

***Why Do People (Not) Worry About Climate Change?
Insights From Answers to an Open-Ended Survey
Question in Norway***

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Abstract

Human activity is causing changes to the earth's climate and nature that can severely threaten both human and non-human life. The extent to which we experience worry about this threat impacts our willingness to change our behavior and take the actions that are necessary to reduce the risk of climate change. This exploratory study aims to investigate why people worry to a different extent about climate change, and what their worries usually involve. Using an open-ended survey question, this study asked a representative sample of the Norwegian population ($N = 1690$) to elaborate on why they were more or less worried about climate change. The results revealed that the most common reasons for worrying about climate change were related to awareness and concern about possible harmful consequences, as well as barriers to preventing these consequences. More frequently mentioning consequences for humans further separated the most worried from the less worried. The most common reasons for *not* worrying about climate change were skepticism, faith in solutions, opposition to parts of the climate movement, and disengagement. These findings indicate there are multiple beliefs and motives among the public that can hinder emotional engagement in climate change, and future approaches seeking to increase this engagement should consider targeting these specific mindsets.

Keywords: climate change, worry, risk perception, open-ended question, Norway

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Sammendrag

Menneskelig aktivitet forårsaker forandringer i jordens klima og miljø som kan utgjøre en alvorlig trussel for både menneskelig og ikke-menneskelig liv. I hvilken grad vi bekymrer oss for denne trusselen påvirker hvor villige vi er til endre atferden vår, og utføre de tiltakene som er nødvendige for å redusere risikoen av klimaendringer. Denne eksplorative studien ønsker å undersøke hvorfor folk bekymrer seg i forskjellig grad for klimaendringer, og hva deres klimabekymringer involverer. Ved bruk av et åpent spørreundersøkelsesspørsmål ba denne studien et representativt utvalg av den norske befolkningen ($N = 1690$) å utdype hvorfor de er mer eller mindre bekymret for klimaendringer. Resultatene viste at de vanligste grunnene til å bekymre seg for klimaendringer var relatert til bevissthet rundt mulige skadelige konsekvenser av klimaendringer, samt utfordringer med å forhindre disse konsekvensene. Å oftere nevne mulige konsekvenser for mennesker var videre noe som skilte de mest bekymrede fra de mindre bekymrede. De vanligste grunnene til å *ikke* bekymre seg for klimaendringer var skeptisisme, tro på løsninger, motstand mot deler av klimabevegelsen, og mangel på følelsesmessig engasjement. Disse funnene tyder på at det er flere oppfatninger og motiver i befolkningen som kan forhindre engasjement for klimaendringer, og fremtidige metoder for å øke dette engasjementet burde forsøke å treffe disse bestemte tankesettene.

Nøkkelord: klima, bekymring, risikopersepsjon, åpne spørsmål, Norge

Acknowledgment

This thesis constitutes my contribution to the field of climate psychology and our collective understanding of people's experiences related to worry about climate change. This project was developed to put focus on the serious threat that our changing climate represents, and the high stakes at play for our planet and global community. I believe that truly understanding people's personal relations and feelings concerning climate change, without judgment, is an important first step to unifying the public against this challenge, and helping the people contribute to the best of their abilities in our mission to protect our planet.

I would like to thank my supervisors, Rouven Doran and Thea Gregersen, for helping me develop and carry out this project, as well as for sharing their knowledge, broadening my perspectives, and repeatedly directing me back on the right track throughout the process. I would also like to thank The Digital Social Science Core Facility for giving me the opportunity to realize this project by making it a part of the 22nd wave of the Norwegian Citizen Panel Survey. Further, I will also express my deepest gratitude to the Center for Climate and Energy Transformation for providing me with an office, and to all the wonderful affiliates for their generosity, support, advice, and positive environment during my time there. I will also give a special thanks to the coders, Andrea Roso Johansen and Marthe Larsen Øyerhamn, who tirelessly coded a vast number of responses into an extensive coding system; this project could not have been completed without you. Also, thanks to the participants who offered their thoughts and time for the purpose of climate change research. And not at least, a huge thank you to my supportive family, friends, and partner for their persistent and unconditional love and encouragement.

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Note. The data applied in the analysis of this publication are based on The Norwegian Citizen Panel wave 22, 2021. 'The survey was launched by the University of Bergen (UiB). 'The data are provided by UiB, prepared and made available by ideas2evidence, and distributed by Norwegian Centre for Research Data (NSD). Neither UiB, I2E, nor NSD are responsible for the analyses/interpretation of the data presented here.

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Why Do People (Not) Worry About Climate Change?

Insights From Answers to an Open-Ended Survey Question in Norway

The earth is heating up faster than at any other time in human history, threatening the basis of life for thousands of species, including humans. The sixth assessment report by the United Nations' Intergovernmental Panel on Climate Change (IPCC) states that the risk of not changing pathways to stop this global warming is severe (IPCC, 2022b). Human activities such as deforestation and emissions of greenhouse gasses are causing harmful changes to the earth's climate and nature, such as melting of the Arctic, rising sea levels, more common and severe incidents of extreme weather, and general weather change in all regions (IPCC, 2021). These changes will further threaten the living conditions of 3.5 billion people living in areas vulnerable to climate change (IPCC, 2022a). The report concludes that in order to reduce these negative impacts, we need to take on considerable lifestyle and societal changes (IPCC, 2022b).

The field of psychology studies human behavior and the related mental processes and contextual factors that determine this behavior. Facing this global climate crisis, psychology aims to understand how people perceive this risk, and what motivates or hinders them to take necessary action on climate change (Swim & Whitmarsh, 2018). Psychological research thus touches upon the fundamental question of “what is required in order to achieve such radical behavior change that is necessary to prevent severe climate change?”

One of our strongest motivators for behavior are *emotions*. Emotions are biological responses that give us immediate feedback on how we feel about a situation or stimulus, and whether we should approach it, avoid it, or take action to change it (Zeelenberg et al., 2008). Although there is no consensus on a definition, an emotion is often described as a spontaneous reaction to a stimulus that involves a subjective feeling, an evaluation of the stimulus, a biological response, and a motivation for behavior (e.g., Damasio, 1998; Zeelenberg et al., 2008). In a risk situation, this can typically involve feelings of fear or worry, an evaluation of the situation *as uncertain* and *dangerous*, biological responses such as increased heart rate, and a motivation for doing whatever behavior needed to reduce the risk. The negative emotions we experience when contemplating the risk of global climate change can therefore function as a driving force for climate-friendly behavior.

The emotion that people have reported experiencing most intensely in response to environmental risks such as climate change, is *worry* (Böhm, 2003). Worry about climate change, or *climate worry*, has been characterized as “*the worry, and accompanying stress,*

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associated with current and predicated damage, loss, and destruction from climate change” (Ojala et al., 2021, p. 37). Research finds that higher levels of climate worry is, in fact, linked to more climate-friendly behavior among the public (Bouman et al., 2020). These associations are found both for personal climate change mitigation behavior (such as using low-emitting means of transport, eating less meat, and saving energy at home) and support for climate change mitigation policies (such as increasing taxes on fossil fuels and using public money to subsidize renewable energy). Due to this discovery, people’s climate worry has become a focal point for much psychological research on the public’s climate change perceptions (van der Linden, 2017).

Still, while much research has investigated who worries about climate change, as well as how and when this worry changes our behavior (Weber, 2016), we know much less about what exactly people worry about (Besel et al., 2017). What aspects of climate change are the ones causing emotional distress? Furthermore, the degree to which people worry about climate change varies considerably among the public, and the reasons for this are not entirely known (van der Linden, 2017). Why do some people worry a lot about climate change, while others worry only a little, or not at all? Understanding which beliefs are linked to more or less emotional engagement in climate change has implications for how we choose to communicate this risk to the public to increase engagement, and whether different approaches are needed for targeting different groups of people. Furthermore, studying the public’s perceptions of their relation to climate change can reorient the research field toward laypeople’s subjective experiences, and help identify whether potential false assumptions of these experiences can explain previous discrepancies in literature.

The levels of climate worry in Norway are relatively average compared to other European countries (Gregersen et al., 2020). However, the Norwegian context in relation to climate change is fairly unique in multiple ways. On one hand, Norway is considered a leading country on climate change issues (e.g., CCPI, 2022). On the other hand, Norway is also a country that both profits off of oil and gas, and is estimated to be the most resilient country to climate change impacts (University of Notre Dame, 2022). These contrasts therefore make Norway an interesting case for studying the public’s relations to climate change, and it would be interesting to ascertain how public perceptions manifest in such a country.

In this thesis, I will study what a representative sample of the Norwegian population describes as the reasons they are or are not worried about climate change. By analyzing the responses given to two survey questions, I will examine the links between *how* worried about

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climate change the respondents are, and the reasoning they use to explain *why* this is. I will also measure whether the content of these reasonings tends to vary across gender, age, education level, and political orientation, which are variables that previously have been found to correlate with climate worry (Ivarsflaten et al., 2021). Altogether, these results will reveal more about what factors are linked to more or less emotional engagement in climate change, and the reasons why parts of the population have widely different perceptions and emotional reactions toward the same global risk. I aspire that this research will provide new insight on the public's relation to climate change and will contribute to the development of new approaches for increasing the public's emotional engagement in climate change, further stimulating for action much needed to tackle this urgent global crisis.

What Does It Mean to Be “Worried”?

The climate worry researcher Maria Ojala and her colleagues defines worry as “repetitive thinking about uncertain future negative events, accompanied by an anxiety-like negative affect” (2021, p. 38). Worry, thus, involves concern, but unlike concern, also involves feelings of distress, and is specifically oriented around potential future events. Ojala and colleagues further describe worry as a complex emotion, deriving from more basic emotions of anxiety or fear. Unlike anxiety and fear, however, worry has a stronger cognitive component, which facilitates analytic thinking and problem-solving.

Due to the close relation to anxiety and stress-like feelings, there have been raised concerns regarding the impact of climate worry on mental health (for review of the discussion, see Verplanken et al., 2020). Addressing this, it is important to emphasize that climate worry describes an adaptive and natural emotional response to a real and serious global threat, and not a pathological condition (Verplanken & Roy, 2013). Still, for some people, high levels of climate worry over longer periods of time might lead to dysfunctional stress and poorer well-being (McBride et al., 2021). People can be prone to these symptoms if they feel little hope or ability to contribute (Li & Monroe, 2019), or have poor coping mechanisms (Ojala, 2021). Nevertheless, worry about climate change is overall associated with less pathology than other types of worry (Verplanken & Roy, 2013). Verplanken et al. (2020) concludes that for most people, habitual worrying about climate change is constructive rather than unconstructive, and although it might involve certain negative emotions such as anxiety and anger, it also comes with positive experiences, such as feelings of determination, and pride related to having a “green” self-identity.

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The more *cognitive* aspects of worry include the processes involved with recognizing an “uncertain future negative event”, and estimating the overall seriousness of this scenario. This process is known as *risk perception* (van der Linden, 2017). A *risk* refers here to any potential future event that can involve something the perceiver considers *negative outcomes*, but also involves some sort of *uncertainty* around these outcomes (Aven & Renn, 2009). This uncertainty can apply to either *which* specific negative outcomes will occur, the *likelihood* of the negative outcomes, or the *timing and circumstances* of these outcomes. Many decisions we make in everyday life do therefore involve some degree of risk, whether it is snoozing the morning alarm, eating expired food, or not writing something down because you “are going to remember”. A risk judgment is furthermore a *subjective* judgment, which means that the perceived negative outcomes of an event, as well as the expected likelihood, timing, and circumstances of these, can be more or less accurate compared to the true conditions (Slovic, 1999). Measuring people's degree of worry is an often used construct to measure their perceived risk. I will therefore discuss the leading theories on how we mentally perceive risk, and what factors might influence our perception of the risk of climate change.

How Do We Estimate Risk?

Separating serious risks from unimportant ones is a complicated mental activity. This activity involves numerous parallel processes using available information to arrive at an approximate estimation of the risk in question (Slovic, 1999). Dual-process theories (e.g., Evans & Stanovich, 2013; Kahneman, 2003) postulates that we have *two* main systems (or modes) for information processing, which also apply to when we process information about risk. One of these systems is analysis-based and uses logical reasoning and previous knowledge to arrive at a conclusion. The other system is emotion-based and instead uses our instinctive emotional reactions as sources of information. The two systems do not mutually exclude one another, but complement each other, and may each be used to a varying extent depending on the demands of the situation. However, both systems can also be biased if our previous knowledge, emotional experiences, or other factors are misleading.

The analytic process of estimating risk has traditionally been described as the product of the estimated *severity* and *likelihood* of an outcome (Slovic, 1998). In other words, if an outcome has an insignificant severity (i.e., impact), or an insignificant likelihood (i.e., probability of occurring), it would not be considered a risk. Otherwise, we calculate risk by combining the two measures. For example, when we estimate the risk of getting skin cancer

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from tanning, we mentally combine an estimate of the *likelihood* of getting skin cancer with an estimate of how *severe* we consider this incident. The result of this risk judgment influences whether we decide to go tanning or not. These estimates are often based on previous experiences, available information, and existing knowledge, but can also be affected by additional factors such as our motivation, which will be further elaborated in later sections.

The emotion-based process of estimating risk involves depending on the initial emotions we experience when we are exposed to the risk, and the intensity of these. For example, our perceived risk of driving too fast is affected by whether we feel calm or scared while speeding. This theory is known as the *risk-as-feelings* hypothesis about risk perception (Loewenstein et al., 2001). The emotion-based system for perceiving risk is usually an efficient system, leading to fairly accurate estimations of risk in situations where we have little information available or need to produce a quick response. However, this system might also bias our perceptions by influencing our judgments even when we have more reliable information available. For example, even though we might know that the risk of traveling by airplane is virtually insignificant, we might still perceive it as dangerous if we experience high levels of anxiety while boarding the flight. Similarly, we might underestimate the risk of climate change if we do not feel worried or anxious while reading about it.

What Can Affect Our Risk Perception of Climate Change?

Climate change is a relatively unique risk compared to other risks we encounter daily. For example, climate change is a highly complex risk, having a multitude of causes, facets, and possible impacts. Furthermore, climate change is the consequences of billions of people's collective actions over time, and will likewise affect billions of people, but the consequences are not direct consequences of each person's actions. Additionally, in most countries climate change is a part of the public political discourse (Bostrom et al., 2018), making the climate crisis somewhat associated with political identities and values. Therefore, various factors have been identified as interfering with our risk perceptions of climate change, sometimes causing widely different perceptions of this risk among the public.

Mental Models

In order to create holistic understandings of our environment, we organize our knowledge about concepts into *mental models* (Bostrom, 2017). Bostrom et al. (2018) define

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mental models as “*the knowledge structures that an individual ‘runs’ or simulates to make inferences and to solve problems*” (p. 260). These structures thus help us store and sort information so that we can obtain comprehensive understandings of various concepts, as well as estimate implications of these concepts, such as the likelihood and severity of a risk (Bostrom, 2017). However, the information we base these models on is not necessarily accurate or representative of the true phenomenon. Especially when it comes to highly complex risks such as climate change, people can have fairly diverging mental models, and it is not uncommon that these are partially false. For example, studies have found that people have widely different mental models of the process of global warming, ranging from global warming caused by carbon emissions, to global warming as air pollution, global warming as ozone depletion, and global warming as weather change (Bostrom, 2017). Furthermore, although new information might lead us to restructure our mental models to fit the new information, we tend to be reluctant to do so, preferring our existing models to new ones (Bostrom, 2017). These diverging mental models can therefore lead to varying estimations of the related risk that climate change and global warming represent.

Motivated Reasoning

Another mechanism that might both assist and interfere with our estimations of risk is our conscious and subconscious motivations for which conclusions we want to arrive at. This is a phenomenon known as *motivated reasoning* or *motivated cognition* (Bayes & Druckman, 2021). Motivated reasoning affects which information, such as what arguments or evidence, we pay more or less attention to, when for example estimating a risk. One motivation we might have is *accuracy*, meaning that we are motivated to reach the most accurate conclusion. However, other motivations might be *directional*, where we are motivated to arrive at a predetermined conclusion. Reasoning so that our existing mental models are confirmed and our worldview is not disrupted, is one such directional motivation. Another directional motivation can be social consensus-seeking, which is the motivation to arrive at the same conclusion as others. These motivations can therefore influence what we eventually believe about a risk.

Directional motivation can furthermore cause *group polarization* when individuals are motivated to form perceptions that are consistent with the values of a certain group they identify with, known as *identity protection* (Kahan, 2015). These groups might be small, such as friend groups sharing particular values and interests, or it can be larger groups such as political and religious identities. Motivation for identity protection can lead people in a group

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to reject or deny information that does not coincide with the group's cultural values or involve implications that are not "popular" within the cultural worldview. For example, it can lead people to reject scientific facts regarding the urgency of climate change measures if these measures involve consequences that will negatively affect central aspects of their identity (such as car driving or maintaining a free market).

Psychological Distance

Another factor that can contribute to restraining our emotional reactions to climate change is the perceived distance that many of us experience between us and the expected consequences of climate change. This is known as *psychological distance* (Keller et al., 2022). In most Western societies it is common to expect the most severe impacts of climate change to occur a long time from now (temporal distance), in places far away (geographical distance), and to different people than ourselves (social distance). The bigger this temporal, geographical, or social distance is perceived, the less will our emotions be activated when faced with information about climate change. This perceived distance is therefore a common reason why many people feel only mildly worried about climate change (Keller et al., 2022).

Emotion Regulation

People can also intentionally use techniques to reduce the intensity of their anxiety about certain risks, known as *emotion regulation* (Koole, 2010). We can for example attempt to distract ourselves from the topic or change the ways in which we think about it. Also motivated reasoning can serve as an emotion regulation technique, because it eliminates the negative emotions involved with having beliefs that oppose the social consensus, our group identity, or other convictions (Westen et al., 2006). Using these techniques are often positive for the individual because it makes the risk awareness easier to deal with. However, they can also reduce our risk perceptions to levels that do not accurately represent the true risk (Koole, 2010).

The Influence of Socio-Demographics on Climate Worry

Research finds that the public's degree of climate worry varies systematically between certain social and demographic groups. Data from the spring of 2021 reveal that about 44% of the Norwegian population consider themselves either "worried" or "very worried" about climate change (Ivarsflaten et al., 2021). However, this rate is higher for generations born

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after 1990, as well as for women, people with higher education, and people who identify on the left side of the political spectrum (Ivarsflaten et al., 2021). Similar trends have also been found in other countries, and various explanations have been proposed for these effects. Some of these explanations include influence of cohort (Milfont et al., 2021), differences in affect (e.g., women having stronger emotional reactions than men; Sundblad et al., 2007), differences in knowledge about climate change risk (for gender: McCright, 2010; and for education: van der Linden, 2015), and identity protection causing political polarization (Kahan, 2015).

Furthermore, there are also reasons to believe that different *aspects* of climate change might be important for different social and demographic groups. For example, a study by Urban & Ščasný (2012) found that older generations were more concerned than younger generations about *environmental* issues, such as air pollution, natural resources depletion, and loss of biodiversity. This finding suggests that damage to and loss of nature might contribute more to older generations' climate worries than younger generations'. Moreover, research also indicates that different groups in society conceptualize climate and environmental problems differently (Song et al., 2020). Therefore, studying what different groups in society emphasize when they report their worry might disclose further differences in perceptions and conceptualizations of climate change than what the typical "how worried are you about climate change?" scale manages to pick up.

The Content of People's Climate Worries

Only a handful of studies have attempted to describe what factors people most commonly worry about in relation to climate change.

In the 2000s, Sundblad et al. (2007) reported that affective risk perception of climate change was significantly correlated with knowledge about possible health impacts of climate change, but not with knowledge of other impacts, such as on weather or on sea/glaciers. This particular influence of health concerns on climate worry is also in line with previous findings from Böhm and Pfister (2001). However, these studies were conducted more than 15 years ago, and today, the public's perceptions might be widely different.

A more recent study on this topic was conducted on Ecuadorian adults (Iniguez-Gallardo et al., 2021). This study investigated what emotions the participants most commonly felt in relation to climate change and prompted them to describe in their own words why they felt this emotion. The most commonly experienced emotion was, indeed,

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worry, and the most common topics mentioned when reasoning for this emotion were respectively: Future generations, weather changes, unfriendly behaviors (meaning people who are not willing to take action or responsibility to mitigate climate change), and health.

Another qualitative study on climate worry analyzed autobiographical texts (“life histories”) written by American university students about their experiences with climate change throughout life ($N = 66$; Besel et al., 2017). In this study, the researchers identified that the most common concerns were usually related to non-human life such as animal species and the environment, and more rarely related to humans.

In Norway, scant research has described the content of this population’s climate worries and concerns. However, Andersen (2022) has analyzed 303 Norwegian newspaper chronicles written by young people (aged 13-21) expressing fear and worry about the climate, and identified whom and what these youths were worried for. This study found that the most common objects for worry in these chronicles were: Humanity as a collective/future generations, themselves/their own future, ecological bodies (such as nature or animals), and the world’s poor. Andersen also studied the reasons why these youths were afraid, and found that most common reasons were their sources for knowledge about climate change (such as factual knowledge and sensory experience) and the barriers and challenges related to climate change (such as irreparable loss, lack of political action, and personal loss).

Research Needs

In sum, there is still a need for knowledge about what people’s climate worries usually involve due to scant and somewhat conflicting research findings on this subject. Data are needed from larger, preferably representative samples in order to obtain more reliable and comprehensive results. Additionally, the current risk of climate change, as well as the media’s coverage and the public perceptions of it, are constantly changing (Capstick et al., 2015). There is therefore a demand for constant up-to-date research on the current state of public climate change perceptions.

Public perceptions of climate change also vary substantially across countries (Mostafa, 2016), and a large majority of the studies on this subject originate from the United States. Furthermore, the US population generally deviates significantly not only from the populations of non-Western countries, but also from the populations of other Western countries (Henrich et al., 2010). This tendency is besides particularly salient for topics that are considered partially political—such as climate change—due to the distinct political context

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in the United States (e.g., high polarization and populism; Diamond, 2020). Data from other countries are therefore needed to determine country-specific trends, and assert generalizability of previous findings. Norway's position related to climate change is, as discussed, relatively unique, and studies from this population can therefore provide valuable knowledge of how public perceptions manifest in such a country. In addition to this, data from the Norwegian public is nevertheless of particular interest to Norwegian law-makers, businesses, organizations, and more, who depend on data specific to the Norwegian context.

Because the processes involved in human perception of climate change and risk are highly complex, for example related to a multitude of both cognitive, experiential, and socio-cultural factors (van der Linden, 2015), scholars have called for more qualitative research within the field of climate change perceptions (Whitmarsh, 2009) and risk judgment (Hawkes & Rowe, 2008). Qualitative designs are particularly suited to obtain comprehensive and detailed understandings of subjective experiences such as these (Hawkes & Rowe, 2008). These designs can also disclose limitations and biases in previous research caused by for example certain question framings or forced options. An effective way to achieve qualitative data is by using open-ended questions (Stoneman et al., 2013). These questions can also reduce the bias caused by forced-option questions by providing the participants the option to elaborate on their experiences and using their own words. By using this approach, new research can therefore generate rich and detailed data, which are better suited for seeing a fuller picture of people's experiences.

Lastly, studying the public's responses to open-ended questions can also reveal more about how the respondents personally understand the term "worry", and how they reason when prompted with this term. Research on climate change risk perception has suffered from an inconsistent use of conceptualizations, definitions, and operationalizations (van der Linden, 2017). For example, some studies have mainly focused on the cognitive aspects of risk perception, measuring cognitive judgments such as "perceived likelihood" and "perceived seriousness", whereas other studies have measured participants' self-rated concern, or personal worry. Even more approaches have been used to operationalize and quantify these concepts. This inconsistent use of constructs and operationalizations has led to challenges with knowing the isolated effects of worry compared to the effects of related constructs. Moreover, varying associations and interpretations of the term "worry", especially across different languages, can result in conceptualizations by researchers that do not coincide with the participants' own understandings of these terms. Therefore, designs that expand our knowledge of the public's relation to the term "worry" is needed.

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The Current Study

The current study aims to get a better understanding of the Norwegian population's worry about climate change, or lack thereof. It relies on survey-data from an open-ended question, which prompted the participants to elaborate on the reasons for their answer to a forced-option question that has been routinely used to measure degree of climate worry. The responses to the open-ended question were content analyzed using an atheoretical approach. Background data of the respondents were also collected in order to study the influence of socio-demography on the responses.

The study was guided by the following research questions:

1. What do people report as the reasons for their degree of worry about climate change?
2. Does the content of these responses depend on their...
 - a. expressed degree of worry about climate change?
 - b. gender?
 - c. age?
 - d. political orientation?
 - e. level of education?

By using an open-ended question, together with an atheoretical content analysis, the study achieves a highly exploratory approach. The aim of this thesis is therefore not to support or reject any theories, but rather to explore emerging patterns in the data, and discuss these in light of previous findings and current aims of the research field. Accordingly, no hypotheses were formulated. A preregistration of the study can be found on OSF (osf.io/7h9xe).

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Methods

Research Setting and Design

The survey questions for the current study were distributed as a part of the 22nd wave of the Norwegian Citizen Panel survey, a semiannual online survey measuring Norwegians' beliefs and opinions on social and political topics. After data collection, the text responses to the open-ended question were content analyzed following the outline for content analysis as presented by Bos & Tarnai (1999). Regressions and descriptive data were used to study associations between the response contents, degree of worry, and socio-demographic factors.

Sample and Recruitment

The present study sample was retrieved from the Norwegian Citizen Panel (NCP), an internet panel of respondents representing a cross-section of the Norwegian population above 18 years old. All members of the panel are current citizens of Norway, randomly selected from the National Population Registry of Norway. The members are cross-sectioned based on geography, gender, and birth year in order to achieve high representativeness of the Norwegian population. The recruitment was conducted by ideas2evidence through several rounds, the latest one carried out the same year as the current wave. For more information about the panel, see www.uib.no/en/digsscore/122111/norwegian-citizen-panel, and about the recruitment strategy and representativeness of the 22nd wave, see www.uib.no/en/digsscore/122162/methodology-and-field-periods.

Procedure

Data Collection

The survey was conducted in November 2021. A selected sample of NCP members received an invitation by email to complete the online questionnaire in exchange for the opportunity to win one of three travel gift cards (8000 NOK each). They participated on their personal internet devices using a personal user code. The questionnaire was fully in Norwegian, and administered through the software Conformat. The two survey questions for the current study were presented to a randomized subsample of the panel members participating in the current wave. Randomization was conducted digitally and automatically on each individual participant joining the questionnaire. The participants in the current

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subsample spent on average 19.2 minutes completing the questionnaire, and the current survey questions appeared approximately halfway through.

Measures

The two questions for the current study followed each other in the questionnaire. The initial closed-ended question aimed to measure the participants' self-rated degree of climate worry, while the follow-up open-ended question aimed to explore the reasons why. The open-ended question was designed so that the framing was contingent upon the response given to the first question. The precise question framings were therefore as followed (translated):

- First question (closed-ended): *How worried are you about climate change?*
Response options: *Not at all worried, not very worried, somewhat worried, worried, and very worried.*
- Follow-up question (open-ended): *You have answered that you are [response to question one] about climate change. What is the reason you are [response to question one]?*
Please write down the first that comes to mind. We want all types of answers, in a few sentences or keywords if that fits you better.

A new grouping variable based on the closed-ended question was also constructed for use in the content analysis specifically. Participants were sorted into three worry level groups based on their response to this question. The participants who responded “not at all worried” or “not very worried” were grouped as *low or no worry*, the participants who responded “somewhat worried” were grouped as *medium worry*, and the participants who responded “worried” and “very worried” were grouped as *high worry*.

Socio-demographic data were collected during recruitment. The current study used the following measures: Gender: *Male* or *female*; age (birth year): *1939 and earlier, 1940 to 1959, [...], or 1990 and later*; education: *No education/elementary school, upper secondary education, or university/university college*; and political orientation: *1 - left-wing to 10 - right-wing*.

The original, Norwegian formulations of all measures used in the current study are provided in Appendix A.

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Ethical Considerations

During recruitment, all participants were informed about voluntary participation, storage of data, and confidentiality of the research and gave their written consent. The participants were once again informed of this when taking the survey. All data were stored and analyzed in the University of Bergen's two-factor authentication solution "SAFE" until de-identified in order to obtain full privacy and confidentiality of the research data. The study is developed in consultation with the Norwegian Center for Research Data.

Content Analysis

The content analysis aimed to study patterns in the responses to the open-ended question. A coding scheme specific to the current dataset was first developed, and then independent coders sorted the responses into the predetermined categories by following the instructions of the coding scheme. In order to capture the nuances of responses with high specificity while also including the more general and unspecific responses, the coding scheme followed the same structure as the one presented by Böhm et al. (2018). This coding scheme structure comprises of one level of superordinate main categories, a second level of more specific subcategories, and a third level of the most specific categories for responses to fall into. For example, a response that mentions worry about climate change causing food shortages is sorted into the category called *consequences for living conditions*. This category is a subcategory of *consequences for humans*, which then is a subcategory of one of the main (superordinate) categories called *consequences*. Responses that belong to the high-specificity subordinate categories are automatically also sorted into the superordinate categories. On the other hand, responses that refer to unspecific topics, for example "*the possible consequences of climate change scares me*", are only sorted into a main category (here: *consequences*). If responses mention multiple topics, they are sorted into all relevant categories.

The coding scheme was developed in a bottom-up manner based on an initial screening of the responses. The categories were designed to capture the main essence of the intended message, regardless of wording or irrelevant (off-topic) information. The screening of the responses, as well as the coding of them, was conducted based on only the responses to the open-ended question, thus blinded to what variant of the open-ended question the participant had received. The final coding scheme consisted of 42 categories with six superordinate categories, plus a *remnant* category for responses that were considered not comprehensive or irrelevant to the question and therefore excluded from the study. Each

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category in the coding scheme included a description and an example response to aid coding, as well as a numeric code. The six superordinate categories were: (1) Causes, (2) Solutions, (3) Barriers, (4) Consequences, (5) Sources, and (6) Disengagement. The full coding scheme is provided in Appendix B.

The coding was then conducted by two coders who were unfamiliar with the study's aim. They first coded all responses separately based on the information provided in the coding scheme and an additional instruction sheet on practical matters. After the first round of coding, overlap was calculated (97%), and the two coders then recoded discrepancies through discussion.

Final Sample

Altogether, 2001 participants were presented with the first, closed-ended question. To this question, 12 people did not respond (a response rate of 99.4%). Of the 1989 people who then received the open-ended question, 287 people did not respond (a response rate of 85.6%). These non-responses resulted in a dropout rate of respectively 16.2% for the low or no worry group, 20.0% for the medium worry group, and 11.2% for the high worry group. A Kruskal-Wallis test with post-hoc pairwise comparisons indicated that these rates constitute a significantly lower dropout rate for the high worry group than the two other groups (respectively $p = .037$ compared to the low or no worry group, and $p < .001$ compared to the medium worry group). Moreover, 12 responses (six from low or no worry, five from medium worry, and one from high worry) were categorized in the remnant category and excluded from the final sample. The final sample therefore consisted of $N = 1690$ respondents (51.2% female) and had an overall dropout rate of 15.5% of the original participants completing the survey.

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Results

By studying the responses to the open-ended question, it appears that most of the participants responded sensibly and seriously to the questions. Each respondent wrote on average 20.8 words, and only 2.9% of the responses were placed only in superordinate categories for lacking specificity. These trends therefore imply that most responses had coherent and nuanced contents. Furthermore, a total of 42 categories and six main categories implies that there was also a considerable scope of the responses, revealing that the respondents had a variety of different reasons for their degree of worry.

Response Content by Worry Level

Studying further, we see that the three different worry level groups significantly predicted the topics mentioned in the text responses. A chi-square test for all six main response categories (displayed in Table 1) revealed that all main categories except *sources* were significantly influenced by worry level. This finding suggests that the closed-ended question has picked up a meaningful distinction between the respondents, and that people with different degrees of worry about climate change accounted for this in different manners. Descriptives of the six main categories (also displayed in Table 1) show how frequently each worry group mentioned these topics. Note that each response could mention more than one main category, and column sums will therefore exceed the total participants. I will study the trends behind these differences further by examining which subordinate categories emerged and how often each of the three worry groups mentioned these categories.

Table 1

Descriptives and Chi-Square Tests of the Six Main Response Categories by Worry Level

	Low or no worry		Medium worry		High worry		Total		χ^2	df	p
	N	%	N	%	N	%	N	%			
Causes	114	41 %	31	7 %	53	5 %	198	12 %	277	2	<.001
Solutions	85	31 %	43	10 %	54	5 %	182	11 %	143	2	<.001
Barriers	122	44 %	99	23 %	262	26 %	483	29 %	39.5	2	<.001
Consequences	59	21 %	344	82 %	858	87 %	1261	75 %	505	2	<.001
Sources	21	8 %	16	4 %	52	5 %	89	5 %	4.8	2	0.101
Disengagement	80	29 %	13	3 %	4	0 %	97	6 %	330	2	<.001
Total	278	100 %	422	100 %	990	100 %	1690	100 %			

Note. Percentages within columns.

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The full distribution of response categories by worry group is displayed in Table 2. Note that each response could mention more than one main category, and categories are sorted hierarchically by three levels of specificity. Furthermore, multiple categories were used by very few respondents, and the distributions are not assessed for significance. These results are therefore only for exploratory purposes, and the trends need to be confirmed by further research and confirmatory designs.

Table 2

Distribution of Response Categories Within each Worry Level

Codes		Category		Frequencies				
Label	Level 1	Level 2	Level 3	Low or no worry	Medium worry	High worry	Total (%)	Total (N)
1	1			41 %	7 %	5 %	12 %	198
			Causes					
11		11	Natural causes	39 %	3 %	0 %	7 %	121
12		12	Human causes	2 %	5 %	5 %	5 %	78
13		13	Other causes	1 %	0 %	0 %	0 %	4
2	2			31 %	10 %	5 %	11 %	182
			Solutions					
21		21	Natural solutions	4 %	1 %	0 %	1 %	13
22		22	Human solutions	22 %	9 %	5 %	9 %	148
221			221 Society	11 %	5 %	4 %	5 %	87
222			222 Technology	5 %	3 %	0 %	2 %	26
23		23	Human adaptation	8 %	1 %	0 %	2 %	28
24		23	Other solutions	0 %	0 %	0 %	0 %	1
3	3			44 %	23 %	26 %	29 %	483
			Barriers					
31		31	Natural barriers	12 %	1 %	2 %	3 %	54
32		32	Human barriers	14 %	14 %	20 %	18 %	298
321			321 Specific actors	8 %	5 %	9 %	8 %	130
33		33	Structural barriers	30 %	9 %	7 %	11 %	192
331			331 Economy	6 %	1 %	2 %	2 %	41
332			332 Overpopulation	1 %	1 %	1 %	1 %	19
333			333 Public discourse	19 %	4 %	1 %	5 %	82
334			334 Lack of influence	6 %	1 %	0 %	2 %	28
335			335 Other structural barriers	2 %	2 %	1 %	1 %	25
4	4			21 %	82 %	87 %	75 %	1261
			Consequences					
41		41	Consequences for nature	5 %	59 %	58 %	49 %	833
42		42	Consequences for humans	4 %	43 %	60 %	46 %	782
421			421 Living conditions	0 %	21 %	34 %	25 %	421

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422	422	Social structures	0 %	17 %	22 %	17 %	293
423	423	Future generations	1 %	11 %	21 %	15 %	255
424	424	Global inequality	3 %	5 %	8 %	6 %	107
425	425	Personal consequences	0 %	1 %	1 %	1 %	11
43	43	Lack of consequences	13 %	2 %	0 %	3 %	47
431	431	Lack of personal consequences	11 %	2 %	0 %	3 %	43
5	5	Sources	8 %	4 %	5 %	5 %	89
51	51	Media exposure	1 %	1 %	0 %	1 %	9
52	52	Scientific community	3 %	0 %	2 %	1 %	24
53	53	Personal experience	1 %	2 %	3 %	2 %	35
54	54	Other sources	3 %	0 %	1 %	1 %	14
6	6	Disengagement	29 %	3 %	0 %	6 %	97
61	61	Low worry about climate change	14 %	2 %	0 %	3 %	46
611	611	Due to a lack of emotional activation by the issue	3 %	0 %	0 %	1 %	9
612	612	Due to actively avoiding to engage with the issue	7 %	0 %	0 %	1 %	22
62	62	Low priority of climate change	6 %	1 %	0 %	1 %	23
63	63	Skepticism toward climate change	5 %	0 %	0 %	1 %	15
Total							1690

Note. Percentages within columns. Categories used by less than 0.5% of the total respondents are displayed in gray and not considered due to low power.

In general, the high worry and medium worry groups had more similar patterns in category use than the low or no worry group. These groups were in general heavily oriented around consequences of climate change, while the low or no worry group reflected a greater variance. I will assess the findings in detail by each worry level.

Low or No Worry

The least worried group has responded that they are either “not worried at all” or “not very worried” about climate change. Their responses to the open-ended question were diverse, involving various approaches to account for their lack of climate worry. I will present the response patterns in each of the six main categories.

The *causes* category was frequently mentioned by the low or no worry group, evidently due to the large portion of these responses referring to “natural” or non-human

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causes of climate change. One typical such response was “*the climate goes in cycles. Fluctuations are natural*” (all example responses are translated from Norwegian).

This group also had a considerable use of the category *solutions*. Within this category, the subcategory *human solutions* was most popular, which involved responses expressing that the climate crisis can or will be prevented through human effort. These responses might refer to measures taken by society (“*measures are implemented and there will be even more measures to slow down/turn around the development*”), or by new technology (“*I think skilled people will find good technical solutions to reduce emissions*”). Some people in this group also mentioned that humans will adapt to climate change (“*changes will happen and we will adapt*”), while a small number mentioned natural solutions to climate change (“*nature fixes most things by itself*”).

The category *barriers* involved responses reflecting a form of obstacle or problem related to climate change. This could be barriers to solving the climate crisis, or general challenges related to climate change and the climate change cause. The three worry groups used this category in somewhat different ways, alluding to different types of perceived issues related to climate change. The current group used it the most; as much as 44% of the low or no worry respondents mentioned some sort of barrier. Within this group, the respondents’ main focus was on *structural barriers*, such as “*the environment is a politically controlled issue instead of based on facts and research*” or “*you cannot worry about something you cannot do anything about*”. Barriers referring to the public discourse on climate change were also common, and words such as “*climate hysteria*” were mentioned frequently. One respondent wrote “*too much hysteria and publicity, too little facts and science are presented*”. Some respondents also mentioned human barriers, such as human behavior or political prioritization (“*I also do not think that the solutions that are presented today necessarily are that smart*”) and not rarely, specific actors such as countries were mentioned (“*the large countries like China and Russia are not even at the global climate conference*”).

In contrast to the other groups, the low or no worry group used the category *consequences* in low frequency. Furthermore, this group’s use of the category was dominated by topics implying the *lack of* (severe or significant) consequences of climate change, mostly for themselves. “*The effects are far ahead - after my death, so the worry becomes low*”, writes one respondent in this group.

This group rarely mentioned *sources* for worry, similarly to the other worry groups. Of the eight percent of this group who did mention a source, referring to a scientific source, such as research findings or experts, was most common. These responses typically reflected a

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skepticism toward climate change, such as “*it has been both warmer and colder according to research*” or “*I know a few researchers who are skeptical*”. The other types of sources mentioned vary, and include a low frequency of mentioning the media, personal experience, and other sources.

The low or no worry group also frequently mentioned topics related to *disengagement*. Within this category, this group’s most common type of response was stating that their experienced feelings of worry were low. Of the respondents who specified further, some implied that they intentionally avoid worrying about climate change (“*I avoid worrying about things I can’t change. Worries can be health damaging!*”), while some fewer said that they have little ability to feel emotional activation (“*I am not a person who worries*”). Some respondents also expressed that they do care about the climate even though they do not worry: “*I try to do personal measures that can have a positive effect on the climate changes, but I do not worry. It is the word worry I responded to. It does not mean that I do not care*”. Moreover, a few in the *disengagement* category expressed a low priority of climate change. Of these, many emphasized the importance of other environmental or societal issues. One respondent wrote “*I am worried about the amount of plastic in the ocean and that we send our trash to Africa and Asia, more so than CO₂-emissions and global warming. I feel that the climate cause has the wrong focus*”. Lastly, only five percent of the low or no worry group (one percent of the total respondents) stated that they do not believe the climate is changing at all.

Medium Worry

The respondents in this group have reported that they are “somewhat worried” about climate change, the response option in the middle on the five-point scale. The use of categories in this group generally resembles that of the high worry group, by having a high focus on *consequences*, a moderate focus on *barriers*, and otherwise lower frequency of the remaining categories.

Seven percent of this group mentioned a cause of climate change. Among these responses, it was most common to mention either various human activities that were perceived as causing climate change (“*we pollute too much and the consumption is too great*”), or to remark an uncertainty about the cause (“*I am unsure about what is human caused and what is due to natural variations*”). Ten percent mentioned solutions to climate change, most typically human solutions, such as measures by society or new technology (“*I*

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am worried but hope that people will improve about their own influence on the environment, and that researchers will find solutions”).

This group was furthermore relatively conscious of barriers related to climate change, which was mentioned by 23% of the group. The specific barriers that was mentioned varied vastly among the respondents, including factors such as “*too little is done*”, “*Norway is just a drop in the ocean*”, “*false information - from both sides*”, “*the development goes too fast*”, “*there is a lot of uncertainty around this subject*”, “*I feel that the prioritization is wrong*”, and “*the countries that pollute the most are not contributing*”. Human barriers, such as human behavior or (political) prioritization was mentioned most frequently, followed by *structural barriers*, such as the global, economic, or societal conditions.

Most frequently, this group mentioned *consequences* of climate change. “*Because we are destroying the planet. Not only are we destroying our own basis of life, but we are also destroying the basis of life for other species*”, wrote one respondent. Another wrote “*[I am] worried about how this will affect my children and grand children. And the world in general.*” Altogether, the respondents addressed a wide range of consequences. In particular, various consequences for nature and the environment were mentioned frequently, typically in a summarizing manner (“*there may be more floods, the glaciers are melting. Much more extreme weather*”, “*increasing and more severe storms. Heating. Ice melting and ocean rising.*”). Consequences for humans and human life were mentioned somewhat less than consequences for nature, but were still commonly mentioned by the group.

A small minority of this group mentioned a particular *source* for their worries (“*I see a lot of extreme weather*”, “*all the information in the media*”). This group also mentioned *disengagement* to a low degree (“*I am not able to get sufficiently engaged*”).

High Worry

The high worry group has responded that they are either “worried” or “very worried” about climate change. In this group, few responses mentioned *causes* of climate change, and those who did, referred to human activity as the cause (“*we are destroying the planet with the consumption we have today.*”). A small minority also mentioned *solutions* to the climate crisis, and here, the main focus was on *human solutions*, especially measures and actions by society (“*we need to have faith that most people will change [their behavior], and through that, a change in politics*”) rather than by technology.

This group also focused to some degree (26%) on *barriers* related to climate change. In particular, they mentioned *human barriers*, such as human behavior or prioritization, as an

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obstacle to solving the climate crisis. One respondent wrote “*because we humans does way too little to become more sustainable*”. Almost half of these respondents also mentioned a particular actor, such as “*the rich are to blame*”, “*the most populated countries does not cooperate*”, or “*the politicians doesn't take the climate changes seriously enough*”. A few also mentioned *structural barriers* (“*Norway is 100% dependent on oil*”, “*we are too many people in the world*”).

Consequences was the overwhelmingly most used category within high worry. As much as 87% of these respondents accounted for their worry by describing consequences of climate change. *Consequences for nature* and *consequences for humans* were both mentioned with high frequency, in responses such as “[*I am*] *worried for my grand children's future*”, “*lack of food. Destruction of nature. Floods and drought crises*”, “*that there will be fights for resources globally*”, and “*nature and animals are dying. The fish is disappearing. Ice and glaciers are melting*”. Regarding consequences for humans, *living conditions* was the most common specification, then *social structures* and *future generations*, and to a smaller degree *global inequality*. Only one percent mentioned *personal consequences*.

Five percent of these respondents mentioned *sources* for their worries, and these comprised mainly of personal experiences (“*I believe that we are already seeing the effects of changes in climate*”) and scientific sources (“*I trust that the research is not wrong*”). *Disengagement* was mentioned by less than one percent of this group.

Socio-Demographic Differences

Before studying the influence of the participants' socio-demographic characteristics on their response contents, I first looked at how these characteristics predicted their degree of worry about climate change.

The Influence of Socio-Demographics on Degree of Worry

A correlation matrix displays how the four socio-demographic variables in the current study correlated with the five-level worry variable and with each other, see Table 3. These results show that worry correlated significantly with gender, education, and political orientation, and not with age. The correlations between worry and gender, and worry and education were small, while the correlation between worry and political orientation was medium (Cohen, 1988). Next, most of the socio-demographic variables also correlated significantly with each other, with small effect sizes.

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Table 3

Intercorrelations Between Socio-Demographic Variables and Worry

	N	1	2	3	4	5
1. Worry	1690	—				
2. Gender	1690	0.21***	—			
3. Age	1690	-0.02	-0.08***	—		
4. Education	1661	0.19***	0.08**	-0.04	—	
5. Political orientation	1429	-0.39***	-0.16***	0.11***	-0.11***	—

Note. Pairwise comparisons. ** $p < .01$, *** $p < .001$.

In order to control for these intercorrelations when predicting worry based on socio-demographics, I followed up with a multiple linear regression analysis. This model was assumption checked for collinearity, normality, autocorrelation, and heteroskedasticity, and these criteria were met. A significant regression equation was found, $F(4, 1402) = 79.1$, $p < .001$. The model explained 18.4% of the total variance in worry (R^2 , $R^2_{adj.} = .182$). Gender, education, and political orientation were significant predictors of worry, while age was not, see Table 4. Political orientation explained the most variance in worry, thus constituting the highest relative importance. Self-identifying on the left side on the political scale was linked to higher worry levels. Gender and education explained the second and third highest variance in the model, linking female gender and higher education to higher levels of worry.

Table 4

Multiple Regression Analysis Predicting Worry Level From Socio-Demographic Variables

Predictor	B	SE	t	p	b	95% CI	
						LL	UL
Intercept	3.13	0.18	17.11	< .001			
Gender	0.30	0.05	5.78	< .001	0.14	0.09	0.19
Age	0.02	0.02	1.29	0.196	0.03	-0.02	0.08
Education	0.26	0.05	5.52	< .001	0.13	0.09	0.18
Political orientation	-0.16	0.01	-14.03	< .001	-0.35	-0.39	-0.30

Note. B = Unstandardized regression coefficient; b = Standardized regression coefficient. SE = Standard Error. CI = confidence interval; LL = lower limit; UL = upper limit.

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The Influence of Socio-Demographics on Response Contents

To finally study whether socio-demographics influenced the response contents, six logistic regression analyses were performed to ascertain the effects of the variables gender, age, education, political orientation, and worry on the likelihood of mentioning each of the six main categories in the responses, see Table 5. This method assured that all inter-correlations between these variables would be controlled for. All six regression models were assumption checked for collinearity and independence of errors, and these criteria were met for all models.

Table 5

Binomial Logistic Regressions of Socio-Demographic Variables and Worry on The Six Main Response Categories

	B	SE	Z	p	OR	95% CI	
						LL	UL
Causes							
Intercept	1.14	0.66	1.72	0.085	3.13	0.86	11.43
Gender	-0.06	0.19	-0.31	0.758	0.94	0.65	1.37
Age	0.05	0.07	0.78	0.436	1.05	0.92	1.20
Education	-0.25	0.15	-1.59	0.112	0.78	0.58	1.06
Political orientation	0.05	0.04	1.16	0.245	1.05	0.97	1.14
Worry	-0.94	0.09	-9.93	< .001	0.39	0.33	0.47
Solutions							
Intercept	-0.69	0.68	-1.01	0.311	0.50	0.13	1.91
Gender	-0.28	0.19	-1.51	0.130	0.76	0.53	1.09
Age	0.08	0.07	1.26	0.208	1.09	0.96	1.24
Education	0.37	0.17	2.12	0.034	1.44	1.03	2.02
Political orientation	-0.02	0.04	-0.59	0.553	0.98	0.90	1.06
Worry	-0.68	0.09	-7.53	< .001	0.51	0.43	0.61
Barriers							
Intercept	0.66	0.47	1.42	0.157	1.94	0.78	4.84
Gender	-0.26	0.12	-2.09	0.037	0.77	0.61	0.98
Age	-0.13	0.04	-3.19	0.001	0.88	0.81	0.95
Education	0.06	0.11	0.56	0.579	1.06	0.86	1.32
Political orientation	0.00	0.03	0.17	0.862	1.01	0.95	1.06
Worry	-0.23	0.06	-3.65	< .001	0.80	0.71	0.90

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Consequences							
Intercept	-3.19	0.55	-5.81	< .001	0.04	0.01	0.12
Gender	0.36	0.14	2.51	0.012	1.44	1.08	1.91
Age	0.02	0.05	0.36	0.722	1.02	0.92	1.12
Education	0.04	0.13	0.28	0.782	1.04	0.81	1.33
Political orientation	0.00	0.03	-0.15	0.883	1.00	0.93	1.06
Worry	1.08	0.08	13.67	< .001	2.95	2.53	3.447
Sources							
Intercept	-2.63	0.93	-2.81	0.005	0.07	0.01	0.45
Gender	-0.07	0.25	-0.30	0.767	0.93	0.57	1.51
Age	-0.05	0.08	-0.65	0.517	0.95	0.81	1.11
Education	-0.18	0.21	-0.88	0.381	0.83	0.55	1.26
Political orientation	0.06	0.06	1.02	0.309	1.06	0.95	1.18
Worry	0.07	0.13	0.59	0.553	1.08	0.84	1.38
Disengagement							
Intercept	2.39	0.96	2.51	0.012	10.96	1.69	71.31
Gender	-0.04	0.29	-0.13	0.898	0.96	0.55	1.71
Age	-0.08	0.10	-0.85	0.393	0.92	0.77	1.11
Education	0.28	0.25	1.13	0.258	1.32	0.82	2.14
Political orientation	-0.08	0.06	-1.43	0.153	0.92	0.82	1.03
Worry	-1.82	0.17	-10.73	< .001	0.16	0.12	0.23

Note. B = Unstandardized regression coefficient. SE = Standard Error. OR = Odds Ratio. CI = confidence interval; LL = lower limit; UL = upper limit. Significant correlations in bold.

The logistic regression model for the *causes* category was statistically significant, $\chi^2(5) = 161$ $p < .001$. The model explained 21.2% (Nagelkerke R^2) of the variance in the use of this category. Worry was the only significant predictor, meaning that the variables gender, age, education, and political orientation do not affect the likelihood of using this category.

The logistic regression model for the category *solutions* was also statistically significant, $\chi^2(5) = 75.7$ $p < .001$. The model explained 10.5% (Nagelkerke R^2) of the variance in the use of this category. Worry and education were significant predictors, while gender, age, and political orientation were not. Specifically, increasing education was associated with a 1.44 times increase in the likelihood of using this category.

The logistic regression model for the category *barriers* was also statistically significant, $\chi^2(5) = 33.2$ $p < .001$. The model explained 3.5% (Nagelkerke R^2) of the variance in the use of this category. Worry, gender, and age were significant predictors, while

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education and political orientation were not. Specifically, male gender was associated with a 0.77 times increase in the likelihood of using this category, and younger age was associated with a 0.88 times increase in the likelihood of using the category.

The logistic regression model for the category *consequences* was also statistically significant, $\chi^2(5) = 311$ $p < .001$. The model explained 29.4% (Nagelkerke R^2) of the variance in the use of this category. Worry and gender were significant predictors, while age, education, and political orientation were not. Specifically, female gender was associated with a 1.44 times increase in the likelihood of using this category.

The logistic regression model for the category *sources* was *not* statistically significant, $\chi^2(5) = 2.23$ $p = .816$, meaning that neither worry level nor gender, age, education, and political orientation significantly influence the likelihood of using this category.

Lastly, the logistic regression model for the category *disengagement* was statistically significant, $\chi^2(5) = 203$ $p < .001$. The model explained 38.6% (Nagelkerke R^2) of the variance in the use of this category. Worry was the only significant predictor, meaning that the variables gender, age, education, and political orientation did not affect the likelihood of using this category.

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Discussion

These results found that the respondents typically brought up different topics for explaining their degree of climate worry depending on whether they were highly worried, medium worried, or not very worried. Their response trends were also somewhat influenced by socio-demographic background.

First, I will discuss the most salient response trends that emerged in each of the three worry groups and how these trends can give us insight to the reasons why people worry to a different extent about climate change.

Response Trends in the Low or No Worry Group

Skepticism

One recurring theme in the responses by the low or no worry group was skepticism toward certain scientific depictions of climate change. Many of the respondents expressed doubts regarding whether the climate changes are human-caused, and many also implied that climate change will not be as severe as scientifically portrayed (usually in categories such as *natural causes*, *solutions* or *sources*). That there were a significant number of these types of responses in the current sample is not surprising, considering that previous findings show that Norway generally has a high prevalence of climate change skeptics relative to other countries in Europe (NTB, 2022).

Skepticism toward climate change is generally separated into three distinct types (Rahmstorf, 2004). The types of skepticism that were most commonly observed in this group are known as *attribution skepticism* (skepticism on whether climate change is caused by human activity) and *impact skepticism* (skepticism on whether climate change will cause any significant damage). However, responses expressing the third type, known as *trend skepticism* (skepticism toward if the climate changes at all), was rare. That is, only five percent of this group, and one percent of the full sample, expressed denial of the existence of climate change. This observation aligns with previous research finding that less than one percent of the Norwegian population does not believe that the climate is changing at all (Gregersen, 2022).

The reason why impact skepticism is linked to low worry about climate change is clear; expecting impacts of an event to be highly unlikely or insignificant in severity results in a very low perception of risk, and gives therefore no reason to worry. However, it may be

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less obvious why having a different belief about the cause of climate change is linked to lower worry. Technically, the consequences of climate change can be just as brutal regardless of whether the causes are human-related or natural. Nevertheless, a series of studies by Siegrist and Sütterlin (2014) found that the perceived cause of an event can highly influence how serious we consider the impacts. Their studies found that participants perceived a forest fire as more severe when it was described as caused by a human (i.e., a person lighting a fire) than when it was described as caused by nature (i.e., a lightning strike), even though the described impact in both scenarios was the same. The authors further found that this difference was fully mediated by *affect*, meaning that the reason why the human-caused scenario was perceived as more severe was that it evoked more negative emotions than the nature-caused scenario. Similarly, the idea of human-caused climate change can evoke more negative emotions than the idea of nature-caused climate change, and will thus be experienced as more severe. This can help explain why the respondents who believed that climate change is natural cycles were less worried.

Nevertheless, the belief that climate changes are natural cycles contradicts the large scientific consensus on this matter (IPCC, 2021). Besides, climate change has been very prominent in the Norwegian media for many years (Weiberg-Aurdal, 2020), so there is little reason to believe that the climate skeptics in the current sample have not been exposed to information about the causes and impacts of climate change. Neither were there any responses expressing this lack of familiarity with the concept of climate change. Why, then, did some respondents still express views contradicting scientifically established facts on climate change?

The negative emotions that people experience when being confronted with human-caused damage might be a part of the explanation. Because human-caused climate change, as well as the negative impacts of climate change, can cause uncomfortable emotions, people can be directionally motivated to arrive at the conclusion that climate change is not a threat or is not human-caused. Therefore, due to this motivation, their internal reasoning will be biased toward bringing more attention to evidence suggesting that the climate changes are due to natural fluctuations (e.g., “*It has been both warmer and colder according to research*”), than to evidence suggesting that they are due to human activity (e.g., that the *average* global temperatures have increased since the beginning of the industrial revolution, (e.g., that the *average* global temperatures have increased since the beginning of the industrial revolution; IPCC, 2021).

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Furthermore, identity protection can also cause motivated reasoning effects. This is because the information that severe and human-caused climate change is occurring implies that human behavior, as well as political prioritization and strategies, needs to change. These implications can further be in conflict with certain cultural and political values. Previous studies on the Norwegian population confirm that climate skepticism is highly influenced by political party affiliation (Gregersen, 2022). For instance, only 28% of the people who voted for the most right-leaning party represented in the parliament (The Progress Party, FrP) believed that climate change was to a large extent caused by human influence.

Hence, motivated reasoning can help explain why a notable amount of the respondents who had little climate worry expressed beliefs opposing the scientific consensus. Similarly, this framework can also explain why trend skepticism was relatively rare in the responses: Because merely the fact that the climate is changing does not involve any negative implications as long as the severity and the cause of climate change is denied.

Conflicting Values With the Climate Movement

Perceived conflict between cultural and political values, and implications of climate change was furthermore also explicitly expressed in many of this group's responses (particularly in the *barrier* category, but also other categories such as *low prioritization*). These respondents typically criticize climate change activists, politicians, or political parties for their methods (e.g., rhetorics), agendas (e.g., ending the Norwegian oil production), or prioritizations (e.g., measures with only symbolic effect). These types of responses are clear examples of how conflicting values and opinions on a topic can interfere with the perception of risk. Again in line with the theory on identity protection (Kahan, 2015), the respondents who did not identify with the values of certain people or parties that promote climate change policies, may have been motivated to form risk perceptions that more easily coincide with their own values and worldviews. In this case, this involved low risk perceptions (and worry) about climate change.

Optimism

Another belief that was reflected in the low worry responses was a general optimism toward the prospects of climate change. Many in this group emphasized solutions to climate change, and expressed having faith in areas that could contribute to mitigating the impacts of climate change, such as research, technology, and global cooperation. Importantly, these are responses that do not necessarily downplay the intrinsic severity of climate change (such as

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impact skeptics do), but rather express hope, and focus on positive aspects of the climate change situation. The high presence of these optimistic responses in the least worried group touches upon the discussion within climate attitudes research of whether hope and optimism are mainly positive for our behavioral and emotional engagement in the climate cause or not. One study on this subject has found that although reading optimistic messages about climate change (e.g., about global progress in reducing carbon emissions) can reduce feelings of anxiety and distress, it can also reduce participants' perception of climate change risk (Hornsey & Fielding, 2016). This is in line with the current findings, linking hope and optimism to a low degree of worry about climate change.

One reason why hope and solution-focus is linked to lower perception of risk could be that focusing on hope and positive aspects of the climate crisis can function as a form of emotion regulation. Van Zomeren and colleagues (2019) have found that some people can use hope as an emotion-focused coping mechanism, serving the main function of reducing the negative emotions that are caused by an awareness of risk, while others can use hope as a motivation for behavioral engagement in order to cope with the risk, so-called problem-focused coping-mechanism. Nevertheless, the high prevalence of optimism among the low worried in this sample can imply that many of the respondents in this group mainly use this hope as an emotion-focused coping mechanism, thus reducing their feelings of worry about climate change.

Lack of Engagement

Another subset of the low or no worry group expressed disengagement. The respondents who specified further explained the reasons for this disengagement in a few different ways. Some wrote that they do not see a reason to worry, while others wrote that they do not want to worry, or that they rarely ever worry about anything. Some of these respondents who did not want to worry or rarely worries even explained that they do care, they just do not worry. Responses such as these suggest that certain respondents perceive a distinction between their amount of worry and other concepts regarding their interest in, or concern about, climate change. Van der Linden (2017) addressed this phenomenon in his *Hierarchy of Concern Model*. This model portrays personal feelings of worry as the most specific component of a broader hierarchy of attitudes and concern toward a risk. Van der Linden thus argues that one can be *concerned* (i.e., care) about climate change without experiencing the emotional state of worry. Likewise, one can also perceive climate change to be a *serious issue* without experiencing concern about it. Lastly, one can also perceive

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climate change as *likely to occur* without perceiving it as a serious issue. Thus, the hierarchy goes from the most general likelihood ratings about a risk at the bottom of the pyramid, to more specific perceptions of the seriousness of the risk, to more specific generalized concern about the risk, to the most specific personal feeling of worry about the risk at the very top. The respondents referring to *disengagement* might therefore be at somewhat different levels of the hierarchy, but they all refer specifically to the lack of personal feelings of worry, the emotional activation, as the main reason for their response to the closed-ended question.

So, what did these disengaged respondents reveal regarding the cause for their lack of emotional activation? Some respondents wrote they do not see a reason to worry. This can simply be explained by a low risk perception, most likely accompanied by skepticism toward climate change. Other respondents emphasized that worrying is negative and they therefore have a motivation to avoid worrying. As discussed, wanting to regulate negative emotions is a common motivation, and people can resolve to techniques to achieve this.

Lastly, some respondents expressed that they simply do not manage to feel emotionally engaged about climate change. One reason for this might be the perceived psychological distance between oneself and the impacts of climate change. As mentioned, Norway is considered highly resilient to the negative impacts of climate change compared to other countries (University of Notre Dame, 2022). Moreover, 11% of this low worry group also mentioned explicitly that the consequences of climate change are not likely to affect themselves. This psychological distance between oneself and the places, people, and times that climate change is expected to affect most gravely can contribute to why some people struggle to feel evoked by climate change.

Response Trends in the Medium Worry Group

Concern for Consequences

This group of respondents are primarily preoccupied with *consequences* of climate change. It is clear that most of these respondents are aware of various potential consequences of climate change, and find these consequences both severe and likely enough to constitute a significant risk and cause feelings of worry. Some of the respondents also mention additional circumstances influencing their worry level, including perceived barriers or challenges, faith in solutions, perceived uncertainty related to climate change, and more. Nevertheless, the rate that consequences are mentioned in reveals that the general consequences of climate change are essential to a large majority of the respondents. Because this group is already somewhat

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worried about climate change, and mentions few of the hindrances to engagement that the low or no worry group mentions, a central question regarding this group is why they are not *more* worried than “somewhat”. That is to say, what distinguishes these respondents from the more worried respondents? In general, the themes that this group focused on were highly similar to those mentioned by the high worry group. However, one difference is notable if we study *which* consequences the groups most commonly mention.

Concern for the Environment

For the medium worry group it is more common to mention consequences for nature, animals, and the environment than to mention consequences for humans. In contrast, the high worry group mentions consequences for humans and the environment equally often. This might suggest that for people in the medium worry group, the most common mental model of climate change is one that constitutes mainly an environmental threat, for instance associated with environmental changes and damage to ecosystems, animals, and the ocean. In contrast, for people in the high worry group, their mental models of climate change might be ones that also represent a catalyst for various threats to human living conditions and societal structures, such as food and water shortage, migration, health problems, and global conflict, which all were topics more commonly mentioned among the highly worried.

It may appear intuitive why perceiving climate change as mainly an environmental threat is associated with less worry than when it is perceived as a threat also to humans. First of all, a threat that is affecting only the environment has fewer impacts than a threat that is affecting both the environment and humans. Therefore, it will be perceived as less severe. Secondly, when the perceived victim of a threat is the environment instead of humans, this can constitute a social psychological distance, which limits the emotional reaction and engagement in the risk. Social psychological distance is perceived when the possible victims of a threat are seen as dissimilar to oneself. Manning et al. (2018) illustrated through experiments that non-human life such as animals and the environment do represent a social psychological distance, and our emotional reactions to consequences affecting these types of life are typically smaller than the reactions to consequences affecting humans. Therefore, the respondents who have models of climate change that mostly involve environmental consequences may experience more of this psychological distance.

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Response Trends in the High Worry Group

High Perception of Risk

The most worried group responded relatively homogeneously, generally describing negative prospects on climate change. The large emphasis was on consequences of climate change, while approximately one in four also mentioned barriers. Other categories were rarely used. In sum, it appears that the respondents generally responded by addressing the seriousness of the risk, given how the consequence responses usually emphasized the *severity* of climate change, and the barrier responses usually emphasized circumstances causing a high *likelihood* of the climate change consequences. Being aware of the high risk associated with climate change thus appears to be the key factor causing worry for these people.

Concern for Humans and the Environment

Looking closer at the specific consequences that the high worry group describe, we find that their expectations in general coincide well with the scientific community's predictions. Some of the consequences that this group mentioned frequently, which are also predicted by the IPCC, include environmental changes—such as ice melting and sea-level rise, more extreme weather, temperature changes, and extinction of species—and threats to humans, such as loss of food and water access in certain regions, land areas becoming uninhabitable forcing migration, and higher risk of global conflict (IPCC, 2022a). However, many of the respondents also mentioned environmental issues that are not necessarily related to climate change, such as littering, pollution, and ocean plastic. Therefore, although this group generally have mental models of climate change that include many accurate descriptions, their models are also influenced by current environmental issues.

Concern for Others Than Themselves

Interestingly, out of the numerous consequences mentioned by the highly worried, only one percent of them explicitly mentioned either how or that these consequences will affect themselves. Additionally, as much as 21% of them mentioned that they are worried for future generations, which implies that their worry is not mainly for themselves or their own generation, but for others. This finding illustrates that people are able to worry greatly even about risks that are not expected to significantly harm themselves. This point has also been made by Van Lange (2021), who presented three distinct climate change related concerns that individuals experience, which are not derived from material self-interest. These are: Concern

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with other humans (prosociality), concern with equality (egalitarianism), and concern with animals, and expressions of all of these concerns were apparent in this group's responses. Van Lange argues that all of these concerns can be pathways to care deeply about climate change even when it is not expected to primarily harm oneself.

Nevertheless, the scarce mentioning of personal consequences, even among the most worried, also raises the question of whether this sample displays an *optimism bias* toward climate change. The optimism bias describes the effect that future negative events are perceived as more likely to affect other people than oneself (e.g., O'Sullivan, 2015). This bias has previously been shown to affect people's perceptions of their own risk of being affected by climate change. For instance, people tend to expect that climate change is less likely to gravely affect their own country (Milfont et al., 2011) or town (Barros & Pinheiro, 2020) than other places. However, when it comes to the current sample, the respondents might also just be aware that Norway is expected to be highly resilient toward the consequences of climate change, and other societies are expected to be hit much more gravely. Therefore, it is not clear whether the current response patterns indicate an optimism bias or not.

What Factors Are Most Influential for Degree of Worry About Climate Change?

This analysis, which aimed to study what people report as the reasons for their degree of climate worry, gives us insight to which factors might be most essential for experiencing worry about climate change.

Firstly, the broad tendency to respond by describing certain facets of climate change, such as the perceived causes, specific impacts, and prospects, signifies that the respondents' mental models of climate change are highly important. This notion is further supported by finding that the respondents' characterizations of climate change are significantly different across the three groups. For example, in the low or no worry group, many respondents portrayed climate change as not very severe, solvable, or having natural causes. These portrayals are clearly different from those by the medium and highly worried, who instead portrayed climate change as severe and linked to a vast range of consequences. Also the distinction between the medium or high worry group can be linked to differences in depictions of climate change, by finding that the high worry group more often portrayed climate change as a threat to human lives than the medium worry group did.

Nevertheless, while characterizations of climate change took up most of the responses by the medium and high worry group, the low or no worried group also frequently addressed

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other factors than their models of climate change. One of these factors was the cultural and political implications of and associations with climate change. It therefore appears that the cultural and political setting of climate change is also an important factor for their personal worry. Lastly, an additional subset of the low worry group addressed the role of emotions. These respondents described various reasons for their lack of emotions, including both intentional effort to reduce emotions, disinterest in climate change, or a perceived lack of “ability” to feel worry.

The current findings therefore suggest that having a mental model of climate change that involves it representing a serious risk is necessary, but not sufficient, to induce worry. Climate change, and the implications of climate change, must also not be experienced as conflicting with personal values and identity. Furthermore, the individuals must also have a baseline of personal interest, willingness, and ability to feel worry about climate change in order to perceive themselves as worried.

What Do People Worry About?

The current results also offer insights into what Norwegians’ climate worries typically involve. Most broadly, we find that the respondents are mainly worried about the impacts of climate change on the environment and on humans. A tendency to more commonly worry for non-human life than human life, such as the American university students did in Besel et al. (2017)’s study, was in the current study found only among the responses who perceive themselves as somewhat worried about climate change, and not among the respondents who were even more worried. Health concerns, which were prominent in both Iniguez-Gallardo et al. (2021)’s study on Ecuadorian adults, and earlier studies (Böhm & Pfister, 2001; Sundblad et al., 2007) were not a prominent concern in the current sample. However, concerns regarding future generations and weather changes were prominent both in the current and the Ecuadorian sample. Moreover, the current sample rarely brought up consequences or worry regarding themselves and their own future, which was a common concern among the young Norwegian chronicle writers (Andersen, 2022). This indicates that the adult generations considered in the current sample might not share the same climate worries as generations who are even younger, and the chronicle writers might still be relatively alone in their feelings of worry and fear for their own future. Lastly, perceived barriers and challenges related to the climate change situation also contributed significantly to many of the current respondents’ worries, such as inadequate human behavior, and structural challenges to mitigating climate

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change. These were similar topics to the ones prominent in both the Norwegian chronicles, which included irreparable loss and lack of political action, and the last prominent topic by the Ecuadorian sample, namely “unfriendly behaviors”.

How Does Socio-Demography Influence the Reasons for (Not) Worrying?

Additional analyses studied the influence of gender, age, education, and political orientation on the response patterns. These results indicated that different groups in the society are indeed worried about somewhat different aspects of climate change. Multiple response content categories were predicted by gender, age, and education. Perhaps surprisingly, this study did not document an effect of political orientation on the response contents. However, this does not mean that people with different political orientations necessarily reason the same way regarding their climate worry, their differences could just not be detected with the current study design.

Insight from the content analysis on how the categories were typically used provide further understanding of what these socio-demographic trends in response patterns imply for how different groups in society reason about climate change. For example, knowing that the *causes* category was mainly dominated by people expressing skepticism on whether climate change is human-caused, one would might have expected this category to be predicted by lower education. This is because previous research on the Norwegian population has linked attribution skepticism to lower levels of education (Gregersen, 2022). In the current study, however, the statistical power on this category is unfortunately relatively low; only 198 responses in total were sorted in category. However, the variable *education* was indeed the closest to statistical significance of the socio-demographic variables, and displayed a trend in the direction linking higher use of this category to lower education. Therefore, this association might have been documented with a larger sample. Nevertheless, this is only speculation, and for the current study, no statistically significant association was documented.

There was, however, a significant association between the *solutions* category and higher education. Knowing that this category was mostly used to express optimism and faith in solutions to the climate crisis, and was most prominent for the respondents experiencing less worry, it appears that focus on solutions and hope is a particularly common reason for having low feelings of worry for the highly educated specifically. This also implies that for the lower educated with low feelings of worry, there are more often other reasons (such as skepticism?).

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The findings further reveal that perceived barriers related to climate change are more likely to influence younger generations' climate worry than older generations. This is in line with the findings from a recent study that mapped the climate anxiety of 10 000 young people (aged 16–25) from ten different countries (Hickman et al., 2021). The authors of this study concluded that “*climate anxiety and distress were correlated with perceived inadequate government response and associated feelings of betrayal.*” (p. 863). The current results therefore suggest that younger parts of the Norwegian population might also share these feelings.

In the current study, men were also more likely to mention barriers, while women were more likely to mention consequences. This trend may suggest that while women are more preoccupied with the impacts that climate change can have on the environment and people, men are more preoccupied with problematic *circumstances* of climate change, such as structural challenges, governmental responses, and human inadequacy.

Lastly, the lack of association with categories *sources* and *disengagement* is likely closely related to the low frequency of these topics and thus low statistical power.

Limitations

The current study has the advantage of providing the respondents the opportunity to elaborate on their specific degree of climate worry due to the design of the open-ended question. However, this design also requires special consideration to how to interpret the results. In particular, because the respondents received different question framings depending on their response to the closed-ended question, the responses in the three worry level groups can not be compared to each other as equal treatment conditions. Most essentially, the respondents in the low or no worry group received questions involving negations (“not” and “not very”, orig. “ikke” and “lite”), while the respondents in the more worried groups received questions without negation. These framings are therefore expected to cause the respondents in the low or no worry group to focus mainly on the factors restraining their worry, while medium and high worry groups focus mainly on the factors increasing their worry. This was, of course, intentional because this information is most interesting for the current study's purpose. However, it may also cause the high and medium worry respondents to appear more similar than they truly are. Furthermore, information that perhaps would be valuable for the current study might also not appear in the responses, such as which factors

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contribute most to restraining the worry for the medium worry group, causing them to not experience more climate worry than “somewhat”.

Another limitation of the current study is the high dropout rates among the respondents. These dropout rates ranged from one in nine respondents in the high worry group to one in six respondents for the low or no worry group, and one in five respondents for the medium worry group. Losing these participants causes the final sample to be less representative of the Norwegian population than intended, leading to less representative results. Furthermore, the significant variance in dropout rates among the worry groups also suggests that the dropout might vary systematically depending on the respondents' beliefs. A particular suspicion in this regard is that the respondents who dropped out might have been less interested in climate change than the respondents who chose to answer the open-ended question. This would mean that disengagement would be a more common reason for having medium and low or no worry than the current findings are able to depict.

Directions for Further Research

This research has been exploratory, aiming to study emerging patterns in the data instead of testing specific hypotheses. Further research is therefore necessary to validate the conclusions from this study. For this reason, future research is also recommended to use confirmatory designs, including the use of specific hypotheses testing and equal conditions for all respondents. Furthermore, future studies could also assess how different reasons for worrying are related to climate-related behavior by also including measures of personal climate mitigation behaviors and support for climate policies.

However, future studies could also use a similar design and apply it to new populations. For example, similar designs could be applied to nationally representative populations of other countries, because of the substantial variance in climate change perceptions between countries (van der Linden, 2015). Moreover, it could also be applied to the younger generation in Norway that were not considered in the current study. Children and adolescents is the age group that worries on average most about climate change (Vergunst & Berry, 2022) and are most likely to be personally affected by the impacts (IPCC, 2022a). Therefore, these people's worries could vary significantly from the worries of the current sample.

Future studies using qualitative designs could also add to the current findings by studying clusters in response contents, thus discovering which response topics are more and

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less likely to be mentioned together. Cluster analyses can provide insights to which of the factors influencing people's climate worry are more closely related, and whether there are indications of certain subgroups of mindsets consisting of compound reasonings within different worry groups.

Newer research furthermore suggests that studies might achieve a more nuanced and precise picture of people's climate worry by distinguishing between different dimensions of climate worry. For example, Leiserowitz and colleagues (2021) have identified that there are two crucial dimensions describing people's relation and response to climate change underlying the researchers' classification of different types of climate audiences in the American public (known as the "Six Americas"). The first dimension is people's *attitudinal valence* on climate change. That is, whether they accept or reject the scientific facts on climate change, such as that climate change is human-caused and poses a severe threat. The other dimension is their *issue engagement*, which is how interested and engaged they are in the topic of climate change. Trends in the current study also indicate that this might be a useful distinction. For instance, the respondents who reported having low or no worry varied substantially in their reasonings why: Some of them expressed a relatively high issue engagement combined with negative attitudinal value, for example by emphasizing disagreement with the scientific depictions and political handling of climate change. Others expressed a very low issue engagement, such as lack of interest and emotion, but not necessarily a negative attitudinal valence. Distinguishing between these two dimensions can therefore help to determine the respective role of *opinions* versus *interest* on the respondents' perceptions of their climate worry. This approach could further expand our understanding of what we are measuring with this term and whether we are in fact measuring different concepts in different parts of the population.

Implications and Conclusions

Although high climate worry does not necessarily mean that climate change has a high *priority* to the person, nor that they necessarily will change their behavior, we know that emotions such as worry are generally impactful on our inclination to act climate-friendly (e.g., Bouman et al., 2020; Brosch, 2021). Facilitating for genuine worry among the public about the state of the climate is therefore one of the measures that can contribute to people adapting more climate-friendly behavior, along with, for example, making this behavior more available for the citizens. The current findings can contribute as guidelines when developing

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such approaches by offering insights to which factors are generally most influential for people's climate worry, and how the relative importance of these factors varies among the population.

One such approach to increasing public awareness and worry about climate change is through communication about its risk and nature. Communication that aims to impact emotions has been shown to successfully promote sustainable behavior (for review, see Brosch, 2021). Efficient use of communication about climate change would therefore be beneficial for both public authorities seeking public support for climate change measures, but also for researchers, activists, teachers, the media, and others who wish to increase people's engagement in this issue. Although the current Norwegian sample appeared generally familiar with climate change, differences in how they conceptualized and weighed information about this concept in their mental models was highly influential for their levels of worry. Therefore, the current findings can provide a useful perspective on how climate change should be portrayed in communication in order to more efficiently impact the emotions of the audiences.

Firstly, the impacts of climate change and the severity of these should be thoroughly addressed. Special emphasis on the possible harmful impacts to humans could be particularly effective for activating emotions, especially because this is a concern that is still not prominent for some in the population, but a key object for concern for others. Emphasizing impacts to humans could contribute to reducing the perceived psychological distance between the perceiver and climate change impacts, thus more easily activating worry. Similarly, although expecting personal impacts of climate change is not necessary in order to worry, a lack of perceived personal relevance is for some people a reason for having low worry. Therefore, emphasizing "closer" consequences could generally be successful for increasing interest and worry about climate change.

Secondly, special attention to how progress on climate change is depicted, for example within technology, is also important for the audience's perception of the climate change risk. Too much emphasis on progress and solutions could lead to a reduced sense of severity of climate change. Therefore, progress should preferably be discussed only together with reminders that this progress is still not sufficient to prevent harmful impacts of climate change, and extensive effort is still required to mitigate the damage. Lastly, the current results also illustrated why perceiving climate change as human-caused is important, and that this perception is closely related to how severe people consider climate change. Although people may have specific motivations to perceive climate change this way, addressing the high

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scientific certainty that humans are the main cause of climate change is therefore an important message.

Research has furthermore suggested that climate communication can influence the public's perceptions even more effectively by varying and adjusting the communication to target specific values and motives (Bostrom et al., 2013). In the current study, the sample varied significantly in which values, motivations, and beliefs they addressed as important to their degree of worry, which implies that tailoring climate communication to target specific beliefs could be an effective approach also on the Norwegian population. For example, these findings suggest that some people might not be susceptible to negative portrayals of climate change because of an aversion for negative emotions, which leads to an effort to not pay attention to this information. Nevertheless, some of these respondents also revealed that worry is not necessary in order to *care* about climate change or do climate-friendly actions. Therefore, these people could perhaps instead be susceptible to climate communication that alludes to *positive* emotions, such as pride, to induce sustainable behavior. However, this would require more specific information about for whom these motives are most present. Nevertheless, the current findings suggest that targeting specific socio-demographic groups could give some of this benefit. For instance, emphasis on the devastating impacts of climate change can be more compelling to women, while men are more affected by an emphasis on contextual factors, such as barriers to preventing the impacts.

The significance of people's personal values and motives for their climate change beliefs also have implications for how to prioritize and frame climate measures when implementing these in the society. Explanations by the low worry respondents revealed that perceived conflict between implications of climate measures and their personal identity or values can cause people to have lower perceptions about the severity of climate change. This finding implies that political climate measures that are affecting matters important to certain identities and values can motivate people to oppose policies and worry less about climate change. Political climate mitigation strategies should therefore take into account how close certain matters are to people's identities, and aspire to, as much as reasonable, enforce measures that do not gravely affect important matters for people's identity. For example, in areas where driving a car is an important part of cultural identity, political strategies that promote switching to more electrical cars might be more successful than strategies aimed at restraining the opportunities for driving in general. Additionally, the framing of these strategies could also be influential, such as describing certain climate strategies as measures

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to *help* car drivers reduce their emissions instead of *penalties* to people having high carbon emissions from car driving.

Approaches that are carefully adapted to the public's beliefs and motives might therefore be effective for increasing worry about climate change. The current thesis has illustrated that particularly our beliefs regarding the causes, impacts, and prospects of climate change, as well as our motives related to emotions, values, and identity, are highly influential on our degree of climate worry. Developing approaches that can shift these beliefs as well as not trigger the motives that can reduce our worry can therefore encourage us to change our behavior and take the action necessary to reduce the risk of global climate change.

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Appendix A: Survey Questions in Original Language

Climate Worry Questions

Degree of Climate Worry (Closed-Ended)

Hvor bekymret er du for klimaendringer?

- Ikke bekymret i det hele tatt
- Lite bekymret
- Noe bekymret
- Bekymret
- Svært bekymret

Rationale for Degree of Climate Worry (Open-Ended)

Du har svart at du er [...] for klimaendringer. Hva er grunnen til at du er [...]?

Vennligst skriv ned det første du kommer på. Vi ønsker alle typer svar, gjerne et par setninger, eller bare noen få ord om det passer bedre for deg.

[]

Background Variables Questions

Age

Fødselsår

- 1939 eller tidligere
- 1940-1949
- 1950-1959
- 1960-1969
- 1970-1979
- 1980-1989
- 1990 eller senere

Gender

Kjønn

- Mann
- Kvinne

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Education Level

Høyeste fullførte utdanning

- Ingen utdanning/grunnskole
- Videregående skole
- Høgskole/Universitet

Political Orientation

I politikken snakker man ofte om “venstresiden” og “høyresiden”. Nedenfor er en skala der 0 representerer de som står helt til venstre politisk, og 10 representerer de som står helt til høyre politisk. Hvordan vil du plassere deg selv på en slik skala?

- 1 - Venstresiden
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 - Høyresiden

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Appendix B: Coding Scheme

Code / Level 1 2 3	Category	Description	Example(s) (paraphrased and translated from Norwegian)
1	Causes	The response mentions a presumed (main) cause of climate change. No further specification is mentioned.	<i>“No matter if we are sure whether the climate changes are human-caused or natural cycles, we can not take any chances of not doing anything”</i>
11	Natural causes	The response indicates that climate change is mainly caused by natural or non-human factors, and/or that human influence is marginal.	<i>“The climate goes in cycles. Fluctuations are natural”</i> <i>“There have always been climate changes, [it’s] a part of how the world works”</i> <i>“I think there is only a small part of it that is human-made”</i> <i>“We can not affect the climate like it is claimed. It is the sun that controls the climate.”</i>
12	Human causes	The response indicates any type of human activity as a (main) cause of that climate change.	<i>“We have destroyed this earth the last 70-80 years”</i> <i>“There is no doubt that a lot of it is human-caused”</i> <i>“We consume more than we need”</i> <i>“The use of coal instead of gas”</i>

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13	Other causes	The response indicates that responder is not sure about the main cause of climate change, or mentions a different, rarely mentioned cause of climate change.	<i>“Unsure if all of it is human-caused”</i>
2	Solutions	The response mentions a presumed solution to the climate crisis, or that the climate crisis can or will be solved. No further specification is mentioned.	<i>“I think it will be solved”</i> <i>“There is hope”</i>
21	Natural solutions	The response indicates that the climate crisis can be solved or avoided by forces of nature or natural mechanisms.	<i>“Nature fixes most things on its own”</i> <i>“I think [...] together with nature’s ability to adapt, will make the climate changes livable”</i> <i>“The climate changes do not happen that fast”</i>
22	Human solutions	The response indicates that the climate crisis can be solved or avoided by human effort. No further specification to how.	<i>“Have faith in us”</i> <i>“In Norway we will find solutions for the climate”</i> <i>“I have faith in human ingenuity”</i>
221	Society	The response indicates that the climate crisis can be solved or avoided through human measures and actions, such as public measures, global cooperation and/or actions by the general population.	<i>“Measures are taken and there will be more measures to slow down/turn around the trend”</i> <i>“I think it’s possible to achieve something if everyone does their part”</i>

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222	Technology	The response indicates that the climate crisis will be solved or avoided by new technology and research.	<p><i>“The development of technology will contribute to reduced climate changes”</i></p> <p><i>“The technology development solves to a big extent much of the emission problematics without any political involvement”</i></p>
23	Human adaptation	The response indicates that mankind will adapt to the climate changes and thus avoid the worst consequences.	<p><i>“I think humans and animals adapt to climate change”</i></p> <p><i>“I think we will get better at preparing ourselves and do necessary adaptations”</i></p>
24	Other solutions	The response indicates that the climate crisis will be solved or avoided by other factors.	<i>“I know that a world government appointed by our creator soon will take over the control of the earth and fix everything”</i>
3	Barriers	<p>The response mentions barriers or requirements to solve the climate crisis, or general challenges related to this climate change.</p> <p>No further specification is mentioned.</p>	<i>“That it gets increasingly difficult to turn around a development that is already going in the wrong direction”</i>
31	Natural barriers	The response indicates natural factors or lack of human control as a barrier related to the climate crisis.	<p><i>“I do not think humans can turn around the climate”</i></p> <p><i>“If it is true that we soon will reach a point where the heating of the earth becomes self-reinforcing, there is every reason to be</i></p>

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			<p><i>severely worried</i></p> <p><i>“Nevertheless there are enormous forces in nature itself that no one can control”</i></p> <p><i>“We can reach a point of no return”</i></p>
32	Human barriers	<p>The response indicates human factors, such as human behavior or prioritization as a barrier related to the climate crisis.</p> <p>No further specification, or people in general are to blame.</p>	<p><i>“People are too preoccupied with their own interests”</i></p> <p><i>“We are way too slow to take action and all improvement happens in snail speed”</i></p> <p><i>“I feel we prioritize wrong”</i></p> <p><i>“Everyone needs to contribute”</i></p>
321	Specific actors	<p>The response indicates factors by specific people, countries or other actors (such as insufficient action, lack of responsibility or wrong prioritization) as a barrier related to the climate crisis.</p>	<p><i>“As long as China and Russia isn’t in on it, it’s useless”</i></p> <p><i>“That the rich don’t understand that they are the problem”</i></p> <p><i>“Little will to action from politicians”</i></p> <p><i>“The world leaders don’t care”</i></p>
33	Structural barriers	<p>The response indicates structural factors in society as a barrier to solving the climate crisis, or an issue with the climate change cause itself.</p>	<p><i>“I think the systems we have now do not take the climate changes into account”</i></p>
331	Economy	<p>The response indicates economic factors or the economic system as a</p>	<p><i>“When climate is about money, then something is</i></p>

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		barrier related to the climate crisis.	<p><i>significantly wrong with it all!"</i></p> <p><i>"Capitalism's demand of eternal growth is not compatible with taking care of an earth with limited resources!"</i></p> <p><i>"Norway is 100% dependent on oil so the pollution will continue"</i></p>
332	Overpopulation	The response indicates overpopulation as a barrier related to the climate crisis.	<p><i>"The main reason for the problem is that the globe is overpopulated. One can not do much do about that"</i></p> <p><i>"We are too many people"</i></p>
333	Public discourse	The response indicates traits of the public discourse on climate change, such as false information, uncertainty, or the debate climate as a barrier related to the climate crisis.	<p><i>"Too much hysteria and publicity, too little facts and science is presented"</i></p> <p><i>"The polarization where one does not agree about the aims"</i></p> <p><i>"There is a lot of uncertainty around this topic which makes one somewhat worried"</i></p> <p><i>"I react to authoritarian tendencies in the community around The Green Party and activist groups"</i></p>
334	Lack of influence	The response indicates a too scant or negligible impact by oneself or	<i>"Norway is so small that what we do does not matter"</i>

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		one's country as a barrier related to the climate crisis.	<p><i>"Nothing I do will make a difference"</i></p> <p><i>"We are a drop in the ocean"</i></p>
335	Other structural barriers	The response indicates an different specific structural or societal barrier related to the climate crisis.	<i>"We do not have good enough recycling in our municipality"</i>
4	Consequences	<p>The response mentions consequences of climate change.</p> <p>No further specification is mentioned.</p>	<p><i>"Uncertainty about consequences"</i></p> <p><i>"Unforeseen consequences"</i></p>
41	Consequences for nature	The response indicates consequences of climate change for the environment, climate and weather conditions, and/or non-human life.	<p><i>"The reason is the large negative changes for nature and life that these [climate] changes bring along"</i></p> <p><i>"The [global] warming, thawing of permafrost and glaciers, pollution of the sea and atmosphere"</i></p> <p><i>"The climate changes"</i></p> <p><i>"I think the world will end if we don't do anything"</i></p>
42	Consequences for humans	The response indicates consequences of climate change for humans.	<i>"The climate changes will have severe consequences for everybody"</i>
421	Living conditions	The response indicates consequences of climate change for human living	<i>"I think the earth can be a difficult planet to live on within few"</i>

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		conditions.	<p><i>decades”</i></p> <p><i>“The degree to which climate changes will affect the public health”</i></p> <p><i>“I picture a future with less access to food and water”</i></p> <p><i>“If we keep ignoring the climate changes as much as we do now, mankind will go extinct”</i></p>
422	Social structures	The response indicates consequences of climate change for societal factors, including societal collapse.	<p><i>“I assume that the welfare state will collapse, and the social consequences of that are exclusively negative”</i></p> <p><i>“Unmanageable migrations of people”</i></p> <p><i>“The [social] differences will increase”</i></p> <p><i>“Chaos and war may be the result”</i></p>
423	Future generations	The response indicates consequences of climate change for the responder’s descendants or future generations.	<p><i>“What kind of life future generations will have”</i></p> <p><i>“I am worried about the future of all my grandchildren”</i></p>
424	Global inequality	The response indicates consequences of climate change for certain groups, countries or people.	<i>“Primarily I am worried about people in other countries (e.g. parts of Africa are going to struggle severely if it gets warmer)”</i>

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			<p><i>“Affects very many poor people in poor countries”</i></p> <p><i>“Island societies will disappear”</i></p>
425	Personal consequences	The response indicates negative consequences of climate change that will personally affect the responder.	<p><i>“I work within oil and gas. I’m scared of losing my job”</i></p> <p><i>“I will not get the opportunity to enjoy life at all like my parents and grandparents had”</i></p>
43	Lack of consequences	The response indicates a lack of consequences and/or severity of climate change. This may include indications that consequences are marginal, unlikely, not (sufficiently) proven, nonexistent or not negative.	<p><i>“Because it takes a very long time before we notice the changes”</i></p> <p><i>“I trust that technology and society (in Norway and globally) will be able to [...] make use of the positive effects of a somewhat warmer climate”</i></p> <p><i>“Doomsday prophecies rarely happen”</i></p> <p><i>“With the existing measure and prognosis methods we unfortunately do not have the possibility to predict how climate changes will affect neither us or others in the world”</i></p>
431	Lack of personal consequences	The response indicates that there will be a lack of severe or negative consequences of climate change for the	<i>“I am so old that the worst scenario probably will not happen while I am alive”</i>

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		responder personally.	<i>“I live in a cold climate, and there have been fluctuations before also”</i>
5	Sources	The response indicates that their climate worry (or lack thereof) comes from a specific source. No further specification is mentioned.	<i>“I can read”</i> <i>“Information from serious grounds gives reason for worry”</i>
51	Media exposure	The response indicates the media as a source for climate worry.	<i>“When I watch news and other programs”</i> <i>“There is a lot in the media about the climate crisis”</i>
52	Scientific community	The response indicates research findings, researchers or “experts” as a source for climate worry.	<i>“I have faith in research”</i> <i>“I know a few researchers who are skeptical [toward climate change]”</i>
53	Personal experience	The response indicates personal experience with or observations of climate change as a source for climate worry.	<i>“I have seen how it has been this year with high summer temperatures, drought and brown-burnt lawns, and now with record rainfall”</i> <i>“Already seeing the extreme weather”</i>
54	Other sources	The response indicates an different specific source for climate worry.	<i>“I was at a lecture 18 years ago where [...]”</i> <i>“I have read books with real scare images about how bad it may go”</i>
6	Disengagement	The response indicates disengagement from the	<i>“I do not manage to get sufficiently</i>

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		issue of climate change.	<p><i>engaged</i></p> <p><i>“what happens happens”</i></p> <p><i>“Not relevant for me”</i></p> <p><i>“Do not know enough”</i></p>
61	Low worry about climate change	<p>The response indicates that the responder does not worry.</p> <p>No further specification is mentioned.</p>	<p><i>“It’s not something I go around and worry about”</i></p> <p><i>“I generally worry little about things”</i></p>
611	Due to a lack of emotional activation by the issue	The response indicates that the responder does not worry due to no or little emotional activation by climate change, although the responder might care cognitively about climate change.	<p><i>“I’m by nature not anxious”</i></p> <p><i>“I care, but I do not worry”</i></p>
612	Due to actively avoiding to engage with the issue	This response indicates that the responder does not worry due to intentionally avoiding to worry. Reasons may include concern for negative effects of worrying or no anticipated positive effects.	<p><i>“Worry would be negative for me”</i></p> <p><i>“Worrying does not help”</i></p> <p><i>“Worry is very health damaging!”</i></p> <p><i>“[...] but I CHOOSE to not worry too much”</i></p>
62	Low priority of climate change	This response indicates a larger interest for or higher prioritization of other subjects than climate change. This may include other environmental issues.	<p><i>“The reason [...] is that the big environmental crisis we have found ourselves in for a long time worries me far more”</i></p> <p><i>“I am more worried about pollution in</i></p>

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			<p><i>seas and rivers, as well as destruction of nature and fauna as a result of the wind turbine expansion”</i></p> <p><i>“We should focus on topics like why are there so many people who leave each other and that more and more children grow up with divorced parents or alone with their mother”</i></p>
63	Skepticism toward climate change	The response indicates that the climate does not change.	<p><i>“[There are] no significant findings in temperature differences when these are measured over time”</i></p> <p><i>“There is no evidence of climate changes”</i></p>
7	Remnant (excluded)	The response could not be assigned to one of the above-mentioned categories. This included responses that were either empty or random.	<p><i>“Q”</i></p> <p><i>“...”</i></p> <p><i>“ “</i></p>
71	No elaboration	The response indicates that the responder does not want to or know how to elaborate.	<p><i>“Hard to answer exactly!”</i></p> <p><i>“No comments”</i></p> <p><i>“No special reason”</i></p>
72	Non-codable response	The true meaning of the response is unclear or does not fit any of the other categories.	<p><i>“We have a father in Heaven who has the big overview. The end is perhaps not far away”</i></p>