

ARTICLE

Who are the 3 Per Cent? The Connections Among Climate Change Contrarians

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Abstract

Despite 97 per cent of scientists agreeing on anthropogenic global warming, the remaining 3 per cent play a critical role in keeping the debate about climate consensus alive. Analysis of climate change contrarians from multi-signatory documents reveals 3 per cent of signees to be climate experts, while the remaining 97 per cent do not meet expert criteria and are also involved with organizations and industries who make up the climate change countermovement. The data also reveal most contrarians to be aged sixty-five or older. As a result, we explore other factors (for example, collective memories and ideological views) that may have also contributed to expert and non-expert views.

Keywords: climate change; climate change denial; neoliberalism; collective memories; think tanks; laissez-faire economics

In September 2019, Greta Thunberg, a sixteen-year-old Swedish climate change activist, gave an impassioned speech to hundreds of world leaders at the United Nations calling for action to mitigate climate change: “For more than [thirty] years,” she exclaimed, “The science has been crystal clear. How dare you continue to look away” (Weise 2019, para. 7). As Thunberg asserted, we have known about the dangers of human impact on the environment for decades. Unfortunately, politics impedes action against climate change, providing a cover used by conservative leaders to subvert climate mitigation policies. Climate change contrarians¹ play a critical role in perpetuating this cover by keeping the debate about climate change alive in the political and public arenas—even though it is settled in the scientific realm.

Though few in number, 3 per cent of climate scientists and peer-reviewed climate science papers reject the consensus not only that is climate change occurring, but also that it is happening as a result of human activity (Anderegg et al. 2010; Cook et al. 2013; Cook et al. 2016; Doran and Zimmerman 2009; Pew Research Center 2015). These individuals and publications play a role in progressing the climate change countermovement and allow leaders to point to them as evidence to justify inaction (Boykoff 2011; McCright and Dunlap 2011a; McKewon 2012). Such efforts are just one way “conservative think tanks, advocacy groups, trade associations and conservative foundations, with strong links to sympathetic media outlets and conservative politicians” work to subvert the mainstream climate consensus (Brulle 2014, 692).

Climate change is a critical issue that must be addressed by policy makers (IPCC 2020). Therefore, understanding who is responsible for fueling the debate regarding climate change, as well as why they continue to push contrarian viewpoints, is important if leaders are to

¹We use the term “contrarian” to describe individuals “who vocally challenge what they see as a false consensus of mainstream climate science through critical attacks on climate science and eminent climate scientists, often with substantial financial support from fossil fuels industry organizations and conservative think tanks” (O’Neill and Boykoff 2010, para. 3; see also McCright 2007).

overcome the obstacles posed by these individuals. Others have documented the people and publications that make up the 3 per cent, as well as the intricate web of the climate change counter-movement with which they are connected; however, we seek not only to broaden understanding of who makes up this small cohort of experts, but also to understand similarities between experts and non-experts who share the same views.

Before providing an overview of the individuals compiled in the data, we briefly discuss the history of the climate change science debate. Following analysis of the data, we discuss potential reasons why these individuals may hold contrarian views, for example, events, experiences, and ideological attitudes of certain periods that may influence attitudes toward science and/or government. Importantly, we find support for prior research that calls into question the ability of the 3 per cent to render an expert opinion on the causes and implications of climate change.

Background

Although it is hard to pinpoint when climate science first emerged, it was in 1822 that Jean-Baptiste Joseph Fourier suggested that the Earth is insulated by its atmosphere. Eunice Foote in 1856, as well as John Tyndall in 1859, reported findings on how specific elements (that is, water vapor and carbon dioxide) absorb heat, providing the foundation for what would later be known as the greenhouse effect.² At the turn of the 20th century, Svante Arrhenius made the first argument that human CO₂ emissions would prevent earth from entering the next ice age. On August 14, 1912, in what is believed to be the first newspaper to report on climate change and its link to fossil fuels, the *Rodney and Otamatea Times* printed a brief paragraph in the “science notes and news” section which “warned that the Earth’s atmosphere was changing because of ... [increased] production of fossil fuels” (Brueck 2018, paras 2–3). Despite these early indicators, little attention was paid to these findings. In fact, it would not be until the 1950s that the human impact on the atmosphere slowly began to shift into the mainstream focus.

The 1950s and 1960s saw advancement in space exploration, and with it came a greater understanding of Earth and its atmosphere. Climate change research also began to flourish, with organizations such as the International Global Atmospheric Research Program established to further scientific understanding of weather patterns and climate change. By the end of the 1970s, the scientific community was largely in consensus that global warming was the main environmental risk facing the next century. Unfortunately, just as scientific consensus emerged, so too did political backlash and the rise of neoliberal ideology (Weart 2008). With the changing political climate came an increased effort to challenge the forming scientific consensus regarding the cause and impact of climate change.

Despite political and ideological pushback, the scientific community continued to build upon its knowledge of climate change, reaching near-unanimous consensus on its cause. Naomi Oreskes (2004), for example, found that among 928 abstracts of peer-reviewed papers on anthropogenic global warming (AGW) published between 1993 and 2003, none disagreed with the consensus position on climate change. Doran and Zimmerman (2009, 23) conducted a survey of Earth scientists and determined: “The debate on the authenticity of global warming and the role played by human activity is largely nonexistent among those who understand the nuances and scientific basis of long-term climate processes.” Moreover, they found “the most specialized and knowledgeable respondents (with regard to climate change)” to be the ones who acknowledge overwhelmingly (at a rate of 96.2 per cent) not only that climate change is occurring, but also that

²In addition, Foote (1856, 383) implied how such effects might cause climate change: “An atmosphere of that gas would give our earth a high temperature”; she concluded, “and if as some suppose, at one period of its history the air had mixed with it a larger proportion than at present, an increased temperature from its own action as well as from increased weight must have necessarily resulted” (see also Jackson 2019).

it is happening as a result of human activity (Doran and Zimmerman 2009, 23). Anderegg et al. (2010) evaluated peer-reviewed climate science papers and multi-signatory documents to find 97 to 98 per cent of top climate researchers agree with the consensus; Cook et al. (2013) also found consensus among climate science papers published between 1991 and 2011. Specifically, following analysis of $\approx 12,000$ abstracts and $\approx 1,200$ self-ratings from peer-reviewed climate science papers, Cook et al. found that of those that stated a position on AGW, 97 per cent endorsed the consensus that climate change is real and a result of human activity. Furthermore, of the 3 per cent of papers that expressed a position on AGW but did not endorse the consensus, 2 per cent rejected the consensus on AGW and 1 per cent was undecided. In addition, more than 66 per cent of abstracts stated no explicit position on AGW, suggesting that “the fundamental science of AGW is no longer controversial among the publishing science community and the remaining debate in the field has moved to other topics” (Cook et al. 2013, 4).

Nevertheless, pushback continued, even within the research realm. Peiser (2005), for example, criticized Oreskes’s work for bias. Specifically, Peiser accused Oreskes of ignoring articles contrary to mainstream opinion. As Oreskes pointed out, however, Peiser’s rejection of the study was itself flawed since most of the thirty-four articles Peiser listed upheld the mainstream consensus, with the remaining articles lacking credibility.³ Peiser ultimately recanted his criticisms, further reinforcing scientific consensus regarding climate change (Beck 2006). Doran and Zimmerman’s research was also met with criticism over its sampling methods, sample size, and wording of questions; critics also claim the study is too narrow regarding who the authors consider an expert (Idso, Carter, and Singer 2015). Cook et al.’s research was scrutinized for sampling bias and for its methods, too (Tol 2016). Nevertheless, continued research supports their findings and consistently shows “agreement on AGW is overwhelmingly high because the supporting evidence is overwhelmingly strong” (Cook et al. 2016, para. 23).

Moreover, the 2 per cent of peer-reviewed papers that reject AGW actually provide additional evidence in favor of the climate change consensus (Benestad et al. 2016). Closer examination of thirty-eight papers that refute the 97 per cent consensus reveals all to have flaws rendering their conclusions invalid. The main errors identified were all related to the way the authors tested the data. As Dana Nuccitelli (2015, para. 10) describes: “the 2–3 per cent of papers that reject that consensus are all over the map, even contradicting each other. The one thing they seem to have in common is methodological flaws like cherry picking, curve fitting, ignoring inconvenient data, and disregarding known physics.” Additionally, co-author Katharine Hayhoe found: “Every single one of those analyses had an error—in their assumptions, methodology, or analysis—that, when corrected, brought their results into line with the scientific consensus” (Foley 2017, para. 5).

Several authors of flawed anti-consensus papers also authored books on the same topic (Dunlap and Jacques 2013). Like the articles, Dunlap and Jacques asserted, these books help bolster claims that reject the climate change consensus. Of all books evaluated, the majority were linked to conservative think tanks; most were also affiliated with conservative ideology. These connections help illustrate the “the strong link between conservatism and promotion of climate change denial” (Dunlap and Jacques 2013, 707; see also Jacques et al. 2008; McCright and Dunlap 2011a; McCright et al. 2016). The link between these publications and conservative think tanks/ideology is important since the “climate change counter-movement (CCCM)” is rooted in conservative (and, subsequently, conservative think-tank) efforts (Brulle 2014, 682). The CCCM’s progress, however, requires significant corporate funding, political support, and magnification via the media and others who serve to profit from their efforts (Brulle 2014). In other words,

³Furthermore, despite concerns over “uphold[ing] the integrity of science,” Peiser’s background suggests otherwise (Peiser 2005, para. 4). In addition to affiliations with prominent conservative think tanks, Peiser also served on the editorial board for *Energy & Environment*, an established contrarian journal discussed later (Heartland Institute 2016; Multi-Science 2010). In fact, all of Peiser’s articles on climate change were published in *Energy & Environment*, with the remaining publications on topics unrelated to climate change, i.e., catastrophism and sports medicine (Liverpool John Moores University 2011).

while only a small number of expert scientists reject climate change consensus, there is a much more complex web of individuals and organizations that make up, and work to promote, contrarian efforts that use these expert and non-expert rejections to bolster their claims.

Unfortunately, the misleading publications, coupled with a lack of a cohesive alternative theory and the efforts of the CCCM, also leads to confusion among the public. In the United States, for example, only 33 per cent of Americans believe scientists fully understand whether climate change is happening; even fewer (28 per cent) believe scientists understand its cause (Pew Research Center 2016). While raising awareness of the agreement among the 97 per cent of experts positively impacts the public's views on climate change, the CCCM serves to keep contrarian arguments in competition with the mainstream consensus; they also fuel the political debate as to whether policies that mitigate climate change are necessary (McCright et al. 2013; Rahmstorf 2012; van der Linden et al. 2015). As politicians use contrarian arguments as a reason to justify inaction against climate change, it is important not only to understand who these contrarians are, but also to establish what links, if any, they have to organizations and industries that work tirelessly to prevent climate mitigation efforts. Exploring these connections may help explain why these individuals continue to argue against the climate science consensus.

Methods

Prior studies focus primarily on confirming the 97 per cent consensus among expert scientists. Other research explores publications and/or the intricate web of CCCM organizations (Anderegg et al. 2010; Brulle 2014; Cook et al. 2013; Cook et al. 2016; Doran and Zimmerman 2009). To the authors' knowledge, no study has utilized multi-signatory documents that reject the climate consensus to evaluate expert and non-expert contrarians beyond publications and through the same countermovement lens. Including these non-experts in our profile is important, especially since those who object to the 97 per cent consensus often point to these multi-signatory documents as further evidence to reject AGW (Boykoff 2011; McCright and Dunlap 2011a; McKewon 2012). As a result, and because many of these documents were open to (or remain open to) signatures from anyone who wishes to participate, we can look for commonalities among experts and non-experts alike—specifically, whether individuals from both groups are tied to the entities who work to subvert the mainstream climate consensus.

Many declarations that reject the climate change consensus are publicly available. To compile a list of individuals for this article, names were drawn from the Bali Open Letter, Manhattan Declaration, Paris Climate Challenge, Lindzen Petition, and Climate Scientists' Register. These documents serve as an official challenge to the global climate discussion and often target specific global policy initiatives. The Paris Climate Challenge 2015, for example, was contrarians' response to COP21 (that is, the 2015 United Nations Climate Change Conference), at which they aimed to “challenge the climate ‘consensus’ ... with alternative climate hypotheses” (PCC15 2015, para. 2). The Lindzen Petition also challenged the United Nations Framework Convention on Climate Change (UNFCCC) in 2017 and stated: “carbon dioxide, the target of the UNFCCC is not a pollutant but a major benefit to agriculture and other life on Earth” (Lindzen 2017, para. 1). Others, like that of the International Climate Science Coalition (ICSC), are not a response to a specific policy or initiative, but allow individuals to endorse statements such as: “The relevant scientific evidence [does] not find convincing support for the hypothesis that human emissions of carbon dioxide are causing ... dangerous global warming” (ICSC 2015, para. 1). Although they may have different objectives, the documents serve as official and standing means to voice opposition to the scientific consensus on climate change.

Table 1 provides descriptive information for each multi-signatory document included in the data set. After eliminating signatures that appeared on more than one document, our dataset included 427 individuals. For each of the 427 individuals, we analyzed a variety of variables to gain a better picture of their academic and professional background. Variables include, but are

Table 1. Multi-signatory documents

| Document | Year | Total number of signees in dataset |
|------------------------------|----------------------|------------------------------------|
| 2007 Bali Open Letter | 2007 | 81 |
| Climate Scientists' Register | No date ^a | 141 |
| Lindzen Petition | 2017 | 205 |
| Manhattan Declaration | 2008 ^a | 205 |
| Paris Climate Challenge | 2015 | 157 |

Notes: ^a These documents are still open for signatures. For each document's objectives and complete list of signatories, see Bali Open Letter (2007), Lindzen (2017), ICSC (2008), ICSC (no date) and PCC15 (2015).

not limited to, their highest level of degree, the subject matter of their awarded degree, their publication record, and professional affiliations connected to special interest and industry organizations. Specifically, we investigated links to organizations/industries identified in prior research as tied to the CCCM (Björnberg et al. 2017; Brulle 2014; Dunlap and Jacques 2013; McCright and Dunlap 2011a; McCright et al. 2016; Oreskes and Conway 2010; Plehwe 2014). Although we did not include all previously identified organizations/industries as variables, we included those that appeared the most frequently among contrarians in our data, as well as those that represent individuals with no other known ties.

To create a list of climate-specific publication records, we searched for peer-reviewed articles via Google Scholar (search term: "author:fi-lastname climate"). In the event that search results yielded no publications or appeared to reflect multiple authors, we used additional search terms to verify results ("author:firstname-lastname climate"; "author:fi-mi-lastname climate"). We excluded results that were books, articles not affiliated with a peer-reviewed journal, correspondence published in response to peer-reviewed articles, reviews published in peer-reviewed articles, conference abstracts, repository material, duplicate results, or material not related to natural science.

We included personal variables, such as gender, date of birth, and religious affiliation. We obtained any information not included in multi-signatory document profiles from public online sources (for example, university profiles, personal/professional websites, biographies, interviews, publications, and documents archived on websites like desmog.com, skepticscience.com, and exxonsecrets.com). Care was taken to make certain that information is accurate using intercoder reliability.⁴ We marked any information not found or not verifiable from credible sources as "unknown" and coded it as such.

To determine which individuals in our list are climate experts, we applied criteria used by Anderegg et al. (2010), which set a minimum of 20 climate-related, peer-reviewed publications as the base to establish expertise. To also establish which individuals in our data, if any, were the same contrarians identified in previous studies, we collected data from flawed peer-reviewed papers, published contrarian books, and journals that published abstracts that implicitly or explicitly rejected the climate consensus (Benestad et al. 2016; Cook et al. 2013; Dunlap and Jacques 2013).

Results

As our aim is to create a profile and look for commonalities among individuals who all share contrarian views, we relied on descriptive statistics to analyze the data. Except for unique identifiers (that is, name, birth year, degree information, and publication information), we coded all

⁴We assigned three research assistants to different sections of the data for which they coded all information. Another individual made an entire sweep through the data to verify that all information regarding education and professional experience was accurate. A fifth individual randomly selected 30 individuals in the dataset and verified the accuracy of all entered information. As a final check, one of the authors reviewed all data collected for everyone in the dataset to verify its accuracy.

raw data as ordinal or interval to determine total counts, means, and percentiles. [Table 2](#) provides a complete list of variables included in the dataset, as well as other descriptive statistics.

Demographics

A total of 93 per cent of the climate change contrarians on the list were male. This under-representation is not surprising given that fewer women work in the science, technology, engineering, and mathematics (STEM) fields (Nimmegern 2016). In the United States, for example, the STEM workforce is composed of 27 per cent women and 73 per cent men (Martinez and Christnacht 2021). Importantly, this finding is also consistent with research which found that climate contrarians are more likely to be male compared to the average scientist in general (McCright and Dunlap 2011b).

Individuals in the sample were born between 1922 and 1973, with 1942 as the average birth year (std dev. = 11.85). As a result, 87 per cent of individuals on the list (for which data were available) were born prior to 1957, making most contrarians sixty-five years of age or older. The results suggest that scientists born in the 1960s or later are much less likely to oppose the consensus on climate change, or at least less likely to endorse these documents. This information was difficult to locate and contains only 76 observations. As [Table 3](#) shows, though, the results are consistent with the data (of which there were more observations) regarding the year contrarians earned their degree. These results show 81 per cent of climate change contrarians received their degree in 1985 or prior, with 1970 as the year with the highest number of individuals receiving a degree.

In addition to contrarians' generally advanced age, twenty-seven individuals on the list were deceased at the time of the documents' alleged endorsement. Although no justification is apparent, it is possible that authors copied names from existing declarations to newly drafted documents without knowledge or permission.

Education and Professional Experience

A total of 81 per cent of the climate change contrarians received their highest level of college degree (that is, Bachelor's, Master's, PhD, or level of degree relative to institution, location, and/or area of study) in 1985 or prior.⁵ The most common time when contrarians received their degrees was the 1970s.⁶ This suggests individuals receiving their degrees within the last thirty years are less likely to reject the climate change consensus. This pattern could be for several reasons, for example: new modeling or other scientific revelations not known at the time climate change contrarians received their degree; changes in how certain areas (for example, meteorology) approach research; or, as we suggest later, the impact of conservatism/neoliberalism on views of science and/or government (see [Figure 1](#)).

Almost none of the individuals who signed the documents have a degree directly related to climate science. In fact, less than 1 per cent of the individuals in the sample have a degree deemed relevant to climate science, with relevance defined as individuals having a degree in climatology or a similar field. A total of 77 per cent of contrarians, however, have a scientific degree that could provide some knowledge related to climatology, for example, physics, geography, or engineering. Just under 23 per cent of contrarians have a degree with no direct relation to science, for example, statistics, economics, international relations, and those related to the humanities.⁷

Interestingly, physics is the most common degree (2.4 per cent) to appear in our sample. This finding is consistent with prior research which established that contrarian scientists "tend to be

⁵The data include information for 176 out of 427 individuals.

⁶If data are included where the degree year was inferred, the number who received their degree before 1985 is even higher.

⁷The data include information for 315 out of 427 individuals.

Table 2. Descriptive statistics

| Variable name | N | Min. | Max. | Mean | Std dev. |
|--|-----|------|------|------|----------|
| Gender/sex | 409 | 0 | 1 | 0.97 | 0.18 |
| Deceased | 424 | 0 | 1 | 0.93 | 0.26 |
| International Climate Science Coalition (ICSC) | 427 | 0 | 1 | 0.67 | 0.47 |
| An Open Letter to Bali Indonesia (BALI) | 427 | 0 | 1 | 0.81 | 0.39 |
| Manhattan Declaration | 427 | 0 | 1 | 0.52 | 0.50 |
| Paris Climate Challenge | 427 | 0 | 1 | 0.63 | 0.48 |
| Lindzen Petition | 427 | 0 | 1 | 0.52 | 0.50 |
| Year born | 76 | 1922 | 1973 | 1942 | 11.85 |
| Highest degree awarded | 394 | 0 | 3 | 0.44 | 0.73 |
| Science-related degree | 315 | 1 | 3 | 2.22 | 0.43 |
| PhD awarded | 394 | 0 | 1 | 0.70 | 0.46 |
| Master's degree awarded | 243 | 0 | 1 | 0.66 | 0.47 |
| Master's degree year | 61 | 1936 | 2000 | 1972 | 13.43 |
| Bachelor's degree awarded | 394 | 0 | 1 | 1 | 0.05 |
| Bachelor's degree year | 89 | 1941 | 1994 | 1969 | 12.57 |
| Degree awarded before 1985 | 176 | 0 | 1 | 0.78 | 0.41 |
| Year degree completed | 156 | 1945 | 2004 | 1975 | 12.25 |
| No. with peer-reviewed articles | 427 | 0 | 1 | 0.74 | 0.44 |
| Total peer-reviewed articles | 427 | 0 | 158 | 2.38 | 10.45 |
| Publication year | 427 | 1968 | 2021 | 2001 | 11.47 |
| Contrarian journal | 427 | 0 | 1 | 0.10 | 0.29 |
| Published rejection abstract | 427 | 0 | 1 | 0.14 | 0.35 |
| Publications by experts | 427 | 0 | 1 | 0.03 | 0.17 |
| Author of 2% of flawed papers | 427 | 0 | 1 | 0.03 | 0.18 |
| Climate books | 427 | 0 | 1 | 0.05 | 0.23 |
| Industry | 427 | 0 | 1 | 0.87 | 0.33 |
| Heartland Institute | 427 | 0 | 1 | 0.72 | 0.45 |
| Heritage Foundation | 427 | 0 | 1 | 0.99 | 0.11 |
| Committee for a Constructive Tomorrow (CFACT) | 427 | 0 | 1 | 0.96 | 0.20 |
| Competitive Enterprise Institute (CEI) | 427 | 0 | 1 | 0.98 | 0.13 |
| Cato Institute (CATO) | 427 | 0 | 1 | 0.83 | 0.40 |
| George C. Marshall Institute/CO2 Coalition (GCM-CO2) | 427 | 0 | 1 | 0.94 | 0.24 |
| Fraser Institute (FRASER) | 427 | 0 | 1 | 0.97 | 0.17 |
| Institute for the Study of Earth and Man (ISEM) | 427 | 0 | 1 | 1.00 | 0.07 |
| Euroäisches Institut für Klima und Energie (EIKE) | 427 | 0 | 1 | 0.97 | 0.16 |
| Cornwall Alliance | 427 | 0 | 1 | 0.85 | 0.35 |
| New Zealand Climate Science Coalition (NZCSC) | 427 | 0 | 1 | 0.40 | 0.49 |
| Institute for Climate and Global Research (ICG_CR) | 427 | 0 | 1 | 0.57 | 0.50 |
| Climate Exit (CLEXIT) | 427 | 0 | 1 | 0.85 | 0.36 |
| Friends of Science (FFRIENDS) | 427 | 0 | 1 | 0.97 | 0.17 |
| Affiliations (AFFIL) | 427 | 0 | 3 | 1.05 | 0.79 |

empiricists and physicists (i.e., theoreticians)” (Lahsen 2013, 748). Degrees in geological sciences were the second-largest group at 2.2 per cent. While these degrees represent a broad area of Earth sciences, many that appear in our data (for example, engineering, mining, and geology) are particularly desired by the fossil fuel industry (Allison and Mandler 2018; NRC 2013). Conservative think tanks also heavily target TV weather forecasters and meteorologists, who make up 1 per cent of degrees in our sample, and who may also be prone to contrarian views because of their “stance with political and socio-cultural factors” (Björnberg et al. 2017, 235; see also Homans 2010; Lahsen 2013) (see Table 4).

Publications

We compiled a list of 1,107 climate-related peer-reviewed articles. Of all individuals in our data, just 25 per cent published at least one climate-related peer-reviewed article. The most common journals to appear in our sample were *Geophysical Research Letters*, *Energy & Environment*,

Table 3. Frequencies—year born versus year degree completed

| | Year born | Year degree completed |
|---------------|-----------|-----------------------|
| N | 76 | 156 |
| Mean | 1942 | 1975 |
| Std deviation | 11.85 | 12.25 |
| Range | 51 | 59 |
| Minimum | 1922 | 1945 |
| Maximum | 1973 | 2004 |
| Percentiles | | |
| | 25% | 1933 |
| | 50% | 1942 |
| | 75% | 1949 |

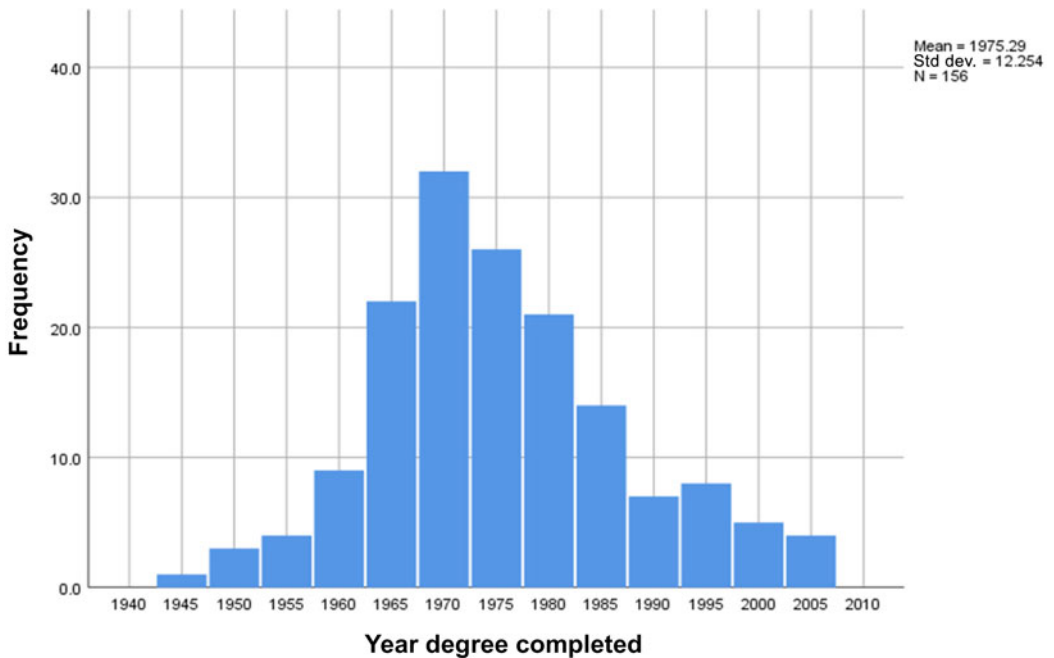


Figure 1. Year contrarians completed highest degree.

and *Journal of Geophysical Research*. Together, these journals account for 16 per cent of articles overall.

Fourteen individuals (3 per cent) meet expert criteria of having published twenty or more climate-related peer-reviewed articles. Collectively, this group authored 65 per cent of articles in our sample. These findings suggest: (1) most contrarians are non-experts in the realm of climate science; (2) the 3 per cent of expert contrarians produce most peer-reviewed articles on climate; and (3) the experts in our sample still represent the 3 per cent—even within a cohort made up entirely of those with contrarian views.

Among all articles included in our sample, 30 per cent were from journals that previously published abstracts that implicitly or explicitly rejected AGW.⁸ Of these articles, 69 per cent were published by contrarian experts. While evaluating these journals is beyond the scope of this

⁸For a full list of journals that published AGW rejection abstracts and for information regarding how their data were compiled, see supplementary material in Cook et al. (2013).

Table 4. Total contrarians in specific degree areas

| Degree area | Total number | Percentage |
|--|--------------|------------|
| Aerospace engineering | 1 | 0.1 |
| Aerospace engineering and geophysical fluid dynamics | 1 | 0.1 |
| Agricultural economics | 1 | 0.1 |
| Air pollution; meteorology | 1 | 0.1 |
| Analytical chemistry | 1 | 0.1 |
| Antarctic glaciology | 1 | 0.1 |
| Animal science | 1 | 0.1 |
| Applied geology | 1 | 0.1 |
| Applied mathematics | 2 | 0.1 |
| Astrophysics | 2 | 0.1 |
| Atmospheric physics | 1 | 0.1 |
| Atmospheric sciences and meteorology | 1 | 0.1 |
| Atomic and molecular physics | 1 | 0.1 |
| Biochemistry | 1 | 0.1 |
| Biochemistry and physiology | 1 | 0.1 |
| Biology | 2 | 0.1 |
| Biology; biochemistry | 1 | 0.1 |
| Biomedical applications of chemical engineering | 1 | 0.1 |
| Botany | 1 | 0.1 |
| Chemical engineering | 4 | 0.3 |
| Chemical physics | 3 | 0.2 |
| Chemical physics and kinetics | 1 | 0.1 |
| Chemistry | 2 | 0.1 |
| Chemometrics | 1 | 0.1 |
| Climatology | 3 | 0.2 |
| Computer science | 1 | 0.1 |
| DenSc | 1 | 0.1 |
| DrEng | 1 | 0.1 |
| DSc | 3 | 0.2 |
| Earth and planetary sciences | 1 | 0.1 |
| Earth sciences | 4 | 0.3 |
| Ecology | 2 | 0.1 |
| Economic geology; geochemistry | 1 | 0.1 |
| Economics | 6 | 0.4 |
| Electrical engineering | 2 | 0.1 |
| Energy conversion | 1 | 0.1 |
| Engineering | 2 | 0.1 |
| Engineering physics | 1 | 0.1 |
| Environmental science | 1 | 0.1 |
| Environmental science and engineering | 1 | 0.1 |
| Environmental science and groundwater hydrology | 1 | 0.1 |
| Environmental sciences education | 1 | 0.1 |
| Experimental nuclear physics | 1 | 0.1 |
| Forensic toxicology | 1 | 0.1 |
| Forensic biometrics | 1 | 0.1 |
| Forest ecology | 1 | 0.1 |
| Forest science | 1 | 0.1 |
| Fuel technology and chemical engineering | 1 | 0.1 |
| Geography | 4 | 0.3 |
| Geography, Earth, atmospheric sciences | 1 | 0.1 |
| Geological sciences | 1 | 0.1 |
| Geology | 22 | 1.6 |
| Geology, climatology | 1 | 0.1 |
| Geology, geochemistry | 2 | 0.1 |
| Geology, minor in astronomy | 1 | 0.1 |
| Geophysical sciences | 1 | 0.1 |
| Geophysics | 3 | 0.2 |
| Glacial geomorphology | 1 | 0.1 |
| High-energy physics | 1 | 0.1 |
| Historical geology and paleontology | 1 | 0.1 |
| Humanities | 1 | 0.1 |

(Continued)

Table 4. (Continued.)

| Degree area | Total number | Percentage |
|--|--------------|------------|
| Inorganic/physical chemistry | 1 | 0.1 |
| International relations | 1 | 0.1 |
| Management | 1 | 0.1 |
| Marine biology | 1 | 0.1 |
| Marine science | 1 | 0.1 |
| Mathematics | 3 | 0.2 |
| Mathematics and atmospheric physics | 1 | 0.1 |
| Mathematics and modeling | 1 | 0.1 |
| Medical doctor | 5 | 0.3 |
| Mechanical engineering | 3 | 0.2 |
| Meteorology | 10 | 0.7 |
| Natural sciences | 1 | 0.1 |
| Nuclear engineering | 1 | 0.1 |
| Nuclear engineering and physics | 1 | 0.1 |
| Nuclear physics | 3 | 0.2 |
| Optical physics | 1 | 0.1 |
| Organic chemistry | 5 | 0.4 |
| Paleontology | 1 | 0.1 |
| Philosophy of science and mathematical logic | 1 | 0.1 |
| Physical chemistry | 5 | 0.4 |
| Physical ecology | 1 | 0.1 |
| Physical geography | 3 | 0.2 |
| Physical geography, plant ecology, landscape ecology | 1 | 0.1 |
| Physics | 30 | 2.2 |
| Physics and optics | 1 | 0.1 |
| Related to cancer research | 1 | 0.1 |
| Scottish history | 1 | 0.1 |
| Soil microbiology | 1 | 0.1 |
| Soil science | 1 | 0.1 |
| Solar-terrestrial physics | 1 | 0.1 |
| Statistics | 1 | 0.1 |
| Synoptic meteorology | 1 | 0.1 |
| Theoretical chemistry | 1 | 0.1 |
| Theoretical physics | 1 | 0.1 |
| Welding technology (thermal cutting) | 1 | 0.1 |
| Zoology | 1 | 0.1 |
| Zoology/evolutionary biology/archaeozoology | 1 | 0.1 |

article, Table 5 shows not only the number of articles published in these journals by contrarians (overall and by experts) in our sample, but also the range of journals that published these authors.

Another 9 per cent of articles in our overall sample (of which experts authored 45 per cent) were from known “contrarian” journals (Benestad 2013; Benestad et al. 2016; Kinne 2003; Wagner 2011). *Energy & Environment*, for example, has long been known as a publication friendly to climate science contrarians. In fact, it provided 131 of the “more than 900+ papers that supported climate change scepticism,” including one (included in our dataset) by Willie Soon and Sallie Baliunas (Hope 2018, para. 3; see also Soon and Baliunas 2003). A shorter version of their paper, published in *Climate Research* just months prior, had already faced significant criticism—including from the journal’s then-editor in chief, who ultimately resigned in protest over the controversy (Ward 2015, para. 6).⁹ Despite these criticisms, the authors expanded on the article and published it in *Energy & Environment*, spearheaded by then-Editor in Chief Sonja Boehmer-Christiansen (yet another prominent contrarian in our sample). SAGE Publishing took over the journal in 2018 and has since “overhauled its peer review practices bringing it into line with SAGE standards” (Hope 2018, para. 2). Not surprisingly, however,

⁹It should be noted that *Climate Research* appears in both Table 5 and Table 6.

Table 5. Articles published in rejection abstract journals

| Journal | Number of articles in sample | Number of articles by experts in sample |
|--|------------------------------|---|
| <i>Geophysical Research Letters</i> | 68 | 53 |
| <i>Journal of Atmospheric and Solar-Terrestrial Physics</i> | 16 | 11 |
| <i>Research & Exploration</i> | 1 | 1 |
| <i>Global and Planetary Change</i> | 17 | 11 |
| <i>Solar Physics</i> | 10 | 10 |
| <i>Ambio</i> | 9 | 6 |
| <i>Atmospheric Environment</i> | 13 | 11 |
| <i>Bulletin of the American Meteorological Association</i> | 18 | 9 |
| <i>Climate Research</i> | 26 | 22 |
| <i>Ecological Modeling</i> | 1 | 0 |
| <i>Energy Sources</i> | 1 | 0 |
| <i>Environmental Conservation</i> | 10 | 9 |
| <i>Environmental Geology</i> | 7 | 0 |
| <i>Environmental Pollution</i> | 5 | 2 |
| <i>Géographie Physique et Quaternaire</i> | 2 | 1 |
| <i>International Journal of Modern Physics</i> | 4 | 0 |
| <i>Journal of Climate</i> | 32 | 24 |
| <i>Journal of Geophysical Research</i> | 44 | 27 |
| <i>Journal of Non-equilibrium Thermodynamics</i> | 3 | 0 |
| <i>Meteorology and Atmospheric Physics</i> | 5 | 4 |
| <i>Oceanology</i> | 2 | 0 |
| <i>Proceedings of the Institution of Civil Engineers</i> | 2 | 0 |
| <i>Proceedings of the National Academy of Sciences of the United States of America</i> | 1 | 1 |
| <i>Science</i> | 18 | 13 |
| <i>Theoretical and Applied Climatology</i> | 19 | 16 |

all articles in our sample from *Energy & Environment* were published prior to the end of Boehmer-Christiansen's editorship.

Remote Sensing, which experienced a similar controversy following publication of a contrarian paper, also appears in our dataset (Spencer and Braswell 2011). Roy Spencer, co-author of the contentious paper, appears in our sample and meets expert criteria. Another journal, *Pattern Recognition in Physics (PRP)*, ceased operation following publication of a contrarian article (Scafetta 2013). The paper's author, Nicola Scafetta, as well as PRP's then Co-editor in Chief Nils-Axel Mörner, both appear in our sample and meet expert criteria (PRP, 2014) (see Table 6).

We also found significant overlap between individuals in our dataset and authors of other contrarian publications. Among previously identified authors of flawed AGW-rejection papers, 42 per cent were found in our data; five of these individuals meet expert criteria.¹⁰ Among previously identified authors of contrarian books, 22 per cent were found in our data; six of these individuals meet expert criteria.¹¹

Table 7 shows authors of the aforementioned publications who appeared in our sample. We also note who meets climate expert criteria. Collectively, these publications illustrate one way a small, yet prominent, cohort works to expand the contrarian movement through the guise of academic research.

Affiliations

A total of 82 per cent of all individuals in our dataset, including 100 per cent of individuals deemed climate experts, have affiliations with industries and/or organizations involved in the

¹⁰For a full list of authors and flawed peer-reviewed articles, see the electronic supplementary materials in Benestad et al. (2016).

¹¹For a full list of authors and climate-change-denial books, see the appendix in Dunlap and Jacques (2013).

Table 6. Articles published in “contrarian” journals

| Journal | Articles in sample | Articles by experts |
|---------------------------------|--------------------|---------------------|
| <i>Climate Research</i> | 26 | 22 |
| <i>Energy & Environment</i> | 66 | 18 |
| <i>PRP</i> | 8 | 4 |
| <i>Remote Sensing</i> | 2 | 2 |

CCCM (Björnberg et al. 2017; Brulle 2014; Dunlap and Jacques 2013; McCright and Dunlap 2011a; McCright et al. 2016; Oreskes and Conway 2010; Plehwe 2014). Of the 82 per cent, we found: (1) 69 per cent have affiliation(s) with conservative think tanks, conservative religious groups, and/or organized causes dedicated to the rejection of the climate consensus; (2) 11 per cent have affiliation(s) with both think tanks/groups/causes and CCCM-related industries (for example, fossil fuel, mining, and utility companies); and (3) another 2 per cent have affiliation(s) just with CCCM-related industries.

Table 8 shows the number of affiliations with CCCM organizations that appeared in our data. Table 9 shows industry affiliations. Each corporation/company appeared just once, with the exceptions of ExxonMobil (seven), Peabody (four), Shell (four), and Western Fuels Association (three). Evaluating these companies/corporations is beyond the scope of this article; however, like other demographic information and affiliations, these affiliations may provide insight into contrarians’ background and views.

Individuals in the sample also represent a variety of other areas, many of which magnify contrarian efforts. The overlap of government, industry, conservative groups, and proponents of the free market—especially prevalent within the United States, UK, and Australia—is evidenced by five contrarians in the dataset who ran for office or serve(d) as government officials while working on behalf of the industries and ideological groups that funded them (Beder 2001; McKewon 2012). Others include medical doctors, chief executive officers (CEOs) of conservative companies, film producers, and bloggers, most of whom are tied to a variety of CCCM organizations. Several other CCCM organizations shown in Table 10 also appear in our dataset but were not included as variables.¹²

While we found no apparent affiliations for the remaining 18 per cent of signees, some individuals of the group presented other commonalities with each other and others in the sample. For example, of the five documents we analyzed, this entire subset of individuals only signed the Lindzen Petition. Eight individuals have a background in nuclear energy. Three authored papers for contrarian or rejection-abstract journals; one served on the editorial advisory board for *Energy & Environment*. The findings suggest that experts and non-experts alike subscribe to the same efforts, as well as the same industries and organizations, which promote contrarian views.

Collectively, our findings show that the majority of those who signed documents that reject AGW are not climate experts. As a result, these individuals lack the authority to render an opinion regarding climate change science. Our results also show that 3 per cent of expert contrarians continuously pervade multiple realms that reject AGW. We found both groups affiliated with industries and organizations of the CCCM. Expert and non-expert publications infiltrate the climate research realm, especially since most anti-consensus papers remain widely available. Contrarian books are often not subject to peer review and are widely accessible; yet, both papers and books are regularly cited despite being refuted by much of the scientific community. Others, including scientists with non-climate backgrounds, individuals who work in media, and

¹²We noted most of these affiliations directly from signee information in multi-signatory documents but excluded them as variables if their ties to other contrarians in the data could not be verified. We also excluded organizations that appeared just once in our data and were tied to individuals with other affiliations.

Table 7. Authors of contrarian publications

| | Published in rejection abstract journal | Published in contrarian journal | Authored flawed AGW-rejection paper | Climate-change-denial book author |
|--------------------------|---|---------------------------------------|--|--------------------------------------|
| Alexander RB | | | | X |
| Balling RC ^a | X | | | X |
| Barrante JR | | | | X |
| Beck EG | | X | X | |
| Boehmer-Christiansen S | | | | X |
| Carter RM | X | | | X |
| Chylek P ^a | X | | | |
| Douglass DH | X | | X | |
| Essex C | X | | | X |
| Gerlich G | X | | X | |
| Gray V | | | | X |
| Hayden H | | | | X |
| Hoyt D ^a | X | | | |
| Humlum O ^a | X | | X | |
| Idso C | X | X | | X |
| Idso SB ^a | X | X | | X |
| Karlén W ^a | X | X | | |
| Kininmonth W | | X | | X |
| Leroux M | | X | | X |
| Lindzen RS ^a | X | X | | |
| Malmgren B ^a | X | | | |
| McKittrick R | X | X | X | X |
| Michaels PJ ^a | X | X | X | X |
| Miskolczi FM | | | X | |
| Mörner NA | X | X | X | |
| Plimer I | | | | X |
| Robinson A | | | | X |
| Scafetta N ^a | X | X | X | |
| Singer SF ^a | X | X | X | X |
| Solheim JE | X | X | X | |
| Soon W ^a | X | X | | X |
| Spencer R ^a | X | X | | X |
| Steward HL | | | | X |
| Stordahl K | X | | X | |
| Thoenes D | | X | | X |
| Tscheuschner RD | X | | X | |
| Watts A | X | | | X |
| Weber GR | X | | | X |
| West BJ | X | | X | |

Note: a Climate science expert.

politicians, support contrarian efforts. Together, this group can magnify arguments that reject the climate change consensus and, as a result, keep the debate on the climate consensus alive.

Discussion

What motivates experts and non-experts alike to pursue a position on climate change contrary to scientific consensus? The role of conservative politics, conservative think tanks, and industry efforts that make up the CCCM is well documented; however, our findings reveal other similarities among contrarians worthy of consideration.

In particular, the data reveal that most individuals in our data are aged sixty-five or older. This age group, at least in the United States, is also the most likely age group to disagree with the climate consensus; conversely, 80 per cent of expert Earth scientists who agree with the consensus

Table 8. Organization affiliations

| Organization | Number of affiliations in sample |
|--|----------------------------------|
| Competitive Enterprise Institute (CEI) | 7 |
| Committee for a Constructive Tomorrow (CFACT) | 17 |
| Climate Exit (CLEXIT) | 63 |
| Cornwall Alliance | 62 |
| European Institute for Climate and Energy (EIKE) | 11 |
| Fraser Institute | 13 |
| Friends of Science | 12 |
| George C. Marshall Institute/CO2 Coalition | 26 |
| Independent Committee on Geoethics (ICG) | 184 |
| Institute for the Study of Earth and Man (ISEM) | 2 |
| New Zealand Climate Science Coalition (NZCSC) | 171 |
| The Cato Institute | 74 |
| The Heartland Institute | 118 |
| The Heritage Foundation | 5 |

Table 9. Industry affiliations

| Company or corporation | |
|-------------------------------------|------------------------------------|
| AES Corporation | Louisiana Land and Exploration Co. |
| Allegheny Energy | L&M Petroleum |
| AMAX Chemical Corp. | Luna Gold Corp. |
| Andean Gold Ltd | Manuta Chemical Consulting, Inc. |
| Anderson Materials Evaluation, Inc. | Newcrest Mining Ltd |
| BP | Ohio Oil and Gas |
| British Coal Corp. | OPEC |
| Burmah Oil | Ormil Energy Ltd |
| Canada Coal | Orosur Mining, Inc. |
| CBH Resources Ltd | Peabody Energy |
| CoalTrans International | Plutonic Power Corp. |
| Colorado Resources Ltd | Rio Tinto |
| ConocoPhillips | Royal Dutch Shell |
| Cyprus Minerals | Silver City Minerals Ltd |
| Evolving Gold Corp. | Sinclair Oil Corp. |
| ExxonMobil | Snyder Oil Corp. |
| Fairfield Nodal | Sun Oil Co. |
| German Coal Mining Association | Talisman Energy, Inc. |
| Gold Fields Mining Corp. | Tempress Technologies, Inc. |
| Hancock Prospecting | TNT Mines |
| Homestake Mining Co. | Uruguay Mineral Exploration, Inc. |
| Husky Energy | Vector Ltd |
| Inova Resources | Western Fuels Association |
| Junior Mining Co. | Western Technology, Inc. |
| Koch Industries | Wexpro |
| Lakes Oil NL | |

on AGW are under the age of sixty-five (Pew Research Center 2015). Although many individuals in our sample were non-experts, the experts were also aged 65 or older on average, with an average birth year of 1944. While we expect contrarian experts to hold views different from most of the scientific community, this age distinction suggests there may be other reasons that led these individuals to align with contrarian efforts. Individuals' experiences, for example, may impact their views of science and government. As a result, this may help explain why both experts and non-experts alike participate in a movement that hinders climate change mitigation efforts.

Behavioral research suggests that experiences during individuals' formative years (that is, teens and twenties) are the most important; collective memory association determines how individuals

Table 10. CCCM organizations

| Organization name |
|--|
| 2nd Vote |
| Adam Smith Institute |
| Alexis de Tocqueville Institution |
| Ayn Rand Institute |
| Center for the Study of Carbon Dioxide and Global Change |
| Doctors for Disaster Preparedness |
| Frontier Centre for Public Policy |
| Greening Earth Society |
| Institute for Public Affairs (IPA) |
| International Climate and Environmental Change Assessment Project (ICECAP) |
| Lavoisier Group |
| National Center for Policy Analysis |
| Natural Resources Stewardship Project |
| The Energy Advocate |
| The Right Climate Stuff |
| Theological Encounter with Science and Technology (ITEST) |
| WeatherAction |
| World Taxpayers Association |

may apply past experiences to later behavior (Goffman 1974; Gongaware 2011; Mannheim 1952 [1928]; Schuman and Scott 1989). In theory, the memories of contrarians aged sixty-five and older would, then, have been defined by events of the 1950s, 1960s and 1970s. This period not only marked significant changes to the study of science, as well as the rise in scientific and technological advances, but also saw an increase in institutional deceit (Atkin and House 1981; Miller 1983; Piller 1991).¹³ Relative to events of this period, trust in government declined among the US public in the mid-1960s; trust in science also declined, particularly among conservatives, in the 1970s (Gauchat 2012; Pew Research Center 2020). Relative to contrarians in our data, these events happened during the time when most received their degrees.

While one might assume that many contrarians in our sample would have higher trust in science because of their scientific degrees, prior research has found this not necessarily to be the case. Specifically, while higher education has a “*positive*” effect on the views of climate change for Democrats/liberals, educational attainment has a “*weaker or negative*” effect on the views of Republicans/conservatives (McCright and Dunlap 2011a, 175, emphasis in original). As a result, and considering the conservative nature of contrarian efforts, we believe this period may have led to unique views on government and science—specifically, government intervention into scientific matters. In other words, despite older contrarians’ scientific knowledge and/or education, their subjective concern about government intervention in science may surpass objectivity regarding mainstream consensus, especially considering the pervasiveness of neoliberalism during this period.

Neoliberalism emerged as a driving force to oppose government oversight and regulation, largely related to backlash from Franklin D. Roosevelt’s New Deal policies and subsequent expansion of the federal government. While tenets of neoliberalism (that is, a *laissez-faire* approach to the market with a heavy emphasis on deregulation and free trade) would become central to CCCM objectives, the ideology pervaded academic circles far earlier (McCright and Dunlap 2011a; Oreskes and Conway 2010). In fact, while the ideology is most notably associated with the creation of the Chicago School of economics, it was not unique to just Chicago.

¹³This period included events, or when the public learned of events, like the Atomic Age, Vietnam War, MK-Ultra, Pentagon Papers, and the Tuskegee Syphilis Experiment. Each of these events, and others, have had long-lasting effects on public trust in science and government (Ellsberg 2003; Gamble 1997; Piller 1991; Sturken 1997).

Neoliberalism was transnational in nature, permeating into other academic and political circles with the help of several institutions established solely to push this ideology (Mirowski and Plehwe 2009). As a result, by the 1950s, there was “an all-out assault on virtually every aspect of Keynesian economics” led, most notably, by Milton Friedman (Yergin and Stanislaw 1998, para. 8). By the 1960s and 1970s, neoliberalism was a prominent theory within economics and other disciplines. As a result, much like collective memories pertinent to older contrarians’ formative years, it is reasonable to believe that neoliberal ideology would have impacted contrarians’ attitudes toward science and government prior to the emergence of the CCCM.¹⁴

The CCCM materialized in 1989 in opposition to the creation of the Intergovernmental Panel on Climate Change (IPCC) (Antonio and Brulle 2011). Throughout the 1990s, “conservative foundations, think tanks, and leaders mobilized to challenge the legitimacy of [climate change] problems and thus undercut the need for government action to deal with them” (McCright et al. 2014, 252; see also Jacques et al. 2008). Corporate foundations (for example, ExxonMobil and Koch), in particular, continuously use free-market ideology to work against the mainstream climate consensus (Brulle 2014). This is not surprising considering the fossil fuel industry knew of climate change as early as the 1970s and have worked to disparage the findings of legitimate climate science ever since (Hall 2015; Oreskes and Conway 2010).

The CCCM pushes neoliberal ideology using a variety of tactics (Brulle 2014). Notably, and consistent with our findings, these organizations organize marketing campaigns that focus on the production of academic publications that present research biased toward the neoliberal agenda. Specifically, these publications are “tailored to specific audiences,” reconfirming the trans-academic nature of the ideological push (Mirowski and Plehwe 2009, 6). Financial support, provided both directly to researchers and to institutions via think tanks, also flow to academics pushing research slanted toward neoliberal ideas (Mirowski and Plehwe 2009). Funding to universities in exchange for substantial say in curricula and hiring practices, such as in the case of Koch, is another way in which these organizations seek to influence youth and, subsequently, future politicians (Carrk 2011; Center for Public Integrity 2018). As previously mentioned, policy makers use these experts’ and non-experts’ publications and official positions to justify inaction and confuse the public when it comes to climate change. Collectively, this evidence suggests a concerted effort to create a new way of thinking ingrained in academia and shrouded under the guise of legitimate academic discourse.

The CCCM still uses these tactics today, and as a result, the academic consensus on climate change must compete with a well-crafted machine meant to confuse science and sway the political rhetoric in its favor. Unfortunately, we believe, rhetoric aligned with older individuals’ existing collective memories of science and government may be dually influential in inhibiting progress on policy and with the public. As a result, while there is no doubt the CCCM successfully employs and targets a broad variety of individuals, other commonalities among many contrarians, such as age, suggest that we need further research to understand these connections.

Conclusion

Climate change is a serious issue that will impact generations to come. Although a gateway belief exists as to the causes and consequences of climate change, there are still those individuals that seek to sow doubt as to the scientific validity of these findings. Our findings suggest the 3 per cent

¹⁴Charles Koch, for example, was not personally included in our sample of contrarians; however, Koch’s background illustrates how corporate funding objectives may be rooted in personal formative experiences. Not only did Koch study the teachings of Adam Smith and others during his formative years (i.e., the 1950s and 1960s) and then apply them to his own business practices, but he also founded the Charles Koch Institute (now the Cato Institute) in the 1970s. During this period, he also collaborated directly with Milton Friedman (Stand Together, 2020). As a result, we have reason to believe that other climate contrarians who were born and educated during the same period, regardless of their expert or non-expert status, may share similar views.

create and circulate misinformation through a web of influence from organizations and industries tied to the CCCM. From bloggers and film producers, to older meteorologists and legitimate climate scientists, these individuals (as well as the entities with which they are affiliated) hold a vested interest in preventing climate change mitigation efforts.

Conservative think tanks, corporations, and others have spent decades challenging the mainstream consensus that fossil fuels are the main contributor to global warming—despite Exxon confirming over forty years ago through its own research that the mainstream consensus on climate change is actually correct. Moreover, industry's influence is also concerning. Not only have foundations long engaged in funding higher education institutions, but they have also had a hand in hiring the professors, and thus shaping the curriculum, that promotes their political agenda.

Perhaps one of the most interesting findings to come from this research is the cohesion among climate change contrarians when it comes to their age and the period in which their degrees were obtained. Although there are some individuals who are younger in age and/or were educated later, it is clear that a majority of contrarians are from a particular era. In addition, closer examination finds that distrust in both science and the government were growing at the same time that neoliberalism was gaining in prominence—not just as an economic theory, but because of a concerted effort to shape the political narrative regarding government involvement in the market. As a result, neoliberal thinking prevailed during most climate change contrarians' formative years. Among experts and non-experts alike, individuals who subscribed to tenets of neoliberalism during their formative years, we hypothesize, are now dedicated to efforts that push a *laissez-faire* approach. As a result, they may reject a mainstream consensus on issues like climate change even when most evidence points otherwise.

In her closing line given at the World Economic Forum in Switzerland in 2019, Greta Thunberg declared, “[I] want you to act. I want you to behave like our house is on fire. Because it is” (Workman 2019, para. 7). Unfortunately, her message has remained largely unheeded, with climate change contrarians turning their attention to target her personally in addition to the science she presents (Waldman 2019). As a result, even with renewed calls to act, it is unlikely contrarians will go away. Regardless, if the data in this article is correct, we should expect to see the scientific consensus on climate change increase, especially since most contrarians are aging out of academic and policy circles. Action on climate change cannot wait until this occurs, however, and there must be more emphasis on distinguishing between the consensus among 97 per cent of scientists and the rhetoric spread by the 3 per cent of contrarians. As a result, and as other evidence has shown, amplifying this mainstream climate consensus and exposing the ties among think tanks, businesses, interest groups, and certain politicians, among others, especially in the United States, will help to delegitimize contrarian efforts and keep the public informed of the realities of climate change.

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