Climate change perception: driving forces and their interactions

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Abstract

Public perception of climate change can either facilitate or hinder the implementation of climate policies. This perception is dependent on a number of influencing factors, called drivers, in ways that are still not clearly understood. Our study quantifies the relative strength of drivers of climate change perception, taking into account differences in the social, political, geographical, economic and educational identities of any considered community. In addition to investigating the direct influence of the main drivers on climate change perception, we particularly examine the interactions among drivers, identifying in this way indirect pathways of influence. We find that perceptions are directly influenced by the share of principles and ideals within a community and by the physical experience of weather change. Indirect influences are found to be related to the level of development of a community, to its level of social interaction (i.e. individualistic vs. communitarian), and to the spread of climate change information. A deeper understanding of interactions among drivers should prove especially useful for the design of effective climate change mitigation and adaptation measures.

Keywords: climate change; perception; community; driver; influence; interaction

1. Introduction

Putting climate policies into practice is often a great a challenge, due to the poor understanding of the different socio-economic and cultural impacts they may cause (Goldberg et al., 2019; ELD Initiative, 2015). Thus, a better knowledge of the ways different socio-cultural groups perceive climate change is crucial for the effective implementation of climate polices (Tesfahunegn, 2018).

Despite the growing impetus of governments worldwide to implement local and regional measures aimed at addressing climate change (IPCC, 2018), current understanding of what drives Climate Change Perception (CCP) remains modest. Among other reasons, the literature on this topic is generally underpinned by different methodologies, uses different criteria and terminologies, and focuses on distinct time frames and geographical locations (Howe et al., 2015; Kahan et al., 2012). Therefore, identifying drivers of CCP and quantifying their importance is in itself a difficult endeavour. In addition, the drivers can also interact with each other, leading to

more complex pathways of influence (Shi et al., 2016). However, to our knowledge, no study has reviewed these potential interactions.

In this context, it is the objective of this study to expose how interactions among drivers of CCP ultimately affect CCPs. To meet this objective, we first identify and expose a comprehensive array of CCP driving mechanisms obtained from a literature search that covers a wide array of research methods, scales, locations and communities. Following this, we quantify the drivers' strength in influencing CCP by counting the number of occurrences found in the reviewed literature. More importantly, and in the same way, we also identify and count interactions among drivers themselves. The resulting network of driver interactions is assessed and visualised. Finally, the direct influence of drivers on CCP is compared to their connectivity among each other, in order to answer the question: are drivers with high influence on CCP also well connected to other drivers?

Identifying a comprehensive array of CCP drivers and their pathways of action, should be useful for decision-makers to formulate more effective policies. This study may also assist in addressing the gap between policy-makers and the public, as the provided CCP drivers are context-independent and allow for generalization.

2. Materials and Methods

2.1. Systematic literature review

The starting point of this work was a literature search on the educational, cultural, and political variables that determine climate change opinion at the community level. Although some of the collected studies were originally performed at the level of individuals, we have treated their outcomes on the community level, with the aim of providing results relevant to policy makers and to the understanding of community needs. For this compilation, we executed a search in the Web of Science database using the search term: "climate change opinion". The review revealed the term "opinion" with a variety of meanings, most often as a synonym to perception or awareness. For consistency purposes, we decided to adopt the term "perception" as a metonym for opinion, awareness and related terms. Therefore, we here define Climate Change Perception as a state of opinion and awareness of anthropogenic climate change, with anthropogenic climate change being defined as a persistent direct and indirect change added to the natural climate variability, largely attributed to carbon dioxide emissions.

We imposed no temporal, geographic, or methodological restrictions. Therefore, national and international data, peer-reviewed and grey literature, quantitative and qualitative studies were all considered (Figure 1). We selected studies in three stages. We conducted a first selection of 300 articles out of 2,214 titles with the condition that the terms "climate change" or "global warming" appeared in the title. In the second stage, we screened the abstracts of the 300 articles and shortlisted 184 that clearly related "climate change" with behaviour, opinion, perception or

awareness. After examining if these works either identified many CCP drivers or analysed few CCP drivers in depth, 49 articles remained. In addition, we then incorporated 15 more relevant studies encountered within the references of these 49 articles, leading to a final selection of 64 studies (see Supporting Information 1, SI-1). In contrast to other recent multi-variable studies (van der Linden et al., 2017; Hornsey et al., 2016; Shi et al., 2016; Capstick et al., 2015; Lee et al., 2015), these 64 studies consider a wide spectrum of disciplinary perspectives by including meta-analyses, secondary analyses, social disclosures, and survey-based studies.

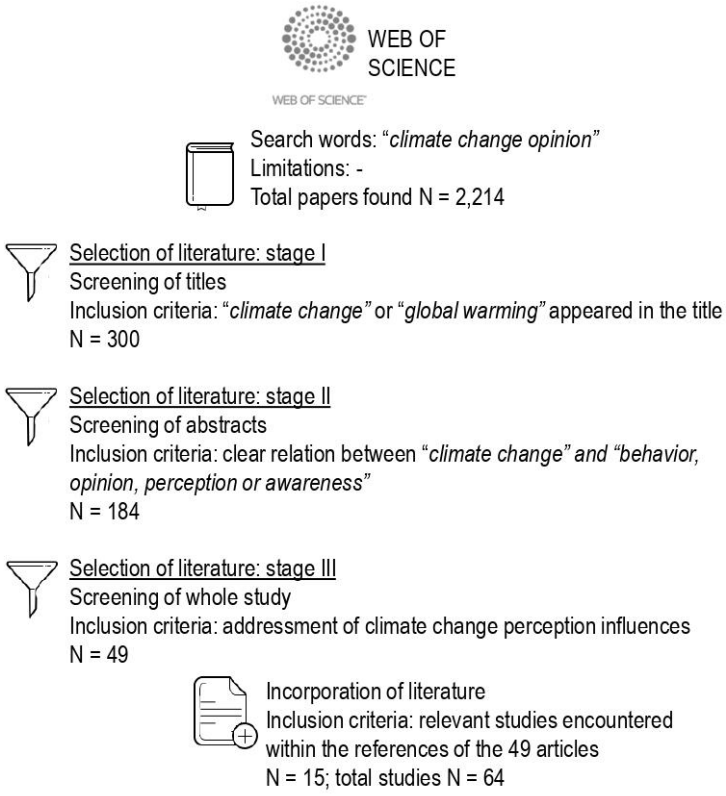


Figure 1. Flow chart of the systematic literature review

2.2. Semi-structured analysis of the selected literature

To perform the semi-structured analysis of the 64 studies, we started by collecting meta-information for each study, which included the date of publication, location of study, data provenance and type of study (SI-2). Controlling for the geographic area is important for two reasons. First, to circumvent the limitation derived from data and literature availability (i.e. bias towards the USA). Second, to test the effectiveness of the developed terminology on multiple scales (from small groups to large populations). The two different cases that emerged were: (a) 34 international studies, which encompass multi-country studies as well as single-country, non-USA studies (i.e. the UK, Australia, China, Spain, and India), and (b) 30 USA-only studies. Note that the work by McCright et al.[34] has been counted twice as (a) and (b) since the study itself makes such a differentiation.

Across the studies we identified 132 key words that describe potential drivers. Subsequently, we reduced those 132 key words (potential drivers). To do so, we used three criteria: a) number of occurrences across studies, as larger numbers of occurrence indicate higher scientific consideration; b) transferability across scales and sites, for the correct integration of studies of different nature; and c) quantifiability. In order to ensure transferability between disciplines we developed a common terminology, that is, we proposed a definition for each of the final 33 drivers and grouped them into seven classes (Table 1).

In a first step we then examined each study for the presence of a positive, negative, and/or neutral influence of each of the 33 drivers onto CCP (SI-3). For example, the following sentence by Shi et al. (2016) was interpreted as a positive influence of Socio-altruistic values (ID:86) on CCP: *"…have been found to be important in the formation of perceptions regarding environmental risks: egoistic values, socio-altruistic values and biospheric values"*, whereas this influence of Self-perceived knowledge (ID:71) on CC and CCP has been interpreted as neutral: *"In this work, general scientific knowledge appeared not to be a robust predictor of perceived climate change…".* "Neutral" here means that the study did analyse the connection but found no effect (observed no-effect). This is different to drivers not having been considered at all.

In a second step, and following the same methodology of positive, negative and neutral relations, we study the connections between drivers themselves (SI-2). An example of a positive connection between the driver *Self-perceived knowledge on CC* (ID:71) and *Emotional concern about CC* (ID:81) by Shi et al. (2016) is: *"knowledge about the causes of climate change was correlated with higher levels of concern about climate change in all countries".* With this information, we developed a network diagram and determined the centrality (strength of connectedness) of the drivers by use of Fuzzy Cognitive Mapping (FCM). We used the number of connections incident on one driver to compute its connectedness (so called degree centrality) (Kosko 1986). The centrality measures were normalized on [0,1] (SI-4). For the visualization we applied the Yifan Hu algorithm and filtered out variables without connections.

In a third step, we compared the driver−CCP (first step) with the driver−driver relationships (second step). In this way, we show how information is missed when accounting only for the direct influence of drivers on CCP without taking into consideration how drivers may be related among themselves (SI-5).

3. Identifying drivers

This section introduces and reviews the 33 drivers of CCP as identified in this study. Table 1 provides their definitions, IDs, grouping into classes and differentiation between instrumental and socio-political types (Table 1).

Table 1. Drivers of climate change perception. List of drivers (n=33) with their grouping into driver classes (n=7) in bold, and corresponding definitions. Abbreviations: CC: climate change, ID: identification number of each driver (see in SI-2).

	Driver class Driver	ID	Definition
Instrumental drivers	**Education and awareness of scientific work**		Processes related to receiving formal instruction on the scientific basis of CC and to interacting with CC experts
	Consumption of scientific articles	1	Reading of scientific articles on climate change
	Direct dealing with experts	2	Amount of interaction and exchange of information with climate experts
	Awareness of scientific climate consensus	3	Knowledge of the fact that > 90% climate experts currently agree that climate change is happening and that it is, at least, partly anthropogenic
	Self-perceived knowledge of CC	4	Self-assessed level of knowledge about climate change
	CC science literacy	5	Ability of understanding, communicating and gaining useful knowledge about climate change
	Media exposure		Exposure to mass media such as television, newspapers and radio
	Media access	6	The opportunity to use mass communication means to be informed about CC
	Volume of CC coverage	7	Level of climate change coverage in the media
	Popular media reports	8	Exposure to largely available and understandable spoken or written accounts about climate change in the media
	Transdisciplinary communication	9	Exposure to climate change information in a way that it is related to more than one branch of knowledge
	Online platforms	10	Use of Internet to obtain and exchange information on climate change
	Influence of corporations		Level of influence of powerful groups
	Conservative public relations firms	11	Influence of establishments engaged in promoting interests related to climate change denial
	Conservative elite cues	12	Influence of prominent individuals and small groups promoting climate change counter-movements
	Conservative think tanks	13	Influence of conservative bodies of experts providing advice and ideas on the non-existence of climate change
	Energy and oil sectors	14	Influence of individuals or groups from the energy and oil sectors promoting their own interests related to climate change denial
Socio-political drivers	**Ethnography**		The characteristic features of societies and cultures with their customs, values, habits, and mutual differences
	Emotional concern about CC	15	Self-assessed emotional concern about climate change
	Trust	16	Belief in the reliability of peers, civil institutions and climate experts
	Collectivistic culture	17	Level of influence of community norms, which emphasizes the needs and goals of the group as a whole over the needs and desires of the individual
	Socio-altruistic values	18	Possession of a set of altruistic, egalitarian and communitarian values
	Belief in anthropogenic CC	19	The acceptance that anthropogenic climate change is true
	Religiosity	20	Possession of religious feeling or belief in a community
	Liberalism supporter	21	Position with respect to the political activity supporting liberalism
	Wealth		Material prosperity

	Prosperity	22	Income and assets; total value of goods produced and services provided in a community during one year (GDP/capita)
	Willingness to pay for CC polices	23	Willingness to support taxes and energy price rises to reduce greenhouse emissions
	Free-market support	24	Position that prices for goods and services are determined by free market
	Personal experience and perception		Events or occurrences that leave an impression and/or perception of changes
	Extreme weather events	25	Experience of an extreme weather event (e.g. drought, hurricane)
	Changed weather	26	Perception of changed local/regional weather (e.g. reduced precipitation, increase on head wave frequency)
	Loss of agricultural activity	27	Experience and/or perception of agricultural activity decrease due to climate change (e.g. soil acidification, plagues)
	Threatened cultures and ecosystems	28	Perception of climate change threatening cultures and/or ecosystems
	Health impact	29	Experience/perception of human health risks related to climate change
	Demographics		Statistical data related to the population structure of a community
	Non-white fraction	30	Fraction of non-white people in a community
	fraction	31	Fraction of people below 30 years old in a community
	Female fraction	32	Fraction of women in a community
	Urban community/ developed nation	33	Presence of high technological infrastructure in a community

3.1. Instrumental driver classes

Instrumental drivers define the level of information about climate change within a community.

Education and awareness of scientific work. Educational attainment has been found by many authors to be the strongest predictor of climate change perception worldwide. However, knowledge about climate change is relatively limited in developing countries in comparison to developed ones (Lee et al., 2015; Leiserowitz, 2007). On the other hand, in developed countries, political commitments and promotion of particular views can threaten education and lead to the adoption of opposing positions (Plutzer et al., 2016). Furthermore, higher literacy is not necessarily related to a broad acceptance of anthropogenic climate change, but instead, it seems to be associated with stronger polarization (Drummond and Fischhoff, 2017; Kahan et al., 2012). Even when the public at large recognizes that scientists play a valuable role in society, public disengagement still can ensue when only a minority of citizens are exposed to scientific works directly (Castell et al., 2014). As a consequence, it is argued that most people in developed countries perceive climate change as a complex and distant topic (Leiserowitz et al., 2015; Smith et al., 2014) and are either unaware of or apathetic towards the scientific consensus that climate change is occurring and is at least partially anthropogenic (Cook et al., 2013). Communicating the scientific consensus, although vital to raise CCPs (van der Linden et al., 2019) has been proven to be not always necessarily effective (Capstick et al., 2015).

Media exposure. Traditional media play a decisive role in the communication of climate science. Adults obtain most of their news from radio, television and printed press and rely on the

interpretations of scientific results to understand climate change research, governance, and decision-making (Shi et al., 2016; Kahan et al., 2012). In contrast to the predominant top-down strategies of traditional media, online platforms are proving to be powerful pathways for engaging individuals more effectively and broadening climate change literacy (Leas et al., 2016). Open access reports and popular science magazines also directly impact public concern and understanding (O'Neill et al., 2015; Brulle et al., 2012). Likewise, media coverage of major scientific advances and assessment reports are found to have a positive effect on public knowledge and understanding of climate change (Boykoff, 2012; Brulle et al., 2012). Thus, the influence of the media extends far beyond the pure delivery of information, by having the capacity to polarize, shape, enhance or inhibit people's engagement (O'Neill et al., 2015).

Influence of corporations. Corporations have been found to enhance public exposure to polarized information according to their own interests, i.e. powerful organizations and/or NGOs asking for climate action vs. powerful organizations and/or private companies casting doubts about climate change. While the effect of the first has been inspected through the drivers "Popular media reports" and "Trans-disciplinary communication", the second has been inspected through this driver class, which assesses the confusion these corporations provoke in the population and the resulting reduction of risk perception (Stern, 2016; Farrell, 2015). Thus, corporations do not only have the capacity to influence the media but also to influence a wide range of variables related to personal experiences and beliefs, which can ultimately undermine established knowledge (van der Linden et al., 2017).

3.2. Socio-political driver classes

Socio-political drivers account for the convictions of climate change based on social norms, as well as cultural, religious, and moral values.

Ethnography. Ethnography turns out to be one of the strongest drivers, as the natural, cultural and political environment shared by a community powerfully shapes perceptions on climate change (Kahan et al., 2012). This induces similar strategic reasoning (Howe et al., 2015; Lee et al., 2015) and leads individuals to form opinions compatible with the values of the groups they identify with (Clayton et al., 2015; Leiserowitz et al., 2015). Communitarian people tend to attribute a stronger role to the anthropogenic cause of climate change than those holding hierarchical values (Cook and Lewandowsky, 2016; Hornsey et al., 2016; Shi et al., 2016; Kahan et al., 2012). Although differences in climate change perception exceed what political orientation alone can explain, it is consistently found that these orientations influence a wide range of beliefs (Bliuc et al., 2015; Hamilton et al., 2015; Huxster et al., 2015; Givens, 2014; Brulle et al., 2012). Further, studies show that whenever climate change polarization is high in the media, citizens rely on their political affiliation as a source of credibility to form an opinion (Hornsey et al., 2016; Stern, 2016; Leiserowitz et al., 2015). Similarly, trust in climate scientists, civil institutions,

government or religion, has proven to shape individual perceptions (McCright et al., 2016; Hope and Jones, 2014; Tjernström and Tietenberg, 2008).

Wealth. Wealth is largely responsible for shaping the specific mitigation and adaptation capacities of a community. In this manner, while developed countries are as likely to experience high exposure to hazards as developing countries, they exhibit lower vulnerability, which may lead to a further disengagement from action (Cook and Lewandowsky, 2016; Hamilton et al., 2015; Leiserowitz, A., Thaker, J., Feinberg, G., & Cooper, 2013). Beyond this, several authors report on the gap found between the early application of climate policies for mitigation and a later response to an obvious need for action (Leiserowitz et al., 2013; Brulle et al., 2012; Leiserowitz, 2007). Citizens generally transfer most of the climate responsibilities to corporations and governments, and although they might be willing to support pro-environmental policies, they often put their own economic interests first (Hanemann et al., 2011; Meira et al., 2009). Similarly, it has been pointed out that in times of economic recession, belief in climate change fades as a result of a rearrangement of priorities (Scruggs and Benegal, 2012). Also, driven by economic interests, free-market supporters are more likely to share corporative ideologies and beliefs related to climate change, consequently manifesting higher levels of scepticism (Cook and Lewandowsky, 2016; Hornsey et al., 2016).

Personal experience and perception. The cognitive association between experiences of extreme weather events and climate change (Howe et al., 2019; Brügger et al., 2015; Capstick et al., 2015) is still under debate, although there is a broad consensus that such experiences raise awareness (Hornsey et al., 2016; Clayton et al., 2015; Lee et al., 2015; van der Linden, 2015). People in developed countries judge negative health, agricultural and cultural impacts as more likely to occur to others than to themselves, viewing climate change as a threat distant in space and time (Maibach et al., 2015; Smith et al., 2014; Akerlof et al., 2010; Moyano et al., 2009; Patz and Olson, 2006; Patz et al., 2005). Moreover, besides extreme weather events, perceived recent local weather changes influence the broad climate change perception, as people become aware of the multiple climate change-related environmental threats to their communities (Howe et al., 2019, 2012; Hornsey et al., 2016; Zaval et al., 2014; Doherty and Clayton, 2011).

Demographics. Race, age, and gender have been found to have a weak influence on climate change perception (Shi et al., 2016; Hesed and Paolisso, 2015; Howe et al., 2015; Leiserowitz et al., 2011). However, climate change perceptions vary geographically, both between and within nations (i.e. rural vs. urban areas) as the result of cultural and ideological factors (Howe et al., 2015; Lee et al., 2015).

4. Quantifying strength of drivers influencing CCP

For all 64 studies, we provide the count of how many times each of the 33 drivers was identified to influence CCP (Figure 2).

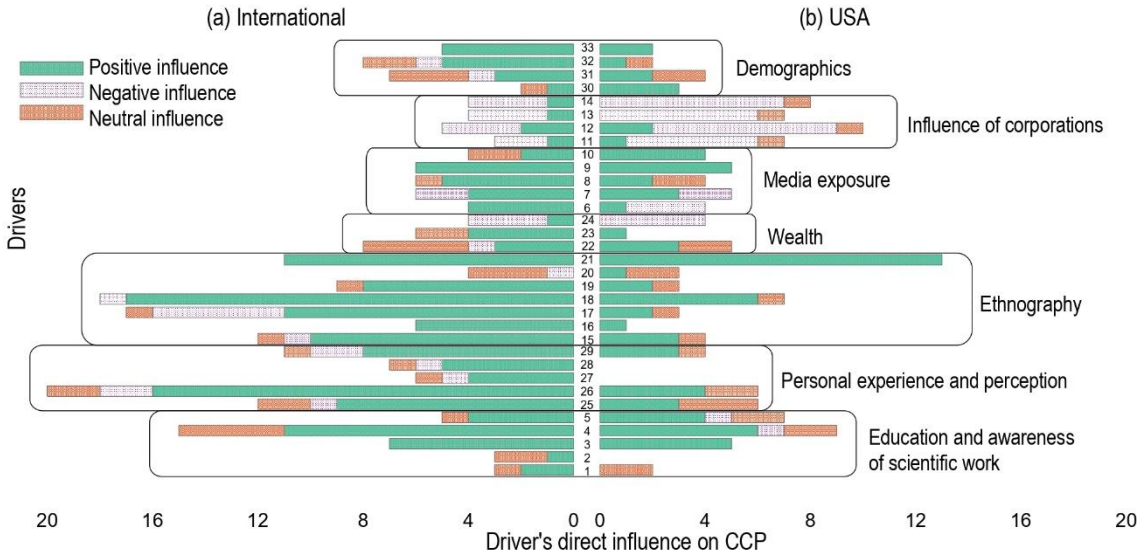


Figure 2. Quantification of the number of times a driver has been found to influence climate change perception (see Section 2.2) for (a) the international case, and (b) the USA case. The sub-drivers are grouped into seven drivers (rounded-corner frames). See description of IDs in Table 1. The bars in the graph can be basically interpreted as follows: if a sub-driver is mentioned in many studies, its associated bar will be long. If most of these studies find a positive interaction, the bar will be predominantly green (dark grey in a greyscale image). In this way we can easily compare the differences in perceptions and relevant drivers between the international and the USA case.

Results show that, in the international case, perception of 'Changed weather' is the mechanism most frequently associated to CCP (ID: 26). Other drivers with high influencing capacity are 'Collectivistic culture' and 'Socio-altruistic values' (ID: 17, 18), followed by the 'Self-perceived knowledge of CC' (ID: 4). Among these drivers, the one with more positive connections to CCP is 'Socio-altruistic values' (ID: 18) closely followed by 'Changed weather' (ID: 26). In contrast, the ones with the highest share of negative influences are the 'Influence of corporations' (ID: 11, 12, 13, 14).

In the USA case, 'Liberalism supporter' (ID: 21) and the 'Influence of corporations' (ID: 11, 12, 13, 14) are found to have the strongest capacity to influence CCP. They are followed by 'Self-perceived knowledge of CC' and 'CC science literacy' (ID: 4, 5). Note that only few studies report on the drivers included in 'Personal experience and perception'.

This counting exercise provides clues of which are the most studied drivers of CCP in different settings, as well as whether their influence was found to be positive, negative, or neutral (observed no-effect). It also exhibits how drivers included under 'Demographics', 'Wealth', and 'Media exposure' play a limited role in determining CCP.

5. Quantifying strength of drivers influencing other drivers

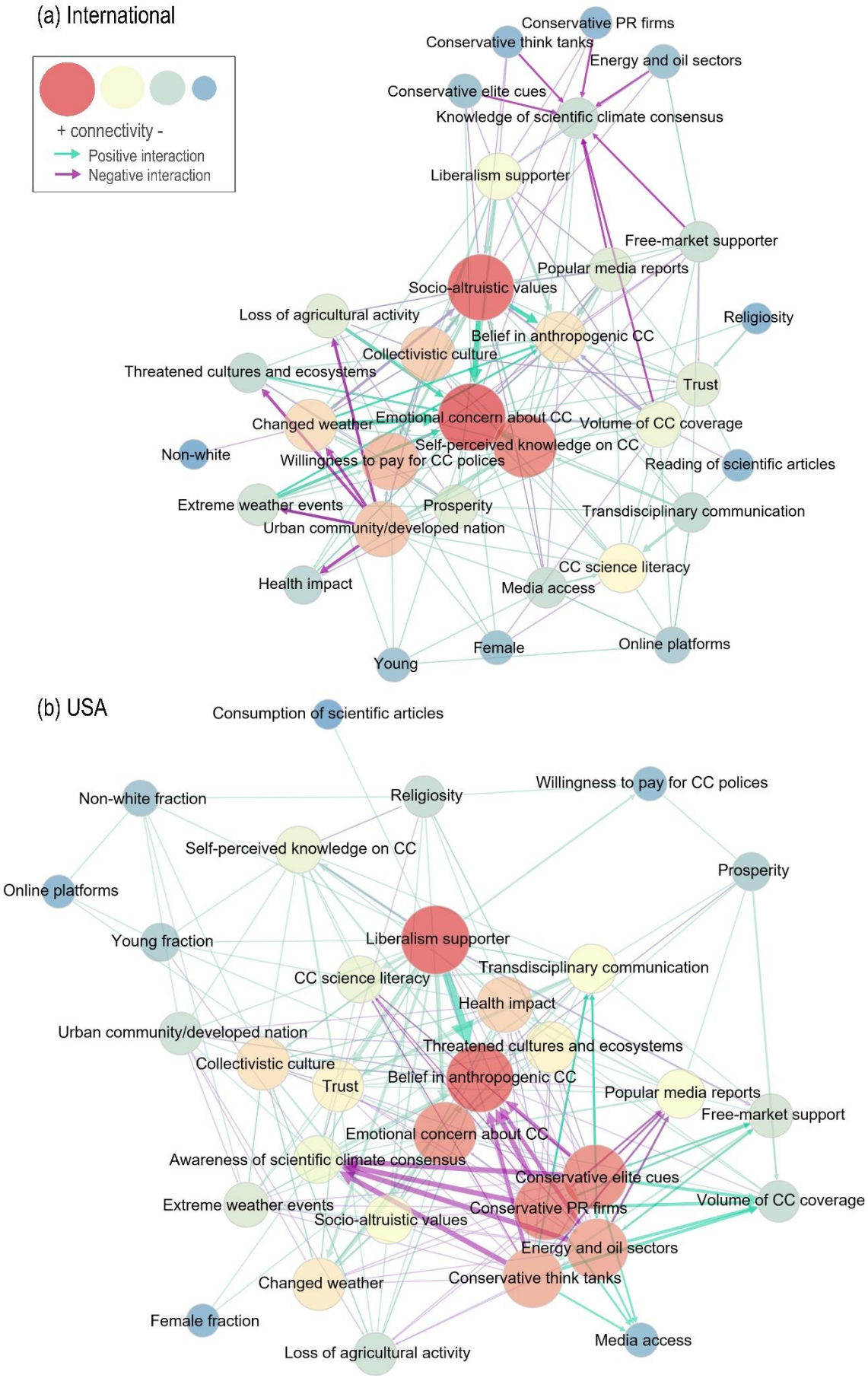
Due to potential interactions among drivers, crucial information about what drives CCPs may be overseen when only assessing direct influences. Beyond the previous analysis, we therefore suggest to investigate how the 33 drivers relate to each other. This information is then used to develop a network diagram that depicts the connections and the resulting centralities (strength of connectedness) of the drivers (Figure 3).

In the International case, 'Socio-altruistic values' (ID: 18) is found to strongly and positively impact 'Emotional concern about CC' (ID: 15) and 'Belief in anthropogenic CC' (ID: 19). 'Urban community / Developed nation' (ID: 33) instead, displays negative connections to 'Personal experience and perception' (ID: 25, 26, 27, 28, 29). 'Awareness of scientific climate consensus' (ID: 3) is negatively impacted by 'Influence of corporations' (ID: 11, 12, 13, 14), 'Free-market supporter' (ID: 24), 'Volume of CC coverage' (ID: 7), and 'Popular media reports' (ID: 8).

The USA network is dominated by two drivers: 'Liberalism supporter' (ID: 21) and 'Influence of corporations' (ID: 11, 12, 13, 14). The first exhibits multiple connections, among which a strong positive one to 'Belief in anthropogenic CC' (ID: 19) stands out. In contrast, 'Influence of corporations' shows negative connections not only with 'Belief in anthropogenic CC', but also with 'Awareness of scientific climate consensus' (ID: 3), 'Popular media reports' (ID:8) and 'CC science literacy' (ID: 5).

The network diagrams reveal how people's CCPs are not only shaped by direct drivers, but also by the interactions among the drivers themselves. Three of these interactions are further highlighted here:

(1) In Figure 2a, the driver 'Urban community / Developed nation' exhibits little influence on CCP directly, while in the network diagram (Figure 3a) this driver is quite central with several negative connections to the drivers grouped under 'Personal experience and perception'. This finding suggests, that the more developed a community is, the less connected to the physical experiences of climate change it becomes. Literature indicates that the rationale behind this observation is that developed communities with high levels of resilience towards climatic adverse effects perceive climatic threats as distant in space and time, while the opposite occurs for less developed communities (Cook and Lewandowsky, 2016; Hamilton et al., 2015; Leiserowitz, A., Thaker, J., Feinberg, G., & Cooper, 2013). A consequence of this, combined with the fact that the drivers under 'Personal experience and perception' positively influence 'Emotional concern about CC' and 'Belief in anthropogenic CC', is that a possible strategy for promoting climate action could be prioritizing the knowledge of the science behind climate change (i.e. promoting education and awareness of scientific work) in developed communities, while relating climate change to direct threats and perceptions in less developed communities.


(a) International
+ connectivity -
Positive interaction
Negative interaction
Conservative PR firms
Conservative think tanks
Energy and oil sectors
Conservative elite cues
Knowledge of scientific climate consensus
Liberalism supporter
Free-market supporter
Popular media reports
Socio-altruistic values
Loss of agricultural activity
Religiosity
Belief in anthropogenic CC
Collectivistic culture
Threatened cultures and ecosystems
Trust
Changed weather
Emotional concern about CC
Volume of CC coverage
Self-perceived knowledge on CC
Non-white
Willingness to pay for CC polices
Reading of scientific articles
Extreme weather events
Prosperity
Transdisciplinary communication
Urban community/developed nation
CC science literacy
Health impact
Media access
Female
Online platforms
Young
(b) USA
Consumption of scientific articles
Non-white fraction
Religiosity
Willingness to pay for CC polices
Self-perceived knowledge on CC
Prosperity
Online platforms
Young fraction
Liberalism supporter
Transdisciplinary communication
CC science literacy
Health impact
Urban community/developed nation
Threatened cultures and ecosystems
Collectivistic culture
Belief in anthropogenic CC
Trust
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Free-market support
Emotional concern about CC
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Conservative elite cues
Extreme weather events
Conservative PR firms
Volume of CC coverage
Socio-altruistic values
Energy and oil sectors
Changed weather
Conservative think tanks
Female fraction
Media access
Loss of agricultural activity

Figure 3. Interactions among drivers. Network diagrams of (a) the international case, (b) the USA case. Each line represents a connection, with the arrow indicating its direction, its width indicating its influencing capacity (number of occurrences), and its colour indicating its nature (positive, negative). Size-colour of the nodes indicates centrality, calculated as the number of links incident upon each driver (i.e. degree centrality). The most relevant connections have been highlighted. Abbreviations: CC: climate change, PR: public relations.

(2) Figure 2a shows how people's CCPs are strongly affected by ethnographic factors directly. The network diagram (Figure 3a) reveals that many of the drivers within this class reinforce each other, leading to a stronger influence. In this way, powerful positive connections exist between 'Socio-altruistic values', 'Emotional concern about CC', and 'Belief in anthropogenic CC'. Past studies have hypothesized that this might be the case as principles and ideals shared within a community are powerfully transmitted and induce similar strategic reasoning (Howe et al., 2015; Lee et al., 2015; Kahan et al., 2012). Hence, in order to achieve climate action, different strategies might be needed in collectivistic vs. more individualistic communities.

(3) In Figures 2a and 2b, drivers in the class 'Influence of corporations' show a moderate but negative influence on CCP directly. In the network diagrams instead (i.e. Figure 3a and 3b), these drivers are quite central and display many connections to other drivers, both negative and positive. On the one hand, they negatively influence 'Belief in anthropogenic CC', 'Awareness of scientific climate consensus', and 'CC science literacy' threatening not only pre-established perceptions and believes of climate change but also, already acquired knowledge (van der Linden et al., 2017; Stern, 2016; Farrell, 2015). On the other hand, they show positive connections to the media, i.e. 'Transdisciplinary communication', 'Volume of CC coverage', and 'Media access', and to the driver 'Free-market support', displaying the channels used for the dissemination of the polarized information casting doubt on climate change. The added value of inspecting indirect influences of CCP in this case, is thus, the possibility of identifying the most effective channels to deliver climate change information.

Similarly, 'Liberalism supporter' is found to both strongly influence CCP directly (Figure 2b) and influence many other drivers (Figure 3b). Among all connections, the most powerful one is with 'Belief in anthropogenic CC', which points towards a neutralization of the effect of the 'Influence of corporations'.

6. Comparison between drivers directly influencing CCP and drivers influencing other drivers

In order to better understand the different roles taken by the assessed drivers, we compare their influences on CCP with their relationships among each other (Figure 4).

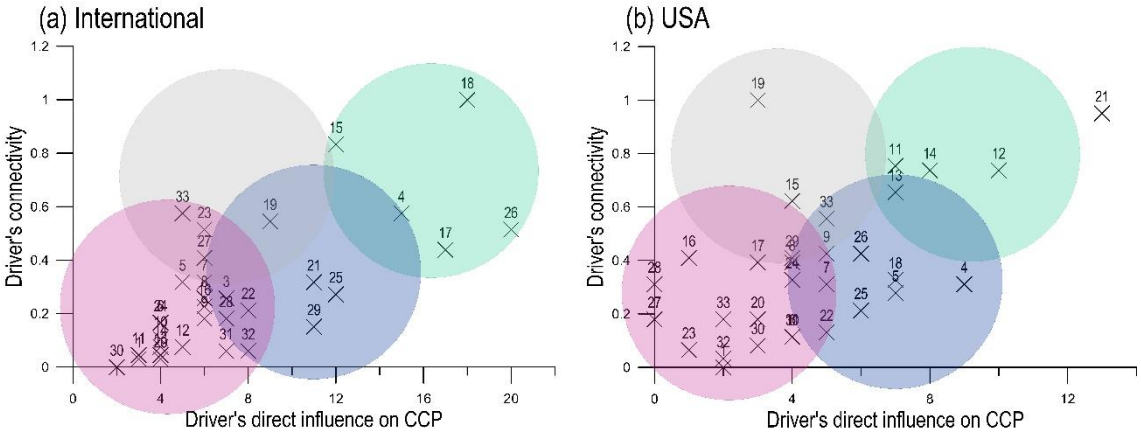

Figure 4. Qualitative assessment of the driver's influencing capacity on climate change perception (CCP) and strength of interactions with other drivers for (a) the International case, and (b) the USA case. Four groups are differentiated: drivers with highest direct influencing capacities on CCP and highest connectivity (green), high direct influencing capacities on CCP and mid-low connectivity (blue), low influencing capacities on CCP and mid-high connectivity (grey), lowest influencing capacities on CCP and low connectivity (pink).

For both the International and the USA case, we have identified four different types of drivers. In general, we observe a positive correlation, in the sense that drivers with a strong direct influence on CCP are also more strongly connected to other drivers.

The most important drivers are the ones with high direct influencing capacity on CCP and high connectivity to other drivers (Fig.4-green). They strongly promote climate change awareness or denial, either directly or indirectly. In the International case, socio-altruistic values (ID:18) is the driver of CCP that shows the strongest combination of both, direct and indirect influences. However, among all, the strongest direct driver is weather changes (ID:26), followed by socio-altruistic values (ID:18), share of a collectivistic culture (ID:17) and the self-perceived knowledge of CC (ID:4). For indirect influences (high connectivity), the second strongest indirect driver of CCP, after socio-altruistic values (ID:18), is emotional concern about CC (ID:15). In the USA case instead, political affiliation (ID:21) appears as the strongest positive direct and indirect driver of CCP, while multiple influences of corporations (ID: 11,12,13,14) are the second most important direct and indirect drivers, strongly promoting climate change denial.

Further, we identify drivers with intermediate importance due to either considerable direct influencing capacity to CCP through specific channels or paths of influence (Fig.4-blue), or high connectivity to other drivers (Fig.4-grey). Drivers of lesser importance exhibit low direct influencing capacity as well as low connectivity (Fig.4-pink). To reduce the size of the current model, these drivers could therefore be removed.

7. Conclusions

In this study we carried out a systematic literature review that allowed the construction of a semi-structured framework for the identification of drivers of Climate Change Perception (CCP) and the quantification of their importance as well of their connectivity.

The collection and definition of drivers (N=33) resulting from the analysis of the literature review convened disperse information under the same terminology and facilitated its use trough their grouping into seven driver classes (Table 1) adding to the existing gap of common terminology across disciplines and targeted communities. The development of this novel semi-structured framework allows for: (1) the quantification of driver influence; (2) the distinction of positive, negative, or neutral (observed no-effect) influences (Figure 2); (3) the analysis of interactions between drivers, pointing to indirect paths of influence to CCP (Figure 3). In particular, for our case study, we observe that the driver 'Urban community/developed nation' while overlooked when inspecting its direct influence to CCP (Figure 2) is found to play an important role in CCP. Moreover, the drivers 'Emotional concern about CC', 'Belief in anthropogenic CC' and 'Socio-altruistic values' are highly interconnected among themselves, reinforcing their influence to CCP. Similarly, the drivers under the umbrella of 'Influence of corporations' are highly connected to many other drivers, strongly influencing CCPs in multiple indirect ways. When inspecting the different roles taken by the assessed drivers, we find that these are either highly influential, specifically influential through specific channels or paths of influence, mediators, or only slightly influential to CCP (Figure 4).

The literature search conducted to identify the drivers is not without limitations. First, due to data availability, it is more inclined towards quantitative longitudinal surveys, rather than in-depth community contextualized studies; and towards more developed countries than developing countries. Second, it is here not possible to disentangle whether the differences in CCP drivers' quantification obtained for the two cases are a product of unbiased investigations or the result of the different criteria taken into account when developing the original studies in each case. Third, the quantification of the interactions/connections is based on subjective interpretation of the works in the literature database.

Conversely, the methodology followed in this study has several advantages. First, by merging similar variables and removing restricted cases, the key drivers are exposed. Second, it combines disperse information under a single terminology, making it comparable regardless of the context of the study. Third, it offers an interdisciplinary view that is most valuable for decision- and policy-making, as this work structures the key drivers of CCP found across disciplines in a comparable way.

Taking into account the seven driver classes when developing climate policies may help in developing policies that are more in line with the public's perceptions, needs, and capabilities. Moreover, the understanding of how drivers that shape CCP are interconnected among themselves

should support the development of effective mitigation and adaptation policies that are in concordance to a particular community, of any characteristics.

CRediT authorship contribution statement

Itxaso Ruiz: Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing - original draft, Writing - review & editing. Sérgio H. Faria: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing - review & editing. Marc B. Neumann: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing - review & editing.

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Bibliography

Akerlof, K., DeBono, R., Berry, P., Leiserowitz, A., Roser-Renouf, C., Clarke, K.-L., Rogaeva, A., Nisbet, M.C., Weathers, M.R., Maibach, E.W., 2010. Public Perceptions of Climate Change as a Human Health Risk: Surveys of the United States, Canada and Malta. Int. J. Environ. Res. Public Health 7, 2559–2606. https://doi.org/10.3390/ijerph7062559

Bliuc, A.M., McGarty, C., Thomas, E.F., Lala, G., Berndsen, M., Misajon, R., 2015. Public division about climate change rooted in conflicting socio-political identities. Nat. Clim. Chang. 5, 226–229. https://doi.org/10.1038/nclimate2507

Boykoff, M.T., 2012. Who speaks for the climate? Making sense of media reporting on climate change. Int. J. Public Opin. Res. 24, 546–550. https://doi.org/10.1093/ijpor/eds035

Brügger, A., Dessai, S., Devine-Wright, P., Morton, T.A., Pidgeon, N.F., 2015. Psychological responses to the proximity of climate change. Nat. Clim. Chang. 5, 1031–1037. https://doi.org/doi:10.1038/nclimate2760

Brulle, R.J., Carmichael, J., Jenkins, J.C., 2012. Shifting public opinion on climate change: An empirical assessment of factors influencing concern over climate change in the U.S., 2002-2010. Clim. Change 114, 169–188. https://doi.org/10.1007/s10584-012-0403-y

Capstick, S., Whitmarsh, L., Poortinga, W., Pidgeon, N., Upham, P., 2015. International trends in public perceptions of climate change over the past quarter century. Wiley Interdiscip. Rev. Clim. Chang. 6, 35–61. https://doi.org/10.1002/wcc.321

Castell, S., Charlton, A., Clemence, M., Pettigrew, N., Pope, S., Quigley, A., Shah, J.N., Silman, T., 2014. Public Attitudes to Science i2014 2.

Clayton, S., Devine-Wright, P., Stern, P.C., Whitmarsh, L., Carrico, A., Steg, L., Swim, J., Bonnes, M., 2015. Psychological research and global climate change. Nat. Clim. Chang. 5. https://doi.org/10.1038/nclimate2622

Cook, J., Lewandowsky, S., 2016. Rational Irrationality: Modeling Climate Change Belief Polarization Using Bayesian Networks. Top. Cogn. Sci. 8, 160–179. https://doi.org/10.1111/tops.12186

Cook, J., Nuccitelli, D., Skuce, A., Jacobs, P., Painting, R., Honeycutt, R., Green, S.A., Lewandowsky, S., Richardson, M., Way, R.G., 2013. Quantifying the consensus on anthropogenic global warming in the scientific literature. Energy Policy 73, 706–708. https://doi.org/10.1016/j.enpol.2014.06.002

Doherty, T.J., Clayton, S., 2011. The psychological impacts of global climate change. Am. Psychol. 66, 265–276. https://doi.org/10.1037/a0023141

Drummond, C., Fischhoff, B., 2017. Individuals with greater science literacy and education have more polarized beliefs on controversial science topics. Proc. Natl. Acad. Sci. 114, 9587–9592. https://doi.org/10.1073/pnas.1704882114

ELD Initiative, 2015. The Value of Land: Prosperous lands and positive rewards through sustainable land management.

Farrell, J., 2015. Network structure and influence of the climate change counter-movement. Nat. Clim. Chang. 6, 1–5. https://doi.org/10.1038/nclimate2875

Givens, J.E., 2014. Sociology: Drivers of climate change beliefs. Nat. Clim. Chang. 4, 1051–1052. https://doi.org/10.1038/nclimate2453

Goldberg, M.H., van der Linden, S., Leiserowitz, A., Edward, M., 2019. Perceived Social Consensus Can Reduce Ideological Biases on Climate Change. Environ. Behav. in press, 1–33.

Hamilton, L.C., Hartter, J., Lemcke-Stampone, M., Moore, D.W., Safford, T.G., 2015. Tracking public beliefs about anthropogenic climate change. PLoS One 10, 1–14. https://doi.org/10.1371/journal.pone.0138208

Hanemann, M., Loureiro, M.L., Labandeira, X., 2011. Preferencias Sociales sobre Políticas de Cambio Climático : Evidencia para España.

Hesed, C.D.M., Paolisso, M., 2015. Cultural knowledge and local vulnerability in African American communities. Nat. Clim. Chang. 5, 683–687. https://doi.org/10.1038/nclimate2668

Hope, A.L.B., Jones, C.R., 2014. The impact of religious faith on attitudes to environmental issues and Carbon Capture and Storage (CCS) technologies: A mixed methods study. Technol. Soc. 38, 48–59. https://doi.org/10.1016/j.techsoc.2014.02.003

Hornsey, M.J., Harris, E.A., Bain, P.G., Fielding, K.S., 2016. Meta-analyses of the determinants and outcomes of belief in climate change. Nat. Clim. Chang. 6, 1–6. https://doi.org/10.1038/nclimate2943

Howe, P.D., Markowitz, E.M., Lee, T.M., Ko, C.Y., Leiserowitz, A., 2012. Global perceptions of local temperature change. Nat. Clim. Chang. 3, 352–356. https://doi.org/10.1038/nclimate1768

Howe, P.D., Mildenberger, M., Marlon, J.R., Leiserowitz, A., 2015. Geographic variation in opinions on climate change at state and local scales in the USA. Nat. Clim. Chang. 5, 596–603. https://doi.org/10.1038/nclimate2583

Howe, P.D., Marlon, J.R., Mildenberger, M., Shield, B.S., 2019. How will climate change shape climate opinion? Environ. Res. Lett. 14, 113001. https://doi.org/10.1088/1748-9326/ab466a

Huxster, J.K., Carmichael, J.T., Brulle, R.J., 2015. A Macro Political Examination of the Partisan and Ideological Divide in Aggregate Public Concern over Climate Change in the U . S . between 2001 and 2013 4, 1–15. https://doi.org/10.5296/emsd.v4i1.6531

IPCC, 2018. Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change,. https://doi.org/10.1017/CBO9781107415324

Kahan, D., Peters, E., Wittlin, M., Slovic, P., Ouellette, L., Braman, D., Mandel, G., 2012. The polarizing impact of science literacy and numeracy on perceived climate change risks. Nat. Clim. Chang. 2, 732–735. https://doi.org/10.1038/nclimate1547

Kosko, Bart. 1986. “Fuzzy Cognitive Maps.” *International Journal of Man-Machine Studies* 24 (1): 65–75. https://doi.org/10.1016/S0020-7373(86)80040-2.

Leas, E.C., Althouse, B.M., Dredze, Mark, Obradovich, Nick, Fowler, J.H., Noar, S.M., Allem, Jon-Patrick, Ayers, J.W., Barnes, B., Anderson, A., Thrall, A., Lollio-Fakhreddine, J., Berent, J., Donnelly, L., Herrin, W., Paquette, Z., Watts, D., Lazer, D., Pentland, A., Adamic, L., Aral, S., Barabasi, A., Brewer, D., Ayers, J., Althouse, B., Dredze, M, Newman, T., Mccallum, M., Bury, G., Shadish, W., Cook, T., King, G., Tomz, M., Wittenberg, J., Ayers, J., Althouse, B., Noar, S., Cohen, J., Noar, S., Althouse, B., Ayers, J., Francis, D., Ribisl, K., Evans, D., Wisely, J., Clancy, T., Lalloo, F., Wilson, M., Johnson, R., Fond, G., Gaman, A., Brunel, L., Haffen, E., Llorca, P., Ayers, J., Althouse, B., Dredze, M, Leas, E., Noar, S., Wakefield, M., Loken, B., Hornik, R., Maibach, EW, Roser-Renouf, C., Leiserowitz, A, Nisbet, M., Moser, S., Allem, J-P, Escobedo, P., Chu,

K.-H., Soto, D., Cruz, T., Unger, J., Kryvasheyeu, Y., Chen, H., Obradovich, N, Moro, E., Hentenryck, P. Van, Fowler, J., Althouse, B., Allem, J., Childers, M., Dredze, M, Ayers, J., Santillana, M., Zhang, D., Althouse, B., Ayers, J., Ayers, J., Althouse, B., Johnson, M., Cohen, J., Ayers, J., Westmaas, J., Leas, E., Benton, A., Chen, Y., Dredze, M, Noar, S., Ribisl, K., Althouse, B., Willoughby, J., Ayers, J., Pearce, W., Holmberg, K., Hellsten, I., Nerlich, B., Lineman, M., Do, Y., Kim, J., Joo, G.-J., Cody, E., Reagan, A., Mitchell, L., Dodds, P., Danforth, C., Hart, P., Leiserowitz, AA, Hmielowski, J., Feldman, L., Myers, T., Leiserowitz, A, Maibach, E, Dredze, M, Broniatowski, D., Smith, M., Hilyard, K., Deryugina, T., Shurchkov, O., Hart, P., Feldman, L., Frumkin, H., McMichael, A., Patz, J., Frumkin, H., Holloway, T., Vimont, D., Haines, A., Hamilton, L., Hartter, J., Lemcke-Stampone, M., Moore, D., Safford, T., Hurlstone, M., Lewandowsky, S., Newell, B., Sewell, B., 2016. Big Data Sensors of Organic Advocacy: The Case of Leonardo DiCaprio and Climate Change. PLoS One 11, e0159885. https://doi.org/10.1371/journal.pone.0159885

Lee, T.M., Markowitz, E.M., Howe, P.D., Ko, C.Y., Leiserowitz, A.A., 2015. Predictors of public climate change awareness and risk perception around the world. Nat. Clim. Chang. 5, 1014–1020. https://doi.org/10.1038/nclimate2728

Leiserowitz, A., Thaker, J., Feinberg, G., & Cooper, D. (2013), 2013. Global Warming ' S Six Indias :

Leiserowitz, A., 2007. International public opinion, perception, and understanding of global climate change. Hum. Dev. Rep. 2008, 2007.

Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., Howe, P., 2015. Climate Change in the American Mind. Environment.Yale.Edu 61.

Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., Rosenthal, S., 2013. Public Support for Climate and Energy Policies in November 2013.

Leiserowitz, A., Smith, N., Marlon, J.R., 2011. American Teens ' Knowledge of Climate Change 1–63.

Maibach, E.W., Kreslake, J.M., Roser-Renouf, C., Rosenthal, S., Feinberg, G., Leiserowitz, A.A., 2015. Do Americans Understand That Global Warming Is Harmful to Human Health? Evidence From a National Survey. Ann. Glob. Heal. 81, 396–409. https://doi.org/10.1016/j.aogh.2015.08.010

McCright, A.M., Marquart-Pyatt, S.T., Shwom, R.L., Brechin, S.R., Allen, S., 2016. Ideology, capitalism, and climate: Explaining public views about climate change in the United States. Energy Res. Soc. Sci. 21, 180–189. https://doi.org/10.1016/j.erss.2016.08.003

Meira, P., Arto, M., Montero, P., 2009. La sociedad ante el cambio climático. Conocimientos, valoraciones y comportamientos en la población española, Fundación MAPFRE, Universidad de Santiago de Compostela.

Moyano, E., Paniagua, Á., Lafuente, R., 2009. Políticas ambientales, cambio climático y opinión pública en escenarios regionales. El caso de Andalucía. Rev. Int. Sociol. 67, 681–699. https://doi.org/10.3989/ris.2008.01.23

O'Neill, S., Williams, H.T.P., Kurz, T., Wiersma, B., Boykoff, M., 2015. Dominant frames in legacy and social media coverage of the IPCC Fifth Assessment Report. Nat. Clim. Chang. 5, 380–385. https://doi.org/10.1038/nclimate2535

Patz, J.A., Campbell-Lendrum, D., Holloway, T., Foley, J.A., 2005. Impact of regional climate change on human health. Nature 438, 310–317. https://doi.org/10.1038/nature04188

Patz, J.A., Olson, S.H., 2006. Climate change and health: global to local influences on disease risk. Ann. Trop. Med. Parasitol. 100, 535–549. https://doi.org/10.1179/136485906X97426

Plutzer, E., Mccaffrey, M., Hannah, A.L., Rosenau, J., Berbeco, M., Reid, A.H., 2016. Climate confusion among U.S. teachers. Science (80-.). 351, 664–665. https://doi.org/10.1126/science.aab3907

Scruggs, L., Benegal, S., 2012. Declining public concern about climate change: Can we blame the great recession? Glob. Environ. Chang. 22, 505–515. https://doi.org/10.1016/j.gloenvcha.2012.01.002

Shi, J., Visschers, V.H.M., Siegrist, M., Arvai, J., 2016. Knowledge as a driver of public perceptions about climate change reassessed. Nat. Clim. Chang. 6, 759–762. https://doi.org/10.1038/nclimate2997

Smith, W.J., Liu, Z., Safi, A.S., Chief, K., 2014. Climate change perception, observation and policy support in rural Nevada: A comparative analysis of Native Americans, non-native ranchers and farmers and mainstream America. Environ. Sci. Policy 42, 101–122. https://doi.org/10.1016/j.envsci.2014.03.007

Stern, P.C., 2016. Sociology: Impacts on climate change views. Nat. Clim. Chang. 6, 341–342. https://doi.org/10.1038/nclimate2970

Tesfahunegn, G.B., 2018. Farmers ' perception on land degradation in northern Ethiopia : Implication for developing sustainable land. Soc. Sci. J. https://doi.org/10.1016/j.soscij.2018.07.004

Tjernström, E., Tietenberg, T., 2008. Do differences in attitudes explain differences in national climate change policies? Ecol. Econ. 65, 315–324. https://doi.org/10.1016/j.ecolecon.2007.06.019

van der Linden, S., 2015. The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model. J. Environ. Psychol. 41, 112–124. https://doi.org/10.1016/j.jenvp.2014.11.012

van der Linden, S., Leiserowitz, A., Maibach, E., 2019. The gateway belief model : A large-scale replication 62. https://doi.org/10.1016/j.jenvp.2019.01.009

van der Linden, S., Leiserowitz, A., Rosenthal, S., Maibach, E., 2017. Inoculating the Public

against Misinformation about Climate Change. Glob. Challenges 1, 1600008. https://doi.org/10.1002/gch2.201600008

Zaval, L., Keenan, E.A., Johnson, E.J., Weber, E.U., 2014. How warm days increase belief in global warming. Nat. Clim. Chang. 4, 143–147. https://doi.org/10.1038/nclimate2093

Supplementary Information 1

List of the 64 selected studies

Akerlof, K., DeBono, R., Berry, P., Leiserowitz, A., Roser-Renouf, C., Clarke, K.-L., … Maibach, E. W. (2010). Public Perceptions of Climate Change as a Human Health Risk: Surveys of the United States, Canada and Malta. *International Journal of Environmental Research and Public Health*, *7*(6), 2559–2606. https://doi.org/10.3390/ijerph7062559

Beder, S. (2014). Lobbying , greenwash and deliberate confusion : how vested interests undermine climate change.

Bliuc, A. M., McGarty, C., Thomas, E. F., Lala, G., Berndsen, M., & Misajon, R. (2015). Public division about climate change rooted in conflicting socio-political identities. *Nature Climate Change*, *5*(3), 226–229. https://doi.org/10.1038/nclimate2507

Bord, R. J., Fisher, A., & O'Connor, R. E. (1998). Public perceptions of global warming : United States and international perspectives. *Climate Research*, *11*(1), 75–84. https://doi.org/10.3354/cr011075

Brechin, S. R. (2003). *Comparative Public Opinion and Knowledge on Global Climatic Change and the Kyoto Protocol: The U.S. versus theWorld?*

Briggs, H. (2014). The badgers moved the goalposts.

Brügger, A., Dessai, S., Devine-Wright, P., Morton, T. A., & Pidgeon, N. F. (2015). Psychological responses to the proximity of climate change. *Nature Climate Change*, *5*(12), 1031–1037. https://doi.org/doi:10.1038/nclimate2760

Brulle, R. J., Carmichael, J., & Jenkins, J. C. (2012). Shifting public opinion on climate change: An empirical assessment of factors influencing concern over climate change in the U.S., 2002-2010. *Climatic Change*, *114*(2), 169–188. https://doi.org/10.1007/s10584-012-0403-y

Budescu, D. V, Por, H., Broomell, S. B., & Smithson, M. (2014). statements around the world, (April), 1–5. https://doi.org/10.1038/NCLIMATE2194

Capstick, S., Whitmarsh, L., Poortinga, W., Pidgeon, N., & Upham, P. (2015). International trends in public perceptions of climate change over the past quarter century. *Wiley Interdisciplinary Reviews: Climate Change*, *6*(1), 35–61. https://doi.org/10.1002/wcc.321

Carmichael, J. T., & Brulle, R. J. (2017). Elite cues, media coverage, and public concern: an integrated path analysis of public opinion on climate change, 2001–2013. *Environmental Politics*, *26*(2), 232–252. https://doi.org/10.1080/09644016.2016.1263433

Chan, K. M. A., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., … Turner, N. (2016). Opinion: Why protect nature? Rethinking values and the environment. *Proceedings of the National Academy of Sciences*, *113*(6). https://doi.org/10.1073/pnas.1525002113

Chuang, Y., Xie, X., & Liu, C. (2016). Interdependent orientations increase pro-environmental preferences when facing self-interest conflicts: The mediating role of self-control. *Journal of Environmental Psychology*, *46*, 96–105. https://doi.org/10.1016/j.jenvp.2016.04.001

Clayton, S., Devine-Wright, P., Stern, P. C., Whitmarsh, L., Carrico, A., Steg, L., … Bonnes, M. (2015). Psychological research and global climate change. *Nature Climate Change*, *5*(7). https://doi.org/10.1038/nclimate2622

Cook, J., & Lewandowsky, S. (2016). Rational Irrationality: Modeling Climate Change Belief Polarization Using Bayesian Networks. *Topics in Cognitive Science*, *8*(1), 160–179. https://doi.org/10.1111/tops.12186

Cook, J., Nuccitelli, D., Skuce, A., Jacobs, P., Painting, R., Honeycutt, R., … Way, R. G. (2013). Reply to "Quantifying the consensus on anthropogenic global warming in the scientific literature: A re-analysis." *Energy Policy*, *73*, 706–708. https://doi.org/10.1016/j.enpol.2014.06.002

Doherty, T. J., & Clayton, S. (2011). The Psychological Impacts of Global Climate Change. *American Psychologist*, *66*(4), 265–276. https://doi.org/10.1037/a0023141

Drummond, C., & Fischhoff, B. (2017). Individuals with greater science literacy and education have more polarized beliefs on controversial science topics. *Proceedings of the National Academy of Sciences*, *114*(36), 9587–9592. https://doi.org/10.1073/pnas.1704882114

Farrell, J. (2015). Network structure and influence of the climate change counter-movement. *Nature Climate Change*, *6*(4), 370–374. https://doi.org/10.1038/nclimate2875

Farrell, J. (2016). Corporate funding and ideological polarization about climate change. *Proceedings of the National Academy of Sciences*, *113*(1), 92–97. https://doi.org/10.1073/pnas.1509433112

Franzen, A., & Vogl, D. (2013). Two decades of measuring environmental attitudes: A comparative analysis of 33 countries. *Global Environmental Change*, *23*(5), 1001–1008. https://doi.org/10.1016/j.gloenvcha.2013.03.009

Givens, J. E. (2014). Sociology: Drivers of climate change beliefs. *Nature Climate Change*, *4*(12), 1051–1052. https://doi.org/10.1038/nclimate2453

Hamilton, L. C., Hartter, J., Lemcke-Stampone, M., Moore, D. W., & Safford, T. G. (2015). Tracking public beliefs about anthropogenic climate change. *PLoS ONE*, *10*(9), 1–14. https://doi.org/10.1371/journal.pone.0138208

Hanemann, M., Loureiro, M. L., & Labandeira, X. (2011). Preferencias Sociales sobre Políticas de Cambio Climático : Evidencia para España.

Hmielowski, J. D., Feldman, L., Myers, T. A., Leiserowitz, A., & Maibach, E. (2013). An attack on science? Media use, trust in scientists, and perceptions of global warming. *Public Understanding of Science*, *23*(7), 866–883. https://doi.org/10.1177/0963662513480091

Hope, A. L. B., & Jones, C. R. (2014). The impact of religious faith on attitudes to environmental issues and Carbon Capture and Storage (CCS) technologies: A mixed methods study. *Technology in Society*, *38*, 48–59. https://doi.org/10.1016/j.techsoc.2014.02.003

Hornsey, M. J., Harris, E. A., Bain, P. G., & Fielding, K. S. (2016). Meta-analyses of the determinants and outcomes of belief in climate change. *Nature Climate Change*, *6*(February), 1–6. https://doi.org/10.1038/nclimate2943

Howe, P. D., Markowitz, E. M., Lee, T. M., Ko, C. Y., & Leiserowitz, A. (2012). Global perceptions of local temperature change. *Nature Climate Change*, *3*(4), 352–356. https://doi.org/10.1038/nclimate1768

Howe, P. D., Mildenberger, M., Marlon, J. R., & Leiserowitz, A. (2015). Geographic variation in opinions on climate change at state and local scales in the USA. *Nature Climate Change*, *5*(April), 596–603. https://doi.org/10.1038/NCLIMATE2583

Huxster, J. K., Carmichael, J. T., & Brulle, R. J. (2015). A Macro Political Examination of the Partisan and Ideological Divide in Aggregate Public Concern over Climate Change in the U . S . between 2001 and 2013, *4*(1), 1–15. https://doi.org/10.5296/emsd.v4i1.6531

Kahan, D., Peters, E., Wittlin, M., Slovic, P., Ouellette, L., Braman, D., & Mandel, G. (2012). The polarizing impact of science literacy and numeracy on perceived climate change risks. *Nature Climate Change*, *2*(10), 732–735. https://doi.org/10.1038/nclimate1547

Leas, E. C., Althouse, B. M., Dredze, M., Obradovich, N., Fowler, J. H., Noar, S. M., … Sewell, B. (2016). Big Data Sensors of Organic Advocacy: The Case of Leonardo DiCaprio and Climate Change. *Plos One*, *11*(8), e0159885. https://doi.org/10.1371/journal.pone.0159885

Lee, T. M., Markowitz, E. M., Howe, P. D., Ko, C., & Leiserowitz, A. A. (2015). risk perception around the world, *5*(November). https://doi.org/10.1038/NCLIMATE2728

Leiserowitz, A., Thaker, J., Feinberg, G., & Cooper, D. (2013). (2014). Global Warming ' S Six Indias :, (Global Warming's Six Indias. Yale University. New Haven, CT: Yale Project on Climate Change Communication).

Leiserowitz, a. (2007). International public opinion, perception, and understanding of global climate change. *Human Development Report*, *2008*, 2007.

Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., & Rosenthal, S. (2014). Politics & Global Warming, Spring 2014. *Center for Climate Change Communication - Yale*.

Leiserowitz, A., Maibach, E., Roser-Renouf, C., & Smith, N. (2015). Climate Change in the American Christian Mind. *Americans' Global Warming Beliefts and Attitudes in May 2011*, (September), 19. Retrieved from http://webdev.p2061.org/events/meetings/climate2010/includes/media/presentations/Leiserowitz_AAAS-NSF2.pdf

Leiserowitz, A., & Smith, N. (2010). Knowledge of Climate Change Across Global Warming's Six Americas. *New Haven CT: Yale Project on Climate Change*, 82. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Knowledge+of+Climate+Change+Across+Global+Warming+?+s+Six+Americas#0

Leiserowitz, A., Smith, N., & Marlon, J. R. (2011). American Teens ' Knowledge of Climate Change, 1–63. Retrieved from http://environment.yale.edu/uploads/american-teens-knowledge-of-climate-change.pdf

Leviston, Z., Walker, I., & Morwinski, S. (2012). Your opinion on climate change might not be as common as you think. *Nature Climate Change*, *3*(4), 334–337. https://doi.org/10.1038/nclimate1743

Maibach, E. W., Kreslake, J. M., Roser-Renouf, C., Rosenthal, S., Feinberg, G., & Leiserowitz, A. A. (2015). Do Americans Understand That Global Warming Is Harmful to Human Health? Evidence From a National Survey. *Annals of Global Health*, *81*(3), 396–409. https://doi.org/10.1016/j.aogh.2015.08.010

Maibach, E. W., Roser-Renouf, C., & Leiserowitz, A. (2008). Communication and Marketing As Climate Change–Intervention Assets. *American Journal of Preventive Medicine*, *35*(5), 488–500. https://doi.org/10.1016/j.amepre.2008.08.016

McCright, A. M., Charters, M., Dentzman, K., & Dietz, T. (2016). Examining the Effectiveness of Climate Change Frames in the Face of a Climate Change Denial Counter-Frame. *Topics in Cognitive Science*, *8*(1), 76–97. https://doi.org/10.1111/tops.12171

McCright, A. M., Marquart-Pyatt, S. T., Shwom, R. L., Brechin, S. R., & Allen, S. (2016). Ideology, capitalism, and climate: Explaining public views about climate change in the United States. *Energy Research and Social Science*, *21*, 180–189. https://doi.org/10.1016/j.erss.2016.08.003

Meira, P., Arto, M., & Montero, P. (2009). *La sociedad ante el cambio climático. Conocimientos, valoraciones y comportamientos en la población española*. *Vasa*. Retrieved from http://medcontent.metapress.com/index/A65RM03P4874243N.pdf%5Cnhttp://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:La+sociedad+ante+el+cambio+clim?tico.+Conocimientos,+valoraciones+y+comportamientos+en+la+poblaci?n+espa?ola#0

Mildenberger, M., & Leiserowitz, A. (2017). Public opinion on climate change: Is there an economy–environment tradeoff? Environmental Politics, 26(5), 801–824. https://doi.org/10.1080/09644016.2017.1322275

Miller-Hesed, C. D. M., & Paolisso, M. (2015). African American communities, 5(June). https://doi.org/10.1038/NCLIMATE2668

Moyano, E., Paniagua, Á., & Lafuente, R. (2009). Políticas ambientales, cambio climático y opinión pública en escenarios regionales. El caso de Andalucía. *Revista Internacional de Sociología*, *67*(3), 681–699. https://doi.org/10.3989/ris.2008.01.23

Myers, T. A., Maibach, E. W., Roser-Renouf, C., Akerlof, K., & Leiserowitz, A. A. (2012). The relationship between personal experience and belief in the reality of global warming. *Nature Climate Change*, *3*(4), 343–347. https://doi.org/10.1038/nclimate1754

O'Neill, S., Williams, H. T. P., Kurz, T., Wiersma, B., & Boykoff, M. (2015). Dominant frames in legacy and social media coverage of the IPCC Fifth Assessment Report. *Nature Climate Change*, *5*(April), 380–385. https://doi.org/10.1038/nclimate2535

Plutzer, E., Mccaffrey, M., Hannah, A. L., Rosenau, J., Berbeco, M., & Reid, A. H. (2016). Climate confusion among U.S. teachers. *Science*, *351*(6274), 664–665. https://doi.org/10.1126/science.aab3907

Scruggs, L., & Benegal, S. (2012). Declining public concern about climate change: Can we blame the great recession? *Global Environmental Change*, *22*(2), 505–515. https://doi.org/10.1016/j.gloenvcha.2012.01.002

Shi, F., Shi, Y., Dokshin, F. A., Evans, J. A., & MacY, M. W. (2017). Millions of online book co-purchases reveal partisan differences in the consumption of science. *Nature Human Behaviour*, *1*(4), 1–9. https://doi.org/10.1038/s41562-017-0079

Shi, J., Visschers, V. H. M., Siegrist, M., & Arvai, J. (2016). Knowledge as a driver of public perceptions about climate change reassessed. *Nature Climate Change*, *6*(8), 759–762. https://doi.org/10.1038/nclimate2997

Smith, W. J., Liu, Z., Safi, A. S., & Chief, K. (2014). Climate change perception, observation and policy support in rural Nevada: A comparative analysis of Native Americans, non-native ranchers and farmers and mainstream America. *Environmental Science and Policy*, *42*, 101–122. https://doi.org/10.1016/j.envsci.2014.03.007

Stern, P. C. (2016). Sociology: Impacts on climate change views. *Nature Climate Change*, *6*(4), 341–342. https://doi.org/10.1038/nclimate2970

Sulemana, I., James, H. S., & Valdivia, C. B. (2016). Perceived socioeconomic status as a predictor of environmental concern in African and developed countries. *Journal of Environmental Psychology*, *46*, 83–95. https://doi.org/10.1016/j.jenvp.2016.04.002

Taylor, A. L., Dessai, S., & Bruine de Bruin, W. (2014). Public perception of climate risk and adaptation in the UK: A review of the literature. *Climate Risk Management*, *4*, 1–16. https://doi.org/10.1016/j.crm.2014.09.001

Tjernström, E., & Tietenberg, T. (2008). Do differences in attitudes explain differences in national climate change policies? *Ecological Economics*, *65*, 315–324. https://doi.org/10.1016/j.ecolecon.2007.06.019

van der Linden, S. (2014). On the relationship between personal experience, affect and risk perception:The case of climate change. *European Journal of Social Psychology*, *44*(5), 430–440. https://doi.org/10.1002/ejsp.2008

van der Linden, S. (2015). The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model. *Journal of Environmental Psychology*, *41*, 112–124. https://doi.org/10.1016/j.jenvp.2014.11.012

van der Linden, S., Leiserowitz, A., Rosenthal, S., & Maibach, E. (2017). Inoculating the Public against Misinformation about Climate Change. *Global Challenges*, *1*(2), 1600008. https://doi.org/10.1002/gch2.201600008

Weber, E. U. (2016). What shapes perceptions of climate change? New research since 2010. *Wiley Interdisciplinary Reviews: Climate Change*, *7*(1), 125–134. https://doi.org/10.1002/wcc.377

Zaval, L., Keenan, E. A., Johnson, E. J., & Weber, E. U. (2014). How warm days increase belief in global warming. *Nature Climate Change*, *4*(2), 143–147. https://doi.org/10.1038/nclimate2093

Supplementary Information 2

Information of the raw data extracted from the 64 studies. Abbreviations stand for: (SB) survery-based study (SD) social disclosure, (SA) secondary analysis, (MA) meta-analysis, (PR) peer-reviewed, (GL) grey literature, (QN) quantitative, (QL) qualitative, (+) positive interaction, (-) negative interaction, (0) neutral interaction.

Ref.	Date of info	Area of study	Data	Type of study			(+) to CCP	(-) to CCP	(0) to CCP	(+) drivers	(-) drivers	(0) drivers
Akerlof et al., 2010	2008–2009	International	4,307 questionaires	SB	PR	QN	45, 81			45 to 81	125 to 45	
Beder, 2014	2008–2010 [web], 1995–2013 [gray lit]	United States (US)	77 corporation activities	SD	GL	QL		111, 112, 114, 115		115 to 102, 103, 112, 114, 111	115 to 33	
Bliuc et al., 2015	2013	United States (US)	448 questionaries	SB	PR	QN	51		71, 72, 103, 31, 81, 85, 86	51 to 81, 85, 86		
Bord et al., 1998	1997	International	1,225 questionaries	SB	PR	QN	71, 86, 81		93	125 to 93		
Brechin, 2003	1989–2002	International	24 countries	SA	PR	QN	31, 87, 51, 93, 72		71	102 to 81		71 to 72 / 51 to 93
Briggs et al., 2014	2012–2014	United Kingdom (UK)	>200 articles	SA	GL	QN	31, 32, 33, 101, 102, 103, 104			31 to 104, 84	102 to 31	
Brügger et al., 2015	–	International	–	SD	PR	QL	41, 42, 43, 44, 45, 86, 85, 81	41, 42, 43, 44, 45	41, 42, 43, 44, 45, 81, 85	85, 86 to 42, 43, 93 / 42, 43 to 86 / 41 to 93 / 41, 42, 43, 44, 45 to 81	85 to 42, 43, 93 / 42, 43 to 86	
Brulle et al., 2012	2002–2010	United States (US)	74 surveys	SA	PR	QN	112, 51, 91, 103,		41, 31	103 to 51 / 51 to 42, 81, 84 / 91, 94 to 102,	51 to 94	111, 112, 114, 115 to 81, 51

							102, 104, 81			103, 104 / 111, 112, 114, 115 to 94		
Budescu et al., 2014	–	International	10,792 questionaries	SB	PR	QN	87, 86, 103, 71, 72, 104, 81			101, 103, 104 to 86, 87		
Capstick et al., 2015	1980–2014	International	33 studies	MA	PR	QN	51, 102, 103, 42, 44, 91, 33, 71, 87, 86, 111, 112, 114, 115	102, 112, 114, 115, 94, 81	103	102, 103 to 51, 87, 86, 81 / 51 to 42, 87, 86 / 91, 94 to 102, 103, 104, 86 / 85, 51 to 86 / 101, 102, 86 to 87, 81 / 42 to 86, 81 / 42, 44 to 85	102, 103 to 51, 87, 86, 81, 33 / 101, 102, 86 to 87 / 42 to 86, 81 / 111, 112, 114, 115 to 86	
Carmichael and Brulle, 2016	2002–2013	United States (US)	74 survey	SA	PR	QN	41, 42, 51, 102, 91		41,103, 111, 112, 114, 115	111, 112, 114, 115 to 104 / 91 to 102		103, 104 to 102
Chan et al., 2016	–	–	–	SD	PR	QL	81, 85, 86	85		61 to 84, 86 / 85 to 86 / 86 to 81		
Chuang et al., 2016	–	China	453 survey	SB	PR	QN	85, 86			85 to 86, 93 / 86 to 85		
Clayton et al., 2015	–	–	–	SD	PR	QL	41, 42, 43, 44, 45, 85, 86, 84, 104, 51, 33, 102, 104	102, 85	71, 31, 32	111, 102, 103, 104 to 71, 72, 31, 33 / 41, 42, 43, 44, 45 to 81	102, 103, 104 to 71, 72, 31, 33	
Cook and Lewandowsky, 2016	2013	International	735 questionaries	SB	PR	QN	33, 87, 84, 94	94		33 to 87 / 51 to 33, 87 / 86 to 84 / 94 to 33	94 to 33, 84, 87 / 51 to 54	
Cook et al., 2013	1991–2011	International	11,944 studies	MA	PR	QN	33	111, 112, 114, 115			111, 112, 114, 115, 102, 103 to 33	
Doherty and Clayton, 2011	–	–	–	SD	PR	QL	41, 42, 43, 44,			41, 42, 43, 44, 45 to 81, 85, 86		

							45, 81, 84, 85, 86					
Drummond and Fischhoff, 2017	2006 and 2010	United States (US)	GSS Data	SA	PR	QN	51, 71, 72, 84	71, 72	61	51, 71, 84 to 87 / 71 to 51, 61	71 to 51, 61	61 to 87
Farrell, 2015	1993–2003	United States (US)	24,659 documents	MA	PR	QN		94, 111, 112, 114, 115, 101, 102		94 to 111, 112, 114, 115 / 111, 112, 114, 115 to 101, 102 / 111 to 111, 112, 114, 115 / 112 to 111, 112, 114, 115 / 114 to 111, 112, 114, 115 / 115 to 111, 112, 114, 115	111, 112, 114, 115 to 33	
Farrell, 2016	1993–2003	United States (US)	40,785 texts	MA	PR	QN		94, 111, 112, 114, 115, 101, 102		94 to 111, 112, 114, 115 / 111, 112, 114, 115 to 101, 102	111, 112, 114, 115 to 33	
Franzen and Vogl, 2013	2010–2012	International	33 countires	SA	PR	QN	51, 71, 81, 85, 86, 91, 125, 72, 84		122, 123	122, 123 to 81 / 71 to 33, 81 / 51, 84 to 87, 81 / 125 to 91 / 91 to 81, 93		
Givens, 2014	2012	United States (US)	7 papers	SA	PR	QN	86, 33, 51		42	86 to 33, 42 / 33 to 87 / 51 to 42, 87		
Hamilton et al., 2015	2010–2015	United States (US)	28,000 questionaries	SB	PR	QN	122, 71, 72, 125, 51, 33, 87	112	41, 42	51 to 71, 72, 87, 81 / 123 to 33	111, 112, 114, 115 to 87, 81 / 122 to 33	
Hanemann et al., 2011	2010	Spain	750 questionaries	SB	GL	QN	85	85	93	85 to 93		81, 71, 42, 86, 87 to 93
Hmielovski et al., 2013	2008	United States (US)	1,036 questionaries	SA	PR	QN	21, 51, 101	101		111, 112, 114, 115 to 102, 103, 104 / 21 to 84	102, 103, 104 to 87	

Hope and Jones, 2014	2012	United Kingdom (UK)	18 people	SB	PR	QN	86	61	61	61 to 86, 84		
Hornsey et al., 2016	–	International	25 questionaroes & 171 studies	MA	PR	QN	33, 41, 42, 51, 71, 86, 91, 112, 121, 123, 122	94, 85		85, 86, 71, 41,42 to 87 / 112 to 86/115 to 94, 94 to 115 / 86, 84 to 71	94 to 33, 71	
Howe et al., 2012	–	International	91,073 questionaries	SB	PR	QN	42			41, 42 to 87 / 122, 123 to 42		
Howe et al., 2015	–	United States (US)	3,143 US coun tries	SA	PR	QN	121, 122, 123, 125, 85, 86			125, 85 to 86, 51, 71, 87 / 125 to 85		
Huxster, 2015	2001–2013	United States (US)	Roper iPoll Database	SA	PR	QN	51			51 to 87, 86, 84, 51		
Kahan et al., 2012	2012	United States (US)	1,540 questionaries	SB	PR	QN	81, 85, 86 71		72	72 to 87 / 72 to 72 / 104 to 84, 72 / 85 to 81, 84, 86, 87 / 86 to 81, 87	85 to 81	72 to 81, 45
Leas et al., 2016	2011–2016	International	Bloomberg l, Google searc Twitter	SA	PR	QN	21			21 to 101, 102, 104, 72		
Lee et al., 2015	2015	International	119 countries	MA	PR	QN	71, 87, 86, 101, 85, 125, 51, 103, 104, 42, 41, 93	123, 122, 45	91	125 to 71, 72, 101, 85, 91,/ 71 to 71, 72 / 91 to 41, 42, 71, 72	125 to 41, 42, 43, 44, 45, 85 / 91 to 43, 44, 45	
Leiserowitz et al 2014	2014	United States (US)	860 questionaries	SB	GL	QN	51			51 to 87, 93, 94		
Leiserowitz et al., 2010	2010	United States (US)	2,030 questionaries	SB	GL	QN	81, 86, 87, 33, 72			81 to 87, 33, 72, 84	85 to 84, 87	
Leiserowitz et al., 2011a	2010	United States (US)	2,130 questionaries	SB	GL	QN			122	122 to 71, 72, 87		122 to 33

Leiserowitz et al., 2013	2011	India	4,031 questionaries	SB	GL	QN	81, 87, 86, 42	86	87	125 to 71	125 to 93	125 to 86, 42, 41, 87, 81, 84
Leiserowitz et al., 2015a	2015	United States (US)	1,263 questionaries	SB	GL	QN	61, 86			61 to 93, 86, 44, 45	61 to 33	
Leiserowitz, 2007	2007	International	Sur-veys	SB	GL	QN	125, 71, 45, 41, 42, 93, 87			125 to 71, 41, 43 / 81 to 41, 42, 43, 44, 45	125 to 44, 45, 43, 42, 41	125 to 87
Leviston et al., 2012	2010–2011	Australia	10,066 questionaries	SB	PR	QN	85, 86, 51			85 to 85, 84, 86, 81 / 86 to 85	85 to 84, 86, 81 / 86 to 85	
Maibach et al., 2008b	–	United States (US)	<100 studies	SD	PR	QL	102, 103, 104, 111, 112	115		111, 112, 102, 103, 104 to 81, 45, 44		
Maibach et al., 2015	2014	United States (US)	1,275 questionaries	SB	PR	QL	45, 104, 71			103, 104, 71 to 45, 81, 84 / 72 to 45		
McCright et al., 2016a	2014	United States (US)	1,591 questionaries	SA	PR	QN	93	111, 112, 114, 115	61, 45	51 to 84, 87, 93	51 to 94 / 111, 112, 114, 115 to 87, 72, 103, 33, 86, 84, 41, 42, 43, 44, 45	93, 61, 45 to 87
McCright et al., 2016b	1998–2016	International	25 studies	SA	PR	QN	81, 86, 87, 51, 123, 71, 33, 42, 84		123, 122, 91, 61, 121, 42, 41	51 to 81, 85, 86 / 84 to 87		
McCright et al., 2016b	1998-2016	United States (US)	62 studies	SA	PR	QN	51, 86, 121	94, 111, 112, 114, 115		81 to 87 / 111, 112, 114, 115 to 94 / 51 to 71, 72	111, 112, 114, 115 to 33, 51, 87, 103	
Meira-Cartea et al., 2009	2008	Spain	1,200 questionaries	SB	GL	QN	71, 101, 42, 45, 93		32, 21	101, 104 , 21 to 72 / 123 to 93 / 125 to 41, 42 / 122 to 101, 93	71 to 101 / 123 to 102, 72	
Mildenberger and Leiserowitz, 2017	2008–2011	United States (US)	1,043 survey	SB	PR	QN			91		91 to 87	

Miller-Hesed and Paolisso, 2015	2012	United States (US)	65 questionaries	SB	PR	QN	121, 41			121 to 85, 61, 125 / 41 to 121 / 121, 122 to 21, 51		
Moyano et al., 2009	2001–2009	Spain	Ecobarómetro	SB	PR	QN	125, 42			42, 43 to 81		
Myers et al., 2012	2008–2011	United States (US)	1,301 questionaries	SA	PR	QN			123, 71, 91	45, 42, 43, 41, 44 to 85, 81, 87 / 86, 85, 87, 84 to 41, 42, 43, 44, 45		
O'Neill et al., 2015	2015	International	9 media chanel	SA	PR	QN	101, 102, 103, 104			101, 102, 103, 104 to 71, 72 / 103 to 84, 87 / 122 to 21		
Plutzer et al., 2016	2014–2015	United States (US)	1,500 questionaires	SB	PR	QN	71, 33, 104, 72			71 to 72, 84, 87 / 33 to 72, 84, 87 / 104 to 71, 72, 84, 87	111 to 33, 87	
Scruggs and Benegal, 2012	1980–2012	United States (US)	Sur-veys	SA	PR	QL	42, 91	94		91, 42 to 87, 81 / 91 to 93	111, 112, 114, 115 to 87	
Shi et al., 2016	2014	International	2,495 questionaries	SB	PR	QN	86, 85, 104, 123, 122, 71, 72		71, 72	71, 86 to 87, 81 / 86 to 42, 44, 45, 87, 81 / 104 to 71, 72		
Shi et al., 2017	2013	United States (US)	1,449,525 books	MA	PR	QN	51			51 to 31, 33, 72, 81, 84, 87, 104		
Smith et al., 2014	2013	United States (US)	1,054 questionaries	SA	PR	QN	71, 42, 45, 41, 51		87, 122	51 to 41, 42, 44, 45, 71, 85, 87 / 123 to 81 / 44 to 61	125 to 41, 42, 43, 44, 45, 87	
Stern, 2016	–	International	15 studies	SD	PR	QL	51, 86	111, 112, 114, 115		71, 72 to 81, 84, 85 / 86 to 81, 93	111, 112, 114, 115 to 33, 51	71, 72 to 41, 42, 43, 44, 45
Sulemana et al., 2016	–	International	Fifth Wave of the World Values Survey	SA	PR	QN	41, 42, 43, 44, 45		91	42, 43, 44, 45, 91 to 93	125 to 41, 42, 43, 44, 45 / 94 to 93	125 to 93
Taylor et al., 2014	–	United Kingdom (UK)	44 studies	SA	PR	QL	42, 51, 85	42, 85		81, 86 to 93 / 51 to 93 / 104, 42 to 81	42 to 81	41, 42, 87 to 93

Tjernström and Tietenberg, 2008	–	International	<20 studies	SA	PR	QN	71, 125, 84	91	61	71 to 41, 42, 43, 44, 45, 81 / 125 to 81, 84 / 122 to 81	33, 87 to 81	
van der Linden, 2014	2013	United Kingdom (UK)	808 questionaries	SB	PR	QN	41, 81			41 to 81 / 86 to 81 / 81 to 86 / 71 to 86		
van der Linden, 2015	2007–2013	United Kingdom (UK)	10 studies	MA	PR	QN	123, 51, 41, 42, 45		91, 71, 122			
van der Linden, 2017	–	United States (US)	2,167 questionaries	SB	PR	QN	33, 104, 51	112, 114, 115		33 to 51, 87 / 104 to 33, 51	112, 114, 115 to 33	33 to 94
Weber, 2016	2010–2015	International	–	SD	PR	QL	42, 122, 123			41, 42 to 93 / 81 to 87 / 87 to 81 / 41, 42, 43, 44, 45 to 81 / 81, 85 to 87, 93		
Zaval et al., 2014	2013	United States (US)	5 studies	SA	PR	QL	42, 45			42 to 81, 84, 86 / 45 to 86		42 to 51, 71, 91, 122, 123 / 71 to 42

Supplementary Information 3

Information for Figure 2

Quantification of influence of drivers to CCP
id, (+) to CC, (-) to CC, (0) toCC
(a) International
31,2,0,1
32,1,0,2
33,7,0,0
71,11,0,4
72,4,0,1
41,9,1,2
42,16,2,2
43,4,1,1
44,5,1,1
45,8,2,1
81,10,1,1
84,6,0,0
85,11,5,1
86,17,1,0
87,8,0,1
61,0,1,3
51,11,0,0
91,3,1,4
93,4,0,2
94,1,3,0
101,4,0,0
102,4,2,0
103,5,0,1
104,6,0,0
21,2,0,2
111,1,2,0
112,2,3,0
114,1,3,0
115,1,3,0
121,1,0,1
122,3,1,3
123,5,1,2
125,5,0,0
(b) USA
31,0,0,2
32,0,0,0
33,5,0,0
71,6,1,2
72,4,1,2
41,3,0,3
42,4,0,2
43,0,0,0
44,0,0,0
45,3,0,1
81,3,0,1
84,1,0,0
85,2,0,1
86,6,0,1
87,2,0,1
61,1,0,2
51,13,0,0
91,3,0,2
93,1,0,0
94,0,4,0
101,1,3,0
102,3,2,0
103,2,0,2
104,5,0,0
21,4,0,0
111,1,5,1
112,2,7,1
114,0,6,1
115,0,7,1
121,3,0,0
122,2,0,2
123,1,0,1
125,2,0,0

Supplementary Information 4

Information for Figure 3

Quantification of the interaction between drivers
(a) International
Source,Target,Weight
Positive
31,104,1
31,84,1
45,81,1
125,93,2
102,81,3
85,42,1
85,43,1
85,93,1
86,42,2
86,43,1
86,93,3
86,85,2
42,86,2
43,86,1
41,93,2
41,81,3

42,81,5
43,81,3
44,81,2
71,86,2
101,86,1
81,61,1
85,84,1
85,85,1
103,86,2
103,87,3
104,86,1
104,87,1
102,51,1
102,87,2
102,86,1
103,51,1
101,21,1
103,81,1
104,21,1
104,81,1
121,42,1
122,101,1
122,93,1
123,93,1

51,93,1
51,42,1
51,87,3
51,86,3
61,84,2
91,102,1
91,103,1
91,104,1
91,86,1
94,102,1
94,103,1
94,104,1
94,86,1
85,86,4
101,81,1
86,87,4
86,81,5
42,85,1
44,85,1
42,93,2
43,93,1
44,93,1
45,93,1
33,87,1

51,33,1
81,87,2
81,93,1
86,84,1
112,81,1
123,81,1
71,33,1
71,81,4
51,81,2
51,85,1
84,87,2
84,81,1
125,91,1
91,81,1
91,93,2
71,41,1
71,42,1
71,43,1
71,44,1
71,45,1
125,81,1
125,84,1
122,81,1
85,87,2

71,87,2
41,87,2
42,87,2
112,86,1
115,94,1
94,115,1
86,71,1
84,71,1
122,42,1
123,42,1
21,101,1
21,102,1
21,104,1
21,72,1
125,71,3
125,72,1
125,101,1
125,85,1
71,71,1
71,72,1
91,41,1
91,42,1
91,71,1
91,72,1

125,41,2
125,43,1
81,41,1
81,42,1
81,43,1
81,44,1
81,45,1
85,93,2
87,81,1
101,71,1
101,72,2
102,71,1
102,72,1
103,71,1
103,72,1
104,71,2
104,72,3
103,84,1
122,21,1
86,44,1
86,45,1
71,84,1
71,85,1
72,81,1
72,84,1
72,85,1

Negative
85,42,1
85,43,1
85,93,1
42,86,3
43,86,11
102,51,1
102,87,2
102,86,2
102,81,1
102,33,2
103,51,1
103,87,1
103,86,1
103,81,1
103,33,2
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112,33,2
114,33,2

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112,51,1
114,51,1
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94,33,2
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71,101,1
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86,85,1
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125,42,3
125,43,3
125,44,3
125,45,3
125,85,1
91,43,1
91,44,1

91,45,1
33,81,1
87,81,1
Neutral
71,51,1
71,93,1
72,51,1
72,93,1
125,87,1
125,93,1
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71,42,1
71,43,1
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125,86,1
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125,81,1
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41,93,1
42,93,2
71,93,1
81,93,1
86,93,1
87,93,2

(b) USA
Positive
115,102,3
115,103,2
115,112,2
115,114,2
115,111,2
51,81,4
51,85,2
51,86,2
71,51,1
71,61,1
103,51,1
51,42,3
51,84,4
91,102,2
91,103,1
91,104,1

94,102,1	114,114,1	125,85,1	103,81,2	43,85,1
94,103,1	114,115,1	51,51,1	104,81,2	44,85,1
94,104,1	115,115,1	72,87,1	111,45,1	41,85,1
112,94,2	111,111,1	72,72,1	112,45,1	45,81,1
81,61,1	86,33,1	104,72,2	102,45,1	42,81,3
115,94,2	86,42,2	104,84,3	103,45,2	43,81,1
111,94,2	33,87,3	84,87,1	104,45,2	44,81,1
94,112,2	51,87,8	85,81,1	111,44,1	41,81,1
94,114,2	51,71,3	85,84,1	112,44,1	45,87,1
94,115,2	51,72,3	86,81,1	102,44,1	42,87,2
94,111,2	123,33,1	86,87,1	103,44,1	43,87,1
112,101,2	111,103,1	51,93,2	104,44,1	44,87,1
114,101,2	112,103,1	51,94,1	103,84,1	41,87,1
115,101,2	114,103,1	81,87,2	71,45,1	86,43,1
111,101,2	111,104,2	81,33,1	71,81,1	86,44,1
112,102,3	112,104,2	81,72,1	71,84,2	86,41,1
114,102,3	114,104,2	81,84,1	72,45,1	86,45,1
111,102,3	115,104,2	122,71,1	121,85,1	85,42,1
111,112,1	21,84,1	122,72,1	121,61,1	85,43,1
111,114,1	125,86,1	122,87,1	121,125,1	85,44,1
111,115,1	125,51,1	61,93,1	41,121,1	85,41,1
112,111,1	125,71,1	61,86,1	121,21,1	85,45,1
112,112,1	125,87,1	61,44,1	121,51,1	87,42,1
112,114,1	85,86,2	61,45,1	122,21,1	87,43,1
112,115,1	85,51,1	111,81,1	122,51,1	87,44,1
114,111,1	85,71,1	112,81,1	45,85,1	87,41,1
114,112,1	85,87,2	102,81,1	42,85,1	87,45,1

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71,72,1
71,87,2
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42,51,1
42,71,1
42,91,1
42,122,1
42,123,1
71,42,1
103,102,1
103,104,1

Supplementary Information 5

Information for Figure 4

(a) International			(b) USA		
id	**Influence to CCP**	**Driver's connectivity**	**id**	**Influence to CCP**	**Driver's connectivity**
21	4	0,1062	21	4	0,1149
31	3	0,0304	31	2	0,0001
33	7	0,2576	33	5	0,5576
41	12	0,2728	41	6	0,2133
42	20	0,5151	42	6	0,4264
43	6	0,4091	43	0	0,1805
44	7	0,1819	44	0	0,3116
45	11	0,1516	45	4	0,4100
51	11	0,3182	51	13	0,9511
61	4	0,0304	61	3	0,1805
71	15	0,5757	71	9	0,3116
72	5	0,3182	72	7	0,2789
81	12	0,8333	81	4	0,6232
84	6	0,2273	84	1	0,4100
85	17	0,4394	85	3	0,3936
86	18	0,9999	86	7	0,3280
87	9	0,5454	87	3	1,0003
91	8	0,2122	91	5	0,1313
93	6	0,5151	93	1	0,0657
94	4	0,1667	94	4	0,3280
101	4	0,1667	101	4	0,1149
102	6	0,3182	102	5	0,3116
103	6	0,2576	103	4	0,3936
104	6	0,1819	104	5	0,4264
111	3	0,0456	111	7	0,7543
112	5	0,0759	112	10	0,7379
114	4	0,0456	114	7	0,6560
115	4	0,0759	115	8	0,7379
121	2	0,0001	121	3	0,0821
122	7	0,0607	122	4	0,1149
123	8	0,0607	123	2	0,0329
125	5	0,5757	125	2	0,1805

ID rename

Driver class Driver	raw id	paper id
Education and awareness of scientific work		
Consumption of scientific articles	31	1
Direct dealing with scientists	32	2
Awareness of scientific climate consensus	33	3
Self-perceived knowledge on CC	71	4
CC science literacy	72	5
Media exposure		
Media access	101	6
Volume of CC coverage	102	7
Popular media reports	103	8
Transdisciplinary communication	104	9
Online platforms	21	10
Influence of corporations		
Conservative public relations firms	111	11
Conservative elite cues	112	12
Conservative think tanks	114	13
Energy and oil sectors	115	14
Ethnography		
Emotional concern about CC	81	15
Trust	84	16
Collectivistic culture	85	17
Socio-altruistic values	86	18
Belief in anthropogenic CC	87	19
Religiosity	61	20
Liberalism supporter	51	21
Wealth		
Prosperity	91	22
Willingness to pay for CC polices	93	23
Free-market support	94	24
Personal experience and perception		
Extreme weather events	41	25
Changed weather	42	26
Loss of agricultural activity	43	27
Threatened cultures and ecosystems	44	28
Health impact	45	29
Demographics		
Non-white fraction	121	30
Young fraction	122	31
Female fraction	123	32
Urban community/developed nation	125	33