarchies in particular. Further, SDO has been suggested to extend to nature dominance (Milfont et al., 2013) meaning these two forms of group-based dominance seem to be inherently related. However, SDO seems to predict environmentalism due to social reasons as well. That is, it predicts acceptance of anti-environmental actions that benefit high-status social groups (Jackson et al., 2013; Milfont & Sibley, 2014). Testing the effects of SDO and nature dominance simultaneously enables investigating whether denial is better predicted by social (SDO) or environmental (nature dominance) attitudes. The test regarding SDO and nature dominance was exploratory, meaning that no specific hypothesis was formed. As to the results of SDO and system justification, SDO was expected to outperform and mediate the effect of system justification. This hypothesis was based on previous research showing that SDO outperforms variables capturing a more general acceptance of status quo (see Paper I, as well as Milfont et al., 2013).

It has been found that 'tough-minded' personality predicts SDO. That is, SDO scores tend to be higher among individuals who score low in empathy and high in being domineering (Grina et al., 2016; Pratto et al, 1994; Sidanius & Pratto, 1999; Sidanius et al., 2013). Empathy has also been linked to environmentalism (Tam, 2013), and similar effects could be sug-

gested for domineering (see the Chapter 'Acceptance of inequality'). Thus, the *second aim* of Paper II was to test a hypothesis that SDO mediates the effects of empathy and domineering on climate change denial.

Method

Participants (n = 221, 66 % women, 18- 72 years, M_{age} = 28.45, SD_{age} = 10.78) filled the questionnaire online. The questionnaire included measures for climate change denial (see Appendix A), social dominance orientation (Ho et al., 2015), nature dominance (Dhont & Hodson, 2014; Dunlap et al., 2000), system justification (Kay & Jost, 2003), empathy (Davis, 1980) and domineering (Goldberg, 1999). The questionnaire included also other scales which are not related to the present study. It took approximately 40 minutes to complete the questionnaire. Participants received a cinema voucher as reward (approximately 12 €).

Results and comments

As presented in Table 5, all variables correlated with each other, with a couple of exceptions. Some of the correlations did not reach conventional significance levels, and empathy and system justification did not correlate.

Table 5

Bivariate Correlations (R) Between the Variables, Means (M), and Standard Deviations (SD), Paper II.

Variable	R					M	SD
	1	2	3	4	5		
1. Climate change denial	-					1.88	0.68
2. Nature dominance	.30*	-				2.38	0.89
3. Social dominance	.37*	.22*	-			1.99	0.62
4. System justification	.20*	.25*	.26*	-		2.69	0.77
5. Domineering	.11†	.13†	.42*	.11†	-	2.59	0.74
6. Empathy	−.16*	−.17*	−.34*	−.03	−.24*	3.90	0.70

*p < .05 (two-tailed), † p < .10 (two-tailed).

To test the relations between the variables simultaneously, we conducted path analyses using robust maximum likelihood (MLR) estimator in Mplus (Mplus 7.3, Muthén & Muthén, 2012). We began by two simple models that only tested the effects of the three ideological variables. In the first model, only SDO and system justification formed paths to denial (R^2 = .15). As hypothesized, the path from SDO was significant (β = .34, p < .001) while that from system justification to denial was not (β = .11, p = .11). In the second

model, also nature dominance was included as an independent variable. In this model (R^2 = .19), the paths from SDO (β = .31, p < .001) and nature dominance (β = .22, p = .001) were significant, while the path from system justification was not (β = .07, p = .31). Thus, it seems plausible to expect that the group-based dominance variables mediate the relation between system justification and denial.

We then tested the final full model, where core personality variables (domineering and empathy) and system justification formed paths to the group-based dominance variables (SDO and nature dominance), which by their turn formed paths to climate change denial. We also let SDO and nature dominance to correlate. This model showed excellent fit to the data, $\chi2(3)$ = 2.11, p = .55, CFI = 1.00, RMSEA = .00, 90% CI [.00, .10], SRMR = .02. As depicted in Figure 2, all paths were significant, except the path from domineering to nature dominance (β = .07, p = .33) and the correlation be-tween SDO and nature dominance (β = .10, p = .17). As the simpler model presented above, this model explained 19% of the variance in denial. In sum, these results suggest that acceptance of group-based (social and/or human-nature) dominance mediate effects of empathy, domineering, and system justification on denial.
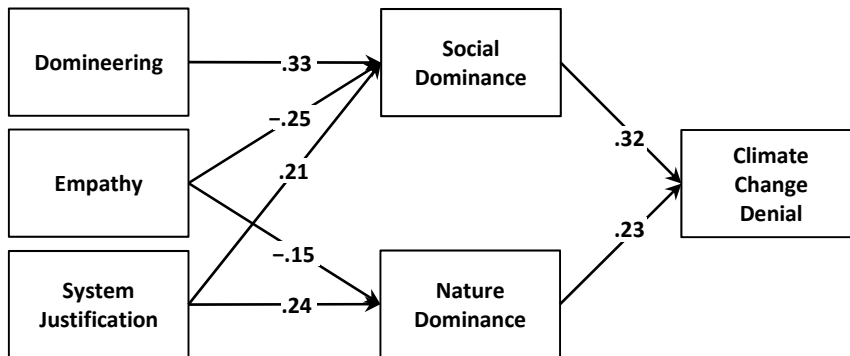
Figure 2. Standardized structural relations explaining climate change denial in Paper II (only significant [p < .05] paths are depicted).

Paper III

Background and aims

Previous research has shown that, when compared to other adults, conservative males are more prone to deny human influence on climate change (McCright & Dunlap, 2011; Milfont et al., 2015; Poortinga et al., 2011). It has been argued that this "conservative male effect" reflects attempts to protect the societal structures where these individuals tend to hold higher power positions (McCright & Dunlap, 2011). This suggestion would be in line with results from Paper I and II (see also Milfont et al., 2013) showing that acceptance of inequality (indexed by SDO) outperforms the other conservative ideologies in predicting denial. Similarly, SDO has been found to mediate the relation between gender and environmentalism (Milfont et al, 2013; Milfont & Sibley, 2016). However, no studies have thus far tested if SDO mediates simultaneously the effects of both political conservatism and gender on denial.

Thus, in Paper III we tested a *mediation hypothesis*, whereby SDO mediates the effects of political conservatism and gender on anthropogenic climate change denial. Further, this mediation hypothesis was tested across two cultural contexts, in Brazil and Sweden, in order to test the replicability of the results. Also, conducting studies in these two countries enhances understanding of the topic, since previous studies investigating 'conservative male effect' have been conducted in English speaking countries.

Method

The Brazilian data was collected as a part of a broader study (Cantal et al., 2015). The sample consisted of 367 participants (59 % women, M_{age} = 29.7, SD_{age} = 10.80) who completed an online survey in January 2014. In the Swedish sample, we used data that was collected for the Paper II (see above for the details of sample and procedure).

Participants filled the questionnaire online. The questionnaires included measures for social dominance orientation (Ho et al., 2012; 2015), political liberal-conservative political orientation, gender, and anthropogenic climate change denial.

Results and comments

	Denial	SDO	Conservatism
Brazil	19.9 (24.3)	24.8 (16.9)	3.5 (1.3)
Men	24.8 (27.6)	27.7 (17.4)	3.4 (1.4)
Women	16.5 (21.2)	22.8 (16.3)	3.6 (1.2)
Sweden	20.2 (23.7)	24.5 (15.6)	2.7 (1.4)
Men	23.5 (26.3)	29.8 (16.0)	2.8 (1.5)
Women	18.6 (22.1)	21.7 (14.7)	2.6 (1.3)

Note. Denial and SDO means are based on POMP scores ranging from 1 to 100, and conservatism means range from 1 to 7.

As shown in Table 7, climate change denial correlated positively with political orientation, gender, and SDO in both samples. However, the analyses also indicate that the relation between denial and political orientation is statistically significant only in the Swedish sample, and the relation between denial and gender is significant only in the Brazilian sample.

Analyses comparing correlation coefficients among men and women showed that the correlation between denial and SDO is comparable among male and females in both samples. However, the results suggest a trend that denial and political conservatism only correlate among males (r_{Brazil} = .19, p = .02, r_{Sweden} = .22, p =.06) but not among females (r_{Brazil} = .04, p = .61, r_{Sweden} = .09, p = .31). Nonetheless, regression analyses did not support the possibility that gender moderates the relation between denial and conservatism, as the conservatism × gender interaction term was non-significant in both samples (ps > .10).

Table 7.
Bivariate Correlations Between the Variables (Brazilian Sample Above Diagonal, Swedish Sample Below Diagonal), in Paper III.

	1	2	3	4
1. Denial of anthropogenic climate change		.25*	.10†	.17*
2. Social dominance orientation	.29*		.29*	.14*
3. Political orientation	.15*	.24*		-.08
4. Gender (female = 1, male = 2)	.10	.25*	.06	

*p < .05 (two-tailed), †p < .10 (two-tailed)

To test the mediating hypothesis, we conducted mediation path analyses in Mplus (Mplus 7.3, Muthén & Muthén, 2012) with 5,000 bootstrap resamples. This full mediation model tests if the effects of political orientation and gender on anthropogenic climate change denial are mediated by SDO (See Figure 3). The results provide support for the mediation hypothesis in both countries. In the Brazilian sample, the effect of conservatism was fully mediated [standardized indirect effect: .065 (p = .003, 95% CI: 0.023, 0.108)] and the effect of gender was partially mediated [standardized indirect effect: .036 (p = .02, 95% CI: 0.006, 0.066), standardized direct effect: .141 (p = .006, 95% CI: 0.041, 0.241)] by SDO. In the Swedish sample, SDO fully mediated the effects of both conservatism [standardized indirect effect: .061 (p = .007, 95% CI: 0.017, 0.106)] and gender [standardized indirect effect: .062 (p = .008, 95% CI: 0.016, 0.108)] on denial.
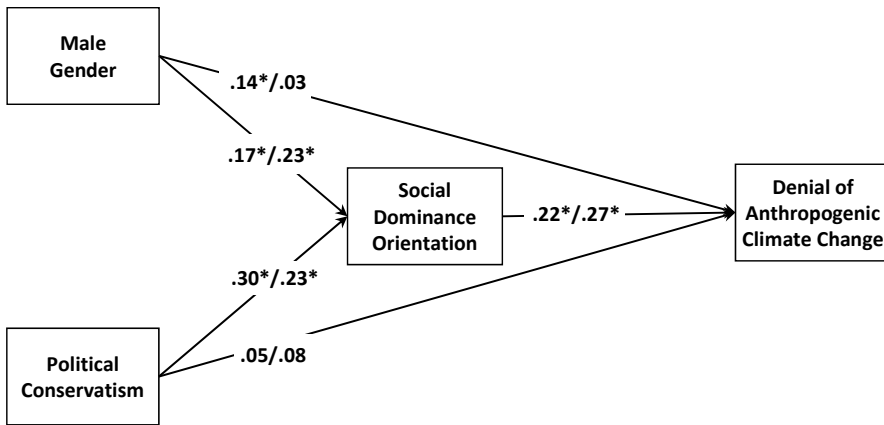
Figure 3. Standardized path coefficients explaining climate change denial (Brazil/Sweden)

Additional analyses

Background and aims

The results presented above consistently show that social dominance orientation (SDO) is a stronger predictor of climate change denial compared to other included ideological variables. Thus, it seems that when it comes to the two core components of right-wing ideology (Jost, Glaser, et al., 2003), climate change denial is better explained by acceptance of inequality than resistance to change. Also, tough-minded personality seems to underpin the ideology-denial relation. However, the broad research questions of this thesis are not satisfactorily answered before some remaining questions have been addressed. The following three research questions will be investigated in the additional analyses.

1. Important questions remain about personality underpinnings of ideology-denial relation. Paper II tested models including personality variables that are relevant particularly when investigating the role of SDO. However, also the effects of personality variables that underpin general conservatism need to be tested. Climate change denial has been found to correlate negatively with *openness to experience* (Milfont et al., 2015; Sibley et al., 2011), and it could be theorized to correlate also with *a predisposition to avoid experiencing anxiety*. Since both of these personality variables are also linked to conservative ideology (e.g., Ekehammar et al., 2004; Jost, Glaser, et al., 2003), it needs to be tested if ideological variables mediate their effects on denial.

2. *Gender* effect needs to be studied further. Although gender was not related to denial in the data that was analyzed in Paper III (Swedish sample), it is a consistent predictor of SDO and empathy (e.g., Sidanius & Pratto, 1999). Thus, it could be investigated if the results of path analysis would change if gender is controlled for.

3. Before concluding what component of right-wing ideology better predicts denial, it should be further investigated whether *conservative political orientation* has a unique effect on denial. This is motivated because in one of the studies of the present thesis, political orientation indeed contributed to explaining some unique part of variance in denial (Study 1, Paper I). Also, in Paper III, which focuses specifically on denial of anthropogenic climate

change, the correlations between political orientation and denial (rs =.25 and .29) were somewhat weaker than in Paper I that focused on general climate change denial (i.e., 16-item scale: rs =.31 and .38). Thus, it would be of importance to test whether SDO fully or partially mediates the effect of political conservatism on general denial.

To address these research questions, I built on the path model presented in Paper II (see Figure 2) by including additional and/or alternative independent variables. Since the included variables can be expected to be intercorrelated, I investigated the above presented research questions by progressively testing three path models. Firstly, I extended the basic model by including measures for openness and anxiety avoidance as independent variables. After this, I tested a model where gender was controlled for. And finally, I tested a model including political conservatism instead of system justification. If some of the results change, this progressive testing procedure allows estimating which variable(s) cause it.

Method

I analyzed the data collected for Paper II (and Paper III: Swedish sample). This data included measures for climate change denial (see Appendix A), nature dominance (Dhont & Hodson, 2014; Dunlap et al., 2000), social dominance orientation (Ho et al., 2015), system justification (Kay & Jost, 2003), political liberal-conservative political orientation, empathy (Davis, 1980), domineering (Goldberg, 1999), openness (Ashton & Lee, 2009: M = 3.70, SD = .68), anxiety avoidance (see method section, M = 2.51, SD = .94), and gender.

Results and comments

As expected, climate change denial correlated negatively with openness and positively with anxiety avoidance (see Table 8). Openness correlated with all other ideological variables except nature dominance, and anxiety avoidance correlated with all ideological variables. Also, openness and anxiety avoidance correlated negatively with each other. Gender did not correlate significantly with denial, but it correlated with SDO, nature dominance, and empathy.

   To address the research questions, three path models were tested. Unlike in Paper II, I now placed system justification causally between personality variables and group-based dominance variables in order to gain as complete picture of the relations as possible. The basic model was otherwise the same

as the model presented in Paper II. The path models were tested using robust maximum likelihood (MLR) estimator in R package lavaan (Rosseel, 2012).

Table 8

Bivariate Correlations between the Variables in the Additional Analyses.

Variable	1	2	3	4	5	6	7	8	9
1. Climate change denial	-								
2. Nature dominance	.30*	-							
3. Social dominance	.37*	.22*	-						
4. System justification	.20*	.25*	.26*	-					
5. Political conservatism	.24*	-.02	.25*	.16*	-				
6. Domineering	.11†	.13†	.42*	.11†	.08	-			
7. Empathy	-.16*	-.17*	-.34*	-.03	-.05	-.24*	-		
8. Openness	-.21*	-.11	-.29*	-.15*	-.20*	-.13†	.18*	-	
9. Anxiety avoidance	.28*	.14*	.18*	.20*	.18*	.05	-.11	-.23*	-
10. Gender	.11†	.25*	.25*	.08	.06	.08	-.29*	-.06	.10

$*p < .05$ (two-tailed), † $p < .10$ (two-tailed).

In Model I (see Figure 4), openness and anxiety avoidance were added as independent variables, forming paths to climate change denial, SDO, nature dominance, and system justification. The other paths were included between variables if those paths were significant in the path model in Paper II, or if significant bivariate correlations were observed between them (see Table 8). Thus, all ideological variables (SDO, nature dominance, and system justification) formed paths to denial. All personality variables formed paths to SDO. Empathy, but not domineering, formed paths also to denial and nature dominance, but none of these two personality variables formed paths to system justification. SDO and nature dominance were allowed to correlate. Also personality variables were allowed to correlate with each other.
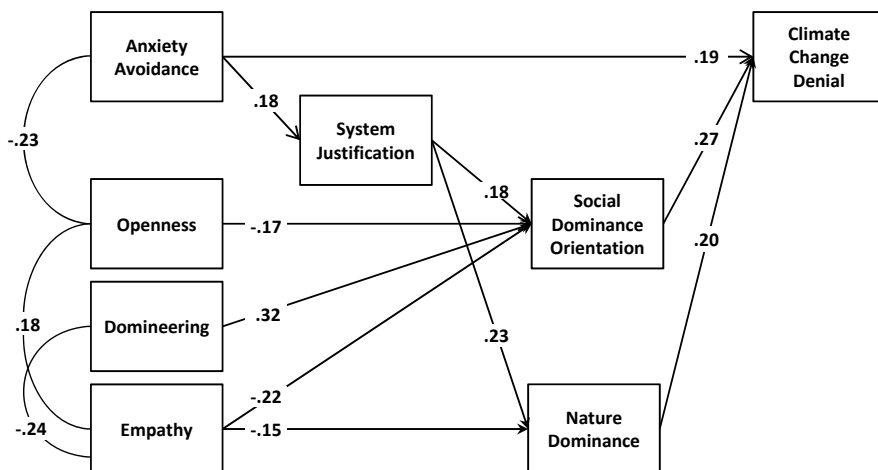
Figure 4. Standardized structural relations explaining climate change denial in Model I, additional analyses (only significant [$p< .05$] paths are depicted).

The model explained 23 % of the variance, and showed excellent fit to the data $\chi2(4) = 3.41$, $p = .49$, CFI = 1.00, RMSEA = .00, 90% CI [.00, .09], SRMR = .02. None of the paths that were reported in Paper II altered. As to anxiety avoidance, it formed significant paths to climate change denial and system justification, but not to SDO ($\beta = .06$, $p = .36$) or nature dominance ($\beta = .07$, $p = .35$). Further, openness formed significant path to SDO, but not to system justification ($\beta = -.11$, $p = .14$), nature dominance ($\beta = -.03$, $p = .67$), or denial ($\beta = -.06$, $p = .29$).

Before testing the Model 2, I removed the nonsignificant path from openness to nature dominance. However, I kept the other nonsignificant paths because significant relations were observed when testing the bivariate correlations (see Table 8). This modification improved slightly the model fit ($\chi2/df = .73$) when compared to Model 1 ($\chi2/df = .85$).

I then tested Model 2, where gender was included as an independent variable, forming paths to climate change denial, SDO, nature dominance, and system justification. Gender was allowed to correlate with all personality variables. Also this model explained 23 % of the variance, and showed excellent fit to the data, $\chi2(5) = 3.91$, $p = .56$, CFI = 1.00, RMSEA = .00, 90% CI [.00, .08], SRMR = .02. The paths from gender to denial ($\beta = -.04$, $p = .53$) and system justification ($\beta = .06$, $p = .35$) were nonsignificant, while the paths to SDO ($\beta = .15$, $p = .01$) and nature dominance ($\beta = .20$, $p = .005$) were significant. Importantly, all other paths were non-affected when gender was controlled for, except the path from empathy to nature dominance, which became nonsignificant ($\beta = -.10$, $p = .15$).

The goal of Model 3 (see Figure 5) was to test if an alternative operationalization of conservative ideology would change the results. More specifically, a model where conservative political orientation replaced system justification was tested. In the model, gender and all personality variables formed paths to all ideological variables (political conservatism, SDO, and nature dominance), which in their turn formed paths to denial. Also, political conservatism formed paths to SDO and nature dominance. Again, SDO and nature dominance as well as personality variables and gender were allowed to correlate. Finally, based on bivariate correlations and the results of Model I and II, paths were formed from empathy, openness, and anxiety avoidance to denial. This model explained 25% of the variance in denial, and showed excellent fit to the data, $\chi2(2) = 1.07$, $p = .59$, CFI = 1.00, RMSEA = .00, 90% CI [.00, .10], SRMR = .01. All paths from ideological variables, as well as the path from anxiety avoidance, to denial were significant. More specifically, political orientation and anxiety avoidance explained unique parts of denial above the effect of SDO and nature dominance. Also, all paths to SDO were significant, except the path from anxiety avoidance. Nature dominance was significantly predicted only by gender. Further, conservative political orientation was predicted only by low openness and anxiety avoidance, as expected based on the bivariate correlations.
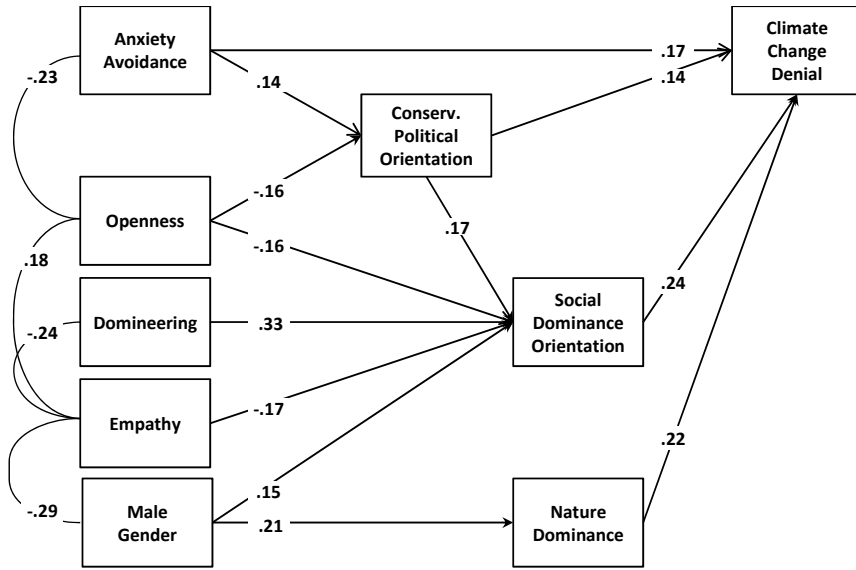
Figure 5. Standardized structural relations explaining climate change denial in Model 3, additional analyses where system justification replaced by conservative political orientation. (only significant [*p*< .05] paths are depicted).

General discussion

Anthropogenic (i.e., human-induced) climate change is a major challenge of our time. Despite widespread scientific evidence supporting climate change (e.g., Anderegg et al., 2010; IPCC, 2014), some individuals remain unconvinced that the climate is changing due to human action, or that these changes will have any serious consequences (e.g., Poortinga et al., 2011; Rahmstorf, 2004). It has been suggested that the tendency to doubt and deny climate change reflects ideological motivations rather than scientific reasoning. For example, much of the research that aims to dispute climate change is conducted outside of scientific communities and has links to right-wing political think thanks (e.g., Jacques et al., 2008). Also, a number of empirical studies have connected climate change denial to right-leaning sociopolitical ideology (e.g., Hornsey et al., 2016; McCright & Dunlap, 2011). Thus, although the reasons behind climate change denial may vary across individuals, political ideology seems to play a central role.

The objective of this thesis was to more systematically investigate the ideology-denial relation. To do so, the focus was on testing the unique effects of intercorrelated right-wing ideologies in explaining denial. By doing this, it could be estimated which component of right-wing ideology better explains denial: resistance to change, acceptance of inequality, or some more specific component, such as authoritarianism (e.g., Jost, Glaser, et al., 2003). In line with previous research (see e.g., Leone & Chirumbolo, 2008; Aspelund et al., 2013), acceptance of inequality was indexed in this thesis by measuring *social dominance orientation* (SDO: Pratto et al., 1994). As for change resistance, three ideological variables are considered to represent a general tendency towards resistance to change and protecting the status quo (note that they also capture specific psychological tendencies, as well as correlate with acceptance of prevalent inequalities/hierarchies). These variables are: right-wing/conservative *political orientation*, *right-wing authoritarianism* (RWA: Altemeyer, 1981; 1998), and *system justification* (Jost & Banaji, 1994).

Main findings

The *first aim* was to test whether political orientation, RWA, system justification, and SDO uniquely predict climate change denial. With this approach,

it could be estimated what component of right-leaning ideology best predicts climate change denial. The results of all studies included suggest that, instead of reflecting a general resistance to change of the status quo, denial seems to be better explained by acceptance of group-based hierarchies/inequality: SDO consistently outperformed the other ideological variables in predicting denial. Furthermore, the relation between SDO and denial was found to be stable when participants were shown a newscast that communicated supporting evidence for climate change (vs. control condition). Based on these results, the ideology-denial relation was studied further by mainly focusing on SDO.

The *second aim* was to investigate the psychological underpinnings of the ideology-denial relation, with a particular focus on SDO. To do this, SDO-denial relation was tested simultaneously with variables that have been previously linked either to sociopolitical ideology, or both to ideology and environmentalism. The findings showed that SDO fully mediated the effects of gender (being male), tough-minded and closed-minded personality (i.e., domineering, low empathy, and low openness), and system justification on denial. As for political conservatism, SDO fully mediated the effect on anthropogenic climate change denial, but only partly on general climate change denial (i.e., the full 16-item scale). Moreover, a predisposition to avoid experiencing anxiety predicted climate change denial both directly and through a link via conservative ideology (system justification or political conservatism) and acceptance of inequality (SDO and/or nature dominance). Finally, the effect of SDO was not explained by an endorsement of nature dominance, meaning that both social and nature dominance explained unique parts of the variation in denial.

Resistance to change, acceptance of inequality, or both?

This thesis consistently found that denial is more strongly and consistently predicted by SDO than by other ideological variables. Importantly, this does not need to imply that resistance to change would be irrelevant in the context of climate change. Rather, it still seems plausible that resistance to change is a central driving force behind the tendency to deny climate change. However, acceptance of inequality offers an important explanation for how some individuals may dismiss warnings about the dangers of climate change motivated solely by the desire to protect their current lifestyle. Supporting this suggestion, SDO mediated – at least partially – the effects of system justification and political conservatism on denial.

It should be noted that political orientation explained a unique part of variance in general (but not anthropogenic) climate change denial in two studies (study 1 in Paper I, and additional analyses). Thus, it seems that a conservative political orientation explains some variation beyond acceptance of inequality. Given the differences in results when testing the effect on general

vs. anthropogenic climate change, this question could be studied further by using more fine-tuned measures of both conservative ideology and climate change denial.

Further, some paths were found to differ in the full model when indexing resistance to change by either 'political conservatism' or 'system justification' (see additional analyses). Although political conservatism predicted denial directly, besides the indirect effect through SDO, system justification did not. When it comes to the personality underpinnings of the ideology-denial relation, system justification and conservatism functioned in part similarly, since they both mediated the effect of anxiety avoidance. However, political conservatism also mediated the effect of openness. The latter result seems more consistent with previous findings regarding the link between closed-mindedness and conservative ideology (Jost, Glaser, et al., 2003). Finally, system justification predicted denial through nature dominance, while political conservatism did not. It thus seems that political conservatism is more closely related to the justification of social forms of hierarchies, while system justification also captures the promotion of human-nature hierarchies. Together, these results provide further motivation for the suggestion above: the effect of general conservatism on denial needs to be studied further by using alternative and/or more fine-tuned indexes.

Social and nature dominance

Many people who would need to decrease their impact on the climate are not currently at risk of facing the most serious consequences. While climate change is primarily caused by the lifestyles of wealthier populations, the most serious consequences will be felt by disadvantaged populations, future generations, and non-human animals (e.g., Schlosberg, 2013; IPCC, 2014). From this perspective, it seems logical that an acceptance of the unequal distribution of risks and benefits across social groups and between humans and nature could enable individuals to reject the warnings about climate change and continue living as before.

Previous research has suggested that acceptance of group-based social hierarchies is related to the endorsement of human-nature hierarchies (Feygina, 2013; Milfont et al., 2013). Accordingly, Paper II found that endorsement of social and nature dominance are correlated. Since both of these variables explained unique portions of climate change denial, it seems that denial is not purely a measure for environmental views. Thus, it could be beneficial to consider climate change denial as a variable that captures social views as well (see also Jackson et al., 2013; Milfont & Sibley, 2014). This seems plausible, given that climate change is caused by humans and has various effects on humans.

Underlying individual differences

As found in Papers II and III, SDO and/or nature dominance mediate the effects of empathy, dominance (i.e., being domineering), and gender on denial. Again, these results can be interpreted by considering the uneven distribution of the risks and benefits of climate change. To begin with, low empathy could reduce concern for those facing the highest risks. Similarly, individuals, who are focused on maintaining or gaining high power positions might fear that they will not succeed if societal structures are changed in an effort to mitigate climate change. And finally, males tend to hold higher power positions in society and to be socialized to care less for other people and nature (Milfont & Sibley, 2016; Sidanius & Patto, 1999). In sum, it can be theorized that these predispositions reduce concern for the predicted victims of climate change, and thus enable individuals to continue insisting that more evidence for climate change is needed before admitting it and/or taking action.

The personality underpinnings that were addressed in additional analyses provide a deeper understanding of climate change denial. In line with previous studies (Milfont et al., 2015; Sibley et al., 2011), openness to experience predicted denial. Importantly, the results reported in this thesis suggest that this relation is mediated by SDO and political conservatism (but not by nature dominance or system justification). It is possible that individuals who score low in openness are less inclined to thinking about the consequences of a wealthy lifestyle for the climate.

Furthermore, a predisposition towards avoiding anxiety correlated with all ideological variables, which is consistent with findings showing that right-leaning individuals tend to express a higher preference for avoiding negative emotions (Jost, Glaser, et al., 2003; Leone & Chirumbolo, 2008). In addition, anxiety avoidance did not correlate with SDO or nature dominance in the full model, where the effects of system justification or political conservatism were controlled for. It thus seems that anxiety avoidance is more closely linked to general conservatism than acceptance of inequality. Importantly, anxiety avoidance also had a direct effect on denial. This suggests that some individuals, who are predisposed to managing anxiety by avoiding negative thoughts and emotions, are less inclined to admit to climate change regardless of their ideological views.

When it comes to the concept of nature dominance, certain important questions remain. For example, it is unclear why the personality underpinnings of social and nature dominance showed differences. In the full model (Paper II and additional analyses), SDO was predicted by gender and all personality variables except for anxiety avoidance. However, nature dominance was only predicted by empathy, and even this effect vanished when gender was controlled for. It is possible that, compared to social dominance, nature dominance is considered a more legitimate form of dominance in our

society, and is thus predicted by different personality variables. However, it is also plausible that the scale measuring nature dominance did not capture similar dimensions as the scale measuring SDO. Future studies could aim to examine whether different forms of nature dominance (e.g., dominance over nature *per se* or animals, or aggressive dominance vs. subtle justification of nature dominance) have differing personality and ideology underpinnings, and/or differing effects on climate change denial.

The concept of climate change denial

The mean levels of climate change denial were found to be rather low across the studies. Thus, it can be asked whether the higher scoring participants could be described as uncertain rather than denialists. On the other hand, the term 'denial' is not used in this thesis as a description of any specific psychological processes within particular individuals. Rather, it is considered a variable that captures the phenomenon in general. Accordingly, the aim was not to test belief vs. denial in a categorical sense, and the focus was on relative levels of denial. More research needs to be conducted if the aim is to differentiate between the forms of denial that reflect, for instance, skepticism, rationality, coping efforts, or actual belief in the issue.

When it comes to the level of actual belief, it can be asked whether denial reflects genuine misbelief in climate change or, for example, a lack of motivation to think about it. This question is particularly important when considering that one important reason for denying climate change seems to be inequality acceptance. More specifically, it is possible that people, who are not concerned about the fates of those who could face the most serious consequences, deny climate change in an effort to silence their own questions as well as potential discussions about the issue. Some research results could support at least partly this possibility. It has been found that climate change denial negatively correlates with support for climate change mitigation efforts, but positively with support for climate change adaptation (Sposato, Pidgeon, & Whitmarsh, 2015). It seems puzzling that individuals who do not believe in climate change may nonetheless express willingness to engage in adaptation. One explanation is that adaptation efforts do not necessitate similar changes to the status quo as mitigation efforts do, and hence, they can also be supported by individuals who are not motivated to change their lifestyle to address climate change (Sposato et al., 2015).

Strengths, limitations, and future directions

Methodological comments

Material

All of the studies included in this thesis employed self-report questionnaires to measure the variables. Self-reports provide a quick way to assess psychological variables, but they tend to involve some sources of error variance. For example, participants may interpret the questions differently, and have difficulties assessing their personality traits and attitudes objectively. Participants may also attempt to provide the most positive picture of themselves possible, both for the researchers and themselves, which could lead to deflated mean values in undesirable characteristics. Several of the scales used could be affected by this kind of social desirability effect. To give some examples, tendencies to express low empathy, accept inequality, and deny climate change could be seen as clashing with societal norms in Sweden. Nevertheless, we did observe variation in the scales, as well as the expected correlations, and it is thus likely that individual differences were captured successfully.

When it comes to the experimental manipulation in Paper I, some aspects should be considered. For instance, it can be asked whether the newscast provided an optimal way to alter climate change denial. The video was short (approx. 3 min.) and offered fairly general information about the topic. However, it included important messages about issues that are commonly denied in climate-related discourses (e.g., Rahmstorf, 2004). For example, it highlighted the human influence on climatic changes, as well as the seriousness of the effects. In addition, the manipulation can be suggested to have high ecological validity since the video was a real newscast originally shown on Swedish television. And indeed, the newscast did successfully alter levels of climate change denial, which supports the suitability of the manipulation. Future studies could aim to systematically test the effects of alternative sources of information (e.g., media, casual discussion with a peer, politician), formats (e.g., internet, television), as well as how qualitative aspects (e.g., threatening, hopeful) interact with ideological attitudes.

Online data collection

All of the studies were conducted on the internet. Internet studies are quick, inexpensive and easy to carry out, as the questionnaires can be sent out to many participants at once. A complete data file containing the results can also be downloaded by the researchers. Consequently, no data needs to be entered manually, making it fast to handle and analyze the data, and decreasing the risk of human error.

It is also more pleasant for participants to participate online, because they can decide themselves when and where to participate. However, this also

means researchers have little control over the circumstances in which participants respond to the items. For instance, it is impossible to know if participants have filled in questionnaires alone or in company, on their computer or on their mobile phone, at home or in a public space – to name just a few examples. Thus, some hidden influences may affect the answers. Nonetheless, empirical examinations assessing the potential differences between traditional and online studies suggest that results are comparable (e.g., Buhrmester, Kwang, & Gosling, 2011; Gosling, Vazire, Srivastava & John, 2004). In addition, the results reported in this thesis are consistent with previous research, which provides support for their validity.

Sampling issues

All of the samples were convenience samples recruited through announcements or face-to-face on streets. Thus, it is up for debate whether the results can be generalized to other populations. For example, many participants were students, mean age was rather low, and gender division was not balanced (i.e., more females participated). The results are in line with previous research, which supports their external validity, but they could nonetheless be replicated using nationally representative samples.

Results of statistical analyses

Mean values of denial and social dominance orientation

Related to the issue mentioned above regarding sampling, the mean values of climate change denial and SDO were low, and most participants were politically left-leaning. Due to this restriction of range, it is difficult to say whether the results would hold if the sample included more individuals reporting high levels of denial or SDO and/or leaning more to the right. This problem may be not be a serious one when it comes to correlational studies, as it could be claimed that the restriction of range weakens the results rather than alters them. It is likely that if the studies had been conducted using representative samples, the correlations would have been otherwise similar but stronger.

Perhaps a more concerning question is related to the results of the experimental study (Study 2, Paper I): it is possible that the condition by SDO interaction effect was non-significant due to the restriction of range. That is, perhaps we did not observe further ideological polarization on denial after receiving a climate-related message, reported in some other studies (Hart & Nisbet, 2012; Zhou, 2016), because our study only included a few participants who scored very high in SDO or denial. However, it should be pointed out that the results do not support the possibility of ideological polarization, since the trend indicated an opposite direction. The correlation between SDO and denial was weaker, rather than stronger, in the experimental condition.

Nevertheless, it would be interesting to know if the interaction term showing more decrease in denial among high-SDO individuals would have been significant if there had been more variance in the sample.

Explained variance

The explained variance in climate change denial can be argued to be low in all studies. However, this is not surprising given that several aspects tend to influence psychological outcomes. Indeed, relative to other research results in psychology, the results reported here cannot be described as weaker (see e.g., Richard, Bond, & Stokes-Zoota, 2003). For example, the relation between SDO and climate change denial ranged between .25 and .53 across the studies, which is a quite commonly found correlation strength in psychological research. Further, even smaller effect sizes can potentially have large and significant real-life effects in society (Greenwald, Banaji, & Nosek, 2015). It should also be noted that although much of the variance was left unexplained, the results were consistent, meaning that SDO outperformed the other independent variables in all included studies.

It is plausible that the explained variance was not higher due to error variance. One source for error variance could be that some of the variables included had underlying dimensions. For example, SDO includes two dimensions, and RWA includes three. In addition, the climate change denial scale measures different forms of denial, such as human influence and seriousness of the effects. Interestingly, in the results reported here, SDO correlated stronger with general climate change denial (Papers I and II, and additional analyses: rs =.35 - .52) than with anthropogenic climate change denial (Paper III: rs = .25 & .29). Thus, it is possible that SDO is related more strongly to some other forms of climate change denial than to denial of human influence. Future research could aim to test the ideology-denial relation by exploring the relations between the different dimensions of the variables.

Causal orders between the variables

The results reported here are discussed in causal terms – that is, it is suggested that gender and personality predict sociopolitical ideologies, which in turn predict climate change denial. The results support these causal orders in a statistical sense. However, the studies were cross-sectional, which makes it impossible to make strong claims about the real-life causations. Still, there is much evidence showing that gender and personality do indeed causally predict ideological attitudes (e.g., Ekehammar et al., 2004; Sidanius & Pratto, 1999, but see Sidanius et al., 2014 for evidence showing reciprocal relation). These causal orders are also supported by research results demonstrating that although both personality and ideology are moderately heritable (Bouchard, & Loehlin, 2001; Kandler et al., 2012), a substantial amount of the heritability in ideological attitudes can be explained by genetic variance in personality (Kandler et al., 2012). Hence, it seems that personality is developed earli-

er in life, which then predisposes individuals to perceiving certain ideological views as more appealing.

Finally, ideological worldviews and attitudes can be expected to guide individuals when they decide whether to place more trust in the dismissive or supporting evidence regarding climate change. There is no reason to expect that individuals would first adopt climate change denial, and as a result be attracted to right-leaning ideology. Nevertheless, longitudinal studies are needed in order to test these causal orders empirically.

Implications

Based on the findings of this thesis, certain climate-communication strategies could be designed. There is a need for such research, and a growing number of studies have indeed been aiming to test the possible effects of different kinds of communications. According to some studies, climate-related information creates a boomerang effect, meaning that ideological differences intensify in reaction to communications (Hart & Nisbet, 2012; Zhou, 2016). Some other research suggests that even those who tend to deny climate change can be reached if mitigation efforts are framed as being in line with conservative values (Feygina et al., 2010; Wolsko et al., 2016), or beneficial for everybody in society (e.g., emphasizing a more moral community: Bain et al., 2015). Yet some other lines of research suggest that framing does not have any important effect, at least in simple laboratory studies (Bernauer & McGrath, 2016). In fact, Bernauer and McGrath argue that rather than wasting a lot of time and resources on re-framing climate change, the focus should kept on emphasizing risk reduction, because the scientific community has been investing in that frame for a long time. In that case, however, more research needs to be conducted to investigate how risk-reduction frames are perceived by those who currently lack concern about climate-related risks: a tendency that is more common among right-leaning individuals (Häkkinen & Akrami, 2014; McCright & Dunlap, 2011). Perhaps it is time to start emphasizing the risks that also impact high-status groups (e.g., increased migration to wealthy northern countries).

An additional issue that needs to be considered comes from the interplay between ideological views and reaction to risks. For example, it has been suggested that one way of buffering threatening feelings is to adhere to authority figures and the status quo (Jost, Glaser, et al., 2003). Such reactions can be expected to increase as climate change progresses, for example due to decreased availability of resources (e.g., water) and increased migration and global displacement. Moreover, dog-eat-dog world perceptions, which correlate with SDO (Duckitt, 2001), may be strengthened since climate change is predicted to widen the gap between rich and poor and create new poverty traps (e.g., IPCC, 2014). In sum, climate change poses various health and

security threats. If these threats are not addressed properly, climate change is likely to strengthen the perceptions of the world as 'dangerous', which may increase authoritarian and system-justifying tendencies (see also Feygina et al., 2010; Fritsche et al., 2012). In addition, 'dog-eat-dog world' perceptions could elevate when competition for resources intensifies. Consequently, climate change could increase acceptance of the unequal distribution of climate-related risks, for example.

Concluding remarks

The aim of this thesis was to further investigate the relation between socio-political ideology and climate change denial. The results of the three papers and additional analyses showed that acceptance of group-based social and nature dominance outperform and/or mediate the effects of other relevant variables in explaining denial. Thus, endorsement of group-based hierarchies seems to explain, at least in part, why right-wing ideology, tough-minded and closed-minded personality, and male gender predict climate change denial.

It is important to note that a desire to maintain the status quo could be the driving force behind the refusal to admit climate change. However, given the mediation effects found, conservative ideology in itself does not seem to explain much – if at all – of the variance in denial above the effect of SDO. In other words, conservative and right-wing individuals do not seem to be inclined to deny climate change if they have not also adopted accepting attitudes regarding group-based inequality. Considering these results, it may be more fruitful to focus more on SDO and less on political orientation in future studies and public discourses.

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Appendix A

Climate change denial scale (Häkkinen & Akrami, 2014)

1. I do not find it to be obvious that the Earth's climate has warmed up during the last century.
2. I find it hard to believe that the earth's climate is really changing.
3. My opinion is that Earth's climate shows a pronounced increase in temperature. (R)
4. Climate change, as it is talked about today, is due to human activities, not natural variation. (R)
5. Warming of the climate on Earth is natural and not due to human influence.
6. The temperature on Earth varies naturally and human activity has nothing to do with this variation.
7. Climate change will affect the Earth negatively. (R)
8. Climate change will not affect the life on Earth in any significant way.
9. My opinion is that we will not even notice the effects of climate change.
10. The so-called "climate threat" is exaggerated.
11. The seriousness of climate change is exaggerated in the media.
12. A few degrees here or there in climate change don't do so much.
13. Many people underestimate the seriousness of climate change. (R)
14. I do not believe that scientists are in agreement on the issue of climate change.
15. I believe that there is enough scientific evidence to confirm the changes in Earth's climate. (R)
16. I think the evidence for climate change is far too weak.

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