CHAPTER 2

COMMUNICATION

Public awareness provides the fundamental connection between the people and their 'for-the-people Democracy'. The quality of this connection derives from both the objective process of election and the subjective/objective preferences of the public. Just as modern societies have grown enormously in complexity so has the amount of information and the means by which it is distributed. Hence, the lack of understanding of social issue interjects a randomness and uncertainty in the effectiveness of resolving the issue. Similarly, if the public lacks the education to understand an issue and its proper resolution then the efficacy of the elected government is jeopardized. Unfortunately, on a governmental level such a would-be chain is vulnerable to corruption and neglect that consequently degrades the functionality of the 'Democracy',

A. DEALING WITH A RAPIDLY CHANGING MEDIA

1. CAN WE IMPROVE CREDIBILITY?

1.a. Expansion of Communication. What humans communicate has remained relatively constant compared with how we communicate. For most of human existence since the development of language, communication was face to face. Methods for memorization (including all the kinds of sound patterning like rhythm, alliteration, and rhyme that mostly now belong to poetry and advertising slogans) facilitated the inter-group and intergenerational transmission of information in these oral societies. Then, between 5,000 and 3,000 years ago, writing was developed in several different cultures from simple pictographs and symbols into the actual representation of language.

Writing is a technology so powerful that literacy significantly alters the human brain. It also made possible the explosive growth of vocabulary and the development of more complex abstract thinking. The invention of printing with movable characters, first in China around 1040 CE, then in Europe in the fifteenth century, was a revolution almost as powerful, because it allowed knowledge and ideas not only to be preserved but spread far more widely and rapidly. By the late 1500s in Europe it was facilitating the growth of mass literacy, which blossomed across Europe in the eighteenth and early nineteenth centuries. The telegraph, the telephone, radio, film, and then television followed in rapid succession. Then, late in the twentieth century, the invention of the transistor microchip brought about the third great communications revolution: the internet and the mobile phone, which made possible not only email but the Web, texting, and social media (Fig. 1). Paralleling and facilitating these innovations, starting with physics, moving to chemistry and then, with the development of evolutionary theory and genetics, biology, was an equally rapid explosion of scientific and technical knowledge. Already by the mid-seventeenth century, it was impossible for one person to know all of European philosophy, mathematics, and science—let alone their equivalents in non-European cultures.

Fig. 1. Evolution of communication. From the first grunt to the last tweet. From: Google “evolution of communication timeline”.

All this meant that the evolution of communications technology brought about an expansion of communicative content away from the concrete, sensory, and directly relevant within a single culture in the direction of material more abstract, more geographically distant, and less directly experienced—though photography, film, and television provided additional visual information. At the same time, since the development of print and via newspapers, magazines, broadcasting, and now the Web, the technological options for expressing opinions have proliferated, and because of a much wider range of media for transmitting information, any information that enters these media suffers a greater risk of distortion. The other reason for this is that science and technology are now so vast, diverse, multi-specialized, and complex that even a scientist in one branch of one discipline has to rely on the opinions of colleagues in other disciplines at some remove from his or her own; and the nonscientist public, the great majority, has to rely on the consensus within any scientific discipline on any topic of importance. The alternative, made possible by generalized scientific illiteracy created and maintained by weaknesses in the educational system, the cultural and political power of conservative religious institutions, and the profit-drive of commercial mass media, is to reject science in favor of dogma or pseudoscience—or both. As we will see, this dependence has profound consequences in an age when the power of technology is so great that its implementation has life-and-death consequences not just for society but for the future of the human species and a livable biosphere.

The core of the problem is an inheritance of tens of thousands of years of human biological and social evolution on how to judge the truth of a message, which commonly is that a listener first judges the messenger and then the message content. If the messenger is familiar personally, or appears to be from the same social milieu or otherwise "relatable," the listener will tend to trust the messenger and then consider the content. If the content appears credible within the scope of the listener's belief system or knowledge base, then the message is successfully communicated. For people without the relevant intellectual training—the immense majority in our society—failure to meet these two conditions also poses the risk of poor or null communication. Moreover, if the original information is repeated multiple times, the original information content can become distorted. Even the case of written messages that can be communicated without degradation, the same two criteria are valid: the credibility of the messenger and the compatibility with the receiver's belief system or knowledge base.

1.b. Establishing Veracity and Trust as Journalist Goals. Building trust in the content of a message involves a mix of two approaches: factual (showing that the facts have been verified) and opinion (showing that the interpretation is based on an authoritative source or sources). Scientific journals achieve a generally high level of truthfulness in two ways. First, they employ a peer-review process that checks for errors in the procedure, the data, or its interpretation. Also, they require for any published paper the repeatability of results derived from experimentation, observations, or accepted mathematical analyses. Journal reporting on medical and social research has similar criteria, but allows for a wider range of permissible error due to the subjectivity in human behavior and in the mode of observation. In both cases, the degree of complexity generates a corresponding uncertainty in the reported results. Consequently, the 'truth' is often expressed as a probability, such as a 40% chance of snow. Such pronouncements come with the warning that the uncertainty might be lessened as technology advances or with the widening of the relevant knowledge-bank of the studied system.

Journalistic reporting of 'truth' is necessarily less objective, because it involves seeking a factual basis for events or conclusions that may not have been observed in total and that can't be verified by repetition. Honest professional journalism seeks to meet objectives that are difficult to satisfy for every reported event and by every journalist. For example, Kovach and Rosenstiel[1] list ten points of guidance for professional journalism:

- Having a first obligation to the truth.
- Having a first loyalty to citizens.
- Being a discipline of verification.
- Maintaining an independence from those they cover
- Serving as an independent monitor of power.
- Providing a forum for public criticism and compromise.
- Striving to keep the significant interesting and relevant.
- Keep news comprehensive and proportional.
- Allowing practitioners to exercise their personal conscience.
- Respecting that citizens, too, have rights and responsibilities when it comes to the news.

However, recognizing the wide spectrum of information now available, the authors claim that: "The first task of the new journalist/sense maker is to verify what information is reliable and then order it such that people can grasp it efficiently." A part of this new journalistic responsibility is "to provide citizens with the tools they need to extract knowledge for themselves from the undifferentiated flood of rumor, propaganda, gossip, fact, assertion, and

allegation the communications system now produces." This effectively shifts a greater responsibility on the reader and necessarily requires the reader to have an appropriate level of education about the reported issue, hence, the need for public awareness in a democracy – a condition famously stated by Thomas Jefferson, though what he meant by the "public" at the time was white men of at least some property.

1.c. Do we Need a better-Informed Public? With the modern explosion of information available through research and factual studies, it is less possible than ever for all relevant information on any topic to be stored in an individual's brain. This limitation places more responsibility on the messenger to ensure the truthfulness of the message. This problem has been alleviated by peer review of scientific articles and–to a diminished extent in the last few decades, for reasons we will discuss—the practice of fact checking[2]in journalism. The former type of review is for accuracy, plausibility, and repeatability based on the known science at the time, and the latter is a review to assess how accurately the material is based on information available at the time of observation, though subject to revision with new facts. Both systems have a responsibility to correct their messages. In scientific reporting, this responsibility is weakening in the competition to publish information before its final review. In news reporting, commercial pressures are also having a negative effect. So is the ideology of "balance", in which two opposing views are supposed to be given equal consideration regardless of their basis in fact and whereby the reporter shrugs off responsibility for assessing this basis, for fear of being accused of exercising bias.

Environmental reporting in particular requires both journalistic skill and familiarity with the scientific aspects of the issues concerned. Yet instead of responding to the evident need for more in-depth comprehensive environmental reporting as multiple crises grow worse, the news media has been marginalizing and cutting back their environmental staff at a greater rate than their other layoffs due to digitization and audiovisual media expansion. For example, the number of US daily newspapers with dedicated environmental reporters fell from 555 in 2000 to 300 in 2008. This is roughly 6% greater than the percentage rate of layoffs at the New York Times over the same period[3].

The science-to-public link is not completed without considering the capacity of the public to comprehend messages from the media and their

relevance to the individual and to society. To improve this, more resources must be devoted to public education, to elevate the capability to understand and evaluate scientific material, or scientific literacy[4]. Instead, US schools are lagging in scientific literacy. The 2012 PISA[5] report studied the scientific literacy of 15-year olds in the 34 nations of OECD[6]. On average, US schools lack in scientific literacy according to report, which rated the US in the lower half at 20% in mathematics and just above average at 60% in science. This is much too low for a nation presuming to lead the world. The study also noted that the national scores are influenced by the nation's socioeconomic conditions, by about 15% lower scores. In other words, educational deficiencies are directly related to the economic and social inequalities to which students are exposed (cf. Chap. 4, D.5.3). A broad spectrum of environmental and social sciences is prerequisite for Sustainability Science, which is emerging as the essential discipline for all students (including adults) if they are to understand the necessity of the transition to sustainability and the individual responsibility to participate in that transition

2. IS THE QUALITY OF PUBLIC MEDIA IMPROVING OR DETERIORATING?

2.a The Digital Revolution. The advent of the digital revolution has greatly increased the accessibility of information even as the relentless profit drive of an ever more concentrated mass media ownership (print, radio, TV) narrows the content and constrains the quality of news information. There is an increasing contradiction between the potential to receive and share information and the risk of the information being distorted by an increasing number of intermediaries between the source and the recipient. When these intermediaries sell information, more for its entertainment value than for its quality of truth, the goal of a well-informed public is set back. Because for the quality of news media is crucial to sustaining a society, and it is for this reason the public should demand a high standard from journalistic communications. In the following sections, we describe changing aspects facets of what might represent changes, if not deterioration of the media, now occurring in the U.S.- a process that is analogously being repeated in other nations claiming freedom of expression

2. b. Daily Newspapers. U.S. newspapers are declining in both content and distribution due to competition with Internet news sources and decreased advertising revenue as well as by the rising cost of paper pulp owing to deforestation. The Internet, by contrast, has the advantages of near-universal

availability and low cost. IBISWorld estimates that the industry in the US is experiencing a -5/4% growth rate as of February 2016.[7] To compensate for their rising costs, newspapers are modernizing the printing processes and making their publications available to online subscribers. These cost-cutting strategies often include structural changes, such as resorting to syndication of significant portions of their content, merging with regional newspapers, and acquisitions by large corporate companies, the most prominent of which are Gannett Co., Warren Buffett's Berkshire-Hathaway, Tribune Media, and McClatchy Co. The buyout process leads to additional structural changes and more layoffs of staff, currently occurring at an annual rate of about 8% per year[8].

What does the public lose in this process? In practice, the consolidation has led to a more oligopolistic profit-driven control, shrinking readerships, shrinking staff, less regional diversity, greater corporate influence on editorial opinion, more pseudo-objectivity in reporting on "both sides" as if they had equal validity without fact-checking of their respective claims. In addition, their coverage of social and environmental issues become less accurate in content and complexity.

2.c Social Media. Social networking services offer a vast array of options for sharing personal, professional, and commercial information. The evolution of social media is transforming our options for communication. It allows individuals to communicate personal information instantaneously with distant family and friends and to form online communities of like minds, to educate themselves, and to find and share non-personal information on virtually any topic. Commercial entities can use the networking services for advertisements, and consumers can use social media to obtain product information, evaluate merchants and service providers, and buy and sell. Individuals, institutions, or non-profits can use social networking services for sharing of ideas and data, cooperative actions, petition campaigns, and so forth. These services can be grouped into four lose categories according to how they are used: for *searching* for specific information, such as assistance, education, advice, or goods and services (Google and other search engines, and increasingly Facebook as well); for *personal* socializing through sharing interactions with family and friends through profiles, photos, and updating personal experiences, and to a lesser extent for political debate (Facebook and similar platforms); for *non-fictional* information (Wikipedia); for forming cooperative alliances and seeking employment or *career enhancement* (LinkedIn), and for sharing *professional* publications (Research Gate)..

2.d. Blogging. Another use is blogging**,** which is a mix of news journalism, opinion, and exchange of information on topics such as current events, politics, culture, and science (Huffington Post, countless personal WordPress sites, blogs that form part of the online versions of print publications like Discover). Blogs have the added feature of encouraging reader comments to facilitate discussion of the material posted. Individual log content is informal and generally reflects the author's opinion. It is also often provocative or explorative about news or controversial ideas in a manner aimed at soliciting more discussion from readers. For standalone blogs as opposed to those that appear in respectable online publications, there is no superimposed protocol for writing, no requirement for the use of authoritative sources or references, and no obligation to tell the truth. These conditions provide a great platform for unlimited expression, but a poor platform to host a robust science-public interface—that is, except where the bloggers are verifiably what web companies now call SMEs or subject-matter experts with the appropriate credentials.

2.e. Media Oligopoly. Consolidation of total media companies, with multiple ownership in TV, cable, Internet, radio, etc., has increased significantly over the last several decades (Fig. 2), and is prompting controversy about whether the media presents a sufficient quality and quantity of information to serve the needs of democracy. Are the news media providing an accurate and comprehensive coverage of current events (global to local), or are they through selective and biased reporting impeding the functioning of a free and independent press, considered by Thomas Jefferson to be an essential element of the First Amendment. Media consolidation started in the 1970s and 80s as a consequence of the neoliberal ideology (promoted by both the Nixon and Regan administrations) that government regulations of business concentration were excessive, which promoted a series of deregulatory legal changes based on the argument that deregulation would increase competitiveness, raise productivity, and lower prices for consumers. This rationale has continued through to the present, even though (as so often with neoliberal policy and ideology) the result has been the opposite of the prediction—more consolidation, less competition, lower quality. For example, see Great Kansas Tax Cut Experiment)[9].

Those supporting the resulting consolidation of media companies now argue that lower competition means internal cost-cutting, greater reliance on

broadcasting networks, more syndicated news services, and a greater spread of programs and advertisements to a wider audience, all of which improves their profits. The present set of media corporations is fairly stable, in part because they have all become conglomerates, selling not a single product but an array of communication services, which facilitates some cooperation between them in the sharing of geographic areas and of product diversity.

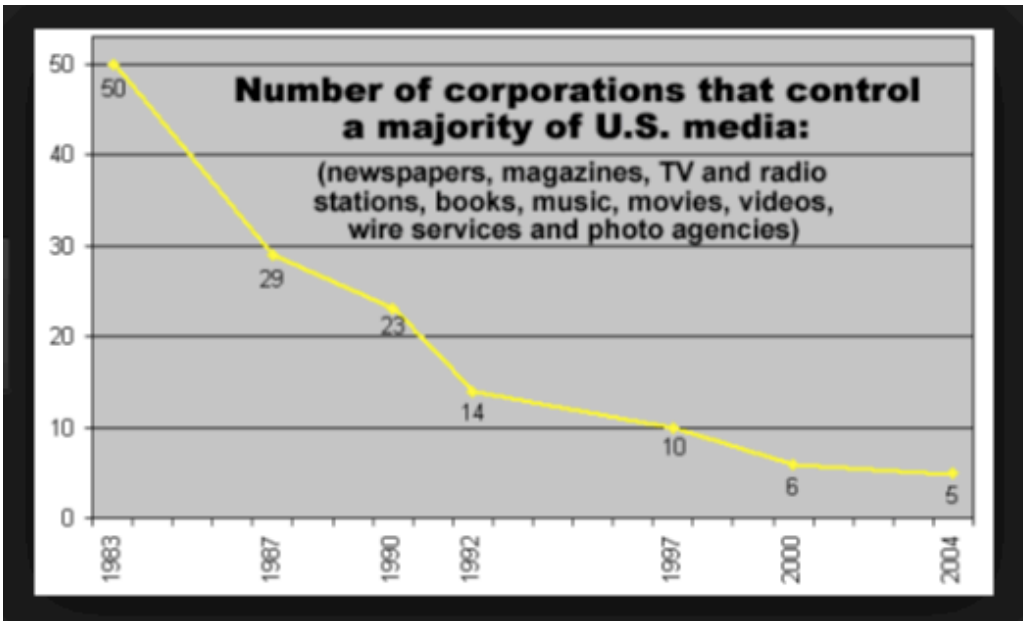

Fig. 2. Consolidation of Total Media Corporations in recent Decades. As of 2012 the surviving six corporations are GE, News Corporation, The Walt Disney Company, Viacom, Time Warner, and CBS[10].

Those opposing consolidation argue that it interferes with their right to have a free and neutral press because it reduces the diversity of news sources and allows for editorial bias toward the interests of the media companies, all of which degrades the quality of national and local news information of importance to the public. As a result, the quality and diversity of information is sacrificed in favor of material that is entertaining, scandalous, or directed to high-end advertisements. Also particularly sacrificed, is objective news coverage of controversial environmental and social issues that are essential to an informed public and its effective participation in the democratic process, for example:

2.f. Political Influence. Accurate and comprehensive political news coverage is not only jeopardized by narrow ownership but by the fact that such ownership tends increasingly to broadcast programs or advertisements

that have false or politically biased content. The recent flood of money into political campaigns has raised two complex controversies. One of these is the interpretation of the First Amendment's definition of freedom of speech, including freedom of the press. The other is the type and extent of campaign finance reform needed to change the role of money in political campaigns. Here, we focus on the question of whether money can limit the quality and accuracy of the news media. In the preceding sections, we have argued that commercial media favors profit-making over preserving news quality and range, which are a democratic necessity, though unfortunately not a right. Freedom of speech through the press (including electronic and digital media channels) relates to content, which is by the citizen's democratic right, be factually objective, have editorial independence, and respect their civic responsibility for honest news reporting. Factual objectivity obviously cannot be absolute; but it provides a standard by which to measure any given piece of reporting. Its first guarantor is, or ought to be, editorial independence: that is, there should be a rigid and impermeable firewall between the business and editorial sides of a news organization. Editorial decisions all the way down the hierarchy should be protected by this independence and by clearly stated policy, which should hold both editors and reporters accountable for factual objectivity. The other guarantor is civic responsibility, which is the principled commitment to "the public's right to know" (Freedom of Information Act[11].) about matters that affect their lives—politically, economically, socially, technologically, medically, culturally, and so on. Civic responsibility should guide editors in their choice of stories for reporters to cover and in the depth and length (in days and follow-up) of that coverage.

The present-day news media in the U.S., even the so-called "newspapers of record" like the *New York Times* and the *Washington Post*, are often failing to meet these criteria. Not only are stories too often rushed out without adequate fact-checking, leading to instances of journalistic fraud, but there is excessive reliance on official sources and an unwillingness to confront powerful individuals (politicians, senior elected officials, corporate CEOs) or organizations with their factual inaccuracies or outright falsehoods: former *Times* reporter Judith Miller's[12] completely uncritical propagation of official falsehoods about the presence of weapons of mass destruction in Iraq in 2002-3 is a particularly egregious example, but there are countless more subtle ones.

2.g. The Corporation for Public Broadcasting (CPB). In 1967 the U.S. government passed the Public Broadcasting Act[13] to assess the needs of the general public, and of minorities and otherwise underrepresented racial, ethnic, and immigrant portions of the national population, and to address these needs through radio (NPR) and television (PBS) in a broadcasting format that would be objective, informative, current, noncommercial, educational, and culturally useful. In short, the Act was intended to promote the informed public so essential for the health of our democracy. The CPB is a non-profit organization and governed by a Board of nine directors appointed by the President, with the requirement that not more than five can be of the same political party. The Board regularly reports activities and reviews directly to Congressional Committees. The Corporation imposes requirements on its broadcasting, some of which are relevant to our discussion and are briefly described in the following points:

1. Its telecommunication services are restricted to noncommercial, instructional material that can be transmitted by electronically.
2. It has only a limited funding from the Federal Government (about 16%), state and local taxes (about 22%) and the remainder in coming from listener and viewer donations and by business or institutional donors (about 59%) identified by name or logogram.
3. Its broadcasting cannot in any way support or oppose any candidate for political office.
4. It must remain responsible that broadcast programs are of high quality, diversity, creativity, excellence, that they are innovative and confirmed from diverse sources, that they are in strict adherence to objectivity and balance in all programs or series of programs of a controversial nature (subject to review by the Corporation).

The fact that NPR is rated the most trusted news source in the U.S. and that it has over 21 million listeners per week testifies to the popularity of public nonprofit news and program broadcasting. Likewise, PBS has been polled as the most trusted of TV broadcasters, and it has more than 350 member stations throughout the U.S. (Wikipedia). The history and success of National Public Radio and the Public Broadcasting Service[14] have provided excellent examples of responsible and comprehensive media that helps their audiences put issues, news, and controversies into a genuinely balanced perspective. The catch to this success is in the time it takes to cultivate such an audience, which can only come from a slow realization of the need, together with a personal interest in bettering the world we live in. Also, government funding for NPR and particularly for PBS has been cut to a small fraction of what they received (in constant dollars) four decades ago; and the more they depend on corporate sponsorship, the less reliable their objectivity is.

2.h. Internet News Outlets. Apart from CPB media services, there has been a rapid growth in internet news sites, of which the largest and best-known is probably *The Huffington Post*, which has both local and international editions. Writers for this site are unpaid, which is also true of many of the others. The informational quality of these sites ranges from the excellent to the worse than worthless—that is, to the delusional or the completely mendacious. It's fair to say that most of the latter are politically to the right, though there are plenty of nominally left-wing conspiracy-oriented or pseudoscience-propagating sites also: 9-1 "truther" sites are examples of the former, and anti-vaccination sites of the latter.

Among the news-blog aggregator sites are *ThinkProgress*, which includes several different sub-sites, including one dedicated to climate-change issues; *Reader Supported News*, which publishes a mix of original content and previously printed columns from the likes of economist and former Labor Secretary Robert Reich; *Common Dreams*, which also features original news reporting and opinion along with stories gathered from other progressive and environmentalist sites; and *DemocracyNow.org*, the web version of the daily news and interview show "Democracy Now" that airs on a handful of public and other nonprofit radio stations. On the environmental side, the largest and generally best news-blog site is the daily *EcoWatch*, which again brings together original reporting, stories first posted by more specialized environmentalist sites that in turn have often been gathered from the press abroad, and articles from sources as mainstream as the *Times* and the *Post*. Alongside these sites are those operated by news-quality watchdog groups like Fairness and Accuracy in Reporting (F.A.I.R.)[15]

The proliferation of what we might call junk news sites combined with the shrinkage of the daily newspapers and the dumbing-down and ideological skewing of much TV news has led to a deteriorating ability on the part of many members of the public—especially but not exclusively the less well educated—to judge the quality of information they find on such sites. Since most right-wing sites, whether secular or religious in orientation, are still propagating climate-change denial, we see no need to identify or evaluate them here: this single criterion is enough to disqualify them as serious news sources.

2.i. Social Media: Information Sharing and Debate. Beyond these sites are social media platforms, of which the largest and most sophisticated by far is Facebook, which had 1.59 billion monthly active users as of August 2015 (Wikipedia). Behind Facebook is Twitter, which as of December 2015 had 645,750,000 users, of whom 289,000,000 are considered active, with 135,000 new users per day (Statistics Brain). While social media's ostensible purpose is to provide users a platform for freedom of expression, in practice there is little quality control on the exchange of factual information and its sources, a shortcoming that acts to distort information and to polarize users. This is particularly true when the social-media participant chooses posts, blogs, or entire sites according to his/her taste as sources that reinforce her or his own opinions. In fact, studies of responses on Twitter "found that replies between like-minded individuals strengthen group identity, and replies between different-minded individuals reinforce in-group and out-group affiliations; and show that people are exposed to broader viewpoints than they were before but can be limited in their ability to engage in meaningful discussions."[16]

However, as the software underlying these platforms involved becomes quasi-intelligent by virtue of its ability to process and analyze vast amounts of user data with incredible speed, the question of opinion-shaping and group identity on social media becomes more complex. Ever-more-sophisticated algorithms are used by Facebook to suggest new friends and to select and sequence posts by existing friends on a given user's "wall"; these algorithms can now intuit a user's emotional response to a post not only via images but by length of response or reply, keywords used, and so forth. But this does not necessarily lead to a filtering of posts made or shared by friends to posts that only support the user's views or feelings.

Consider the intense political debate between the respective supporters of Hillary Clinton and Bernie Sanders in the 2016 primary campaign. Typically, users who identified as Democrats or as Democrat-leaning independents would not share posts from supporters of Donald Trump or Ted Cruz, say, even if they counted one or more of these among their friends and family. However, they *would* typically have some friends who do support the other Democratic candidate, and share posts from these friends, which would continue to appear on the user's wall, and cause another user to comment or reply critically. Of course, if they responded rudely, the poster might block them or unfriend them. But at least among this group of voters and potential

voters, debate generally continued civilly enough that despite some angry words in exchanges, a dialogue of posts and counter-posts continued.

From this experience, it appears that Facebook will sometimes share a post with which it "knows" the user disagrees, for instance, because one or more of the comments or replies is from a position similar to the user's. It is also possible to see a kind of community of follower-friends accumulating around a particular user (or a subject-matter page) in which dialogue takes place. If the user or page focuses on a cause of some kind, whether political or humanitarian, members of this community will amplify each other's contributions by "tagging" friends who are not community members in order to spread a message. What's more, Facebook allows users to apply hashtags to posts they are making in order to contribute to larger discussions, which are also searchable using the hashtag. Whatever its limitations, this may lead potentially more democratic, flexible media for large-scale discussions of social discussions for clarifying issues such as discussions social justice, economic inequality, and environmental sustainability of the kind we want to help foster in our communities.

2.i. Money and Political Debate. Experience suggests that if money can find a way to control content, it will. Consequently, if an individual or organization wants to protest or advocate an issue, or if a candidate wants to conduct a campaign, the amount of money available for that purpose can be determining factor in achieving success or not. Clearly, poor or middle-income people and their issues do not get equal representation in the media with the rich and theirs. So, he who has more money has correspondingly greater means to be heard; under currently dominant interpretations of the First Amendment, that is not only an individual's freedom of speech but an *enhanced* freedom of speech for one buys news representation. As recently as the 1970s, with more than 35% of workers unionized, every newspaper of any size had a labor reporter. Today, with fewer than 17% of the workforce in unions, that specialization has vanished, and without its expertise in reporting on workers' issues, opinions, and struggles.[17]

This tendency is also driven by the removal over the last decade of virtually any constraints on political campaign spending. Since the 1970s there have been organizations called political action committees (PACs) that use individual member contributions to directly fund a particular candidate or legislative campaign. Throughout the last three decades, and especially with

the Supreme Court membership over most of that period, rule after rule limiting campaign spending has been legislatively removed or circumvented or judicially struck down. Recently, the Citizens United decision expanded the ability to fund from individuals to other organizations as such, including corporations, unions, and NGOs; the means is the so-called SuperPAC.[18] SuperPACs are not allowed to coordinate with or give funds directly to candidates or political parties, but they can spend unlimited amounts for political goals independent of individual campaigns. The SuperPAC also qualifies as a tax-free nonprofit. However, many are used to raise money to spend on issue advocacy and voter mobilization—for example, to support the position of a candidate on an issue.

For example, as of February 8th in the 2016 presidential election cycle, SuperPac political expenditures were 94% percent of the total of 1.94$M expenditures accumulated by all organizations. In other words, the current political SuperPacs have already spent 3.6 times what was spent by SuperPacs at same time in the 2012 election cycle[19]**;** which is 48 times more than what has been spent by social welfare groups. This example illustrates how unregulated funding via SuperPacs can destabilize the political campaign process, and how rich entities favor political control over, for example, building social capital. The table in Fig. 3 gives an example of the amount of funding donated only by the Koch Family foundations and philanthropy have spent to counter public acceptance of climate change.The Koch Brothers, who have large investments in the petroleum industry, have spent over 100 million dollars to also support the climate change denial process[20] and intend to spend $900 million on the 2016 election cycle through a mix of organizations. Among other activities, Charles and David Koch ironically support a broad array of non-profits to “further social progress and sustainable prosperity”[21]**.** More generally there are important factors that can alter or modify the polarization process such as if the group is personally acquainted, has diverse backgrounds, or has some common point of reference. Unfortunately, these preconditions do not often exist on the Internet. On the socially constructive side, people listen to or view a program for several reasons, including curiosity, entertainment, or a more deliberate pursuit of knowledge. Relative to our discussion here, the advent of online network services are greatly expanded communication and has the potential, if honestly used, to improve public awareness, accelerate the cooperative interactions between individuals, cultures, and nations in a manner that will eventually prove so essential to global sustainability

Fig. 3 Table of Organizations that Fund for Climate denial.

Global Warming Skeptic Organizations, from Union of Concerned Scientists (UCS)*		
Organization	Activity	Funding
American Enterprise Institute, AEI	AEI plays a role in propagating misinformation about a manufactured controversy	AEI received $3,615,000 from ExxonMobil from 1998-2012, and more than $1 million in funding from Koch foundations from 2004-2011
Americans for Prosperity (AFP)	AFP frequently provides a platform for climate contrarian statements	Koch foundations donated $3,609,281 to AFP Foundation from 2007-2011
American Legistlative Exchange Council (ALEC)	ALEC maintains that "global climate change is inevitable", but since the 1990s has pushed legislation aimed at obstructing policies intended to reduce global warming emissions.	ALEC received more than $1.6 million from ExxonMobil from 1998-2012, and more than $850,000 from Koch foundations from 1997-2011
Beacon Hill Institute at Suffolk University (BHI)	BHI has published misleading analyses of clean energy and climate change policies in more than three dozen states. These economic analyses are at times accompanied by a dose of climate contrarianism.	BHI has publicly acknowledged its Koch funding, which likely includes at least some of the approximately $725,000 the Charles G. Koch foundation contributed to Suffolk University from 2008- 2011.
Cato Institute	Cato's Center Director for the Study of Science, has referred to the latest Draft National Climate Assessment Report as "the stuff of fantasy." Cato's "Handbook for Policymakers" advises that Congress should "pass no legislation restricting emissions of carbon dioxide."	C David Koch remains a member of Cato's Board of Directors. Koch foundations contributed more than $5 million to Cato from 1997-2011.
Competitive Enterprise Institute (CEI)	CEI has at times acknowledged that "Global warming is a reality." But CEI has also routinely disputed that global warming is a problem, contending that "There is no 'scientific consensus' that global warming will cause damaging climate change."	CEI received around $2 million in funding from ExxonMobil from 1995-2005, CEI has also received funding from Koch foundations, dating back to the 1980s.
Heartland Institute	While claiming to stand up for "sound science," the Heartland has routinely spread misinformation about climate science, including deliberate attacks on climate scientists.	Heartland received more than $675,000 from ExxonMobil from 1997-2006. Heartland also millions from the Koch-funded Donors Trust through 2011.
Heritage Foundation	Heritage often uses rhetoric such as "far from settled" to sow doubt about climate science. One Heritagereport even claimed that "The only consensus over the threat of climate change that seems to exist these days is that there is no consensus."	Heritage received more than $4.5 million from Koch foundations from 1997-2011. ExxonMobil contributed $780,000 to the Heritage from 2001-2012. ExxonMobil continues to provide annual contributions to the HF.
Institute for Energy Research (IER)	IER claims s that researchers "exacerbate the sense [that] policies are urgently needed" for monetary gain, noting that "issues that are perceived to be an imminent crisis can mean more funding."	IER has received funding from both ExxonMobil and the Koch brothers.
Manhattan Institute for Policy Research	The Manhattan Institute has acknowledged that the "scientific consensus is that the planet is warming," while at the same time maintaining that "... accounts of climate change convey a sense of certitude that is probably unjustified."	The Manhattan Institute has received $635,000 from ExxonMobil since 1998, with annual contributions continuing as of 2012, and nearly $2 million from Koch foundations from 1997-2011.

B. DEMOCRATIC EFFICACY.

1. INFORMATION FOR LEADERSHIP

1.a. Limited Access to Environmental & Social Information. The changes in the means and structure of communication methodology just described have the potential to enhance the efficiency with which the public can exchange information, organize, and influence government. However, there are still many improvements needed to achieve intelligent, comprehensive environmental information: raising scientific literacy, better translation of scientific results, more environmental journalism, less undocumented commentary, less commercialization of media, more open fact-checking of fallacious claims, and most importantly, less corporate interference through the funding of fallacious or mendacious arguments. Two important examples of such interference can cause long delays in public acceptance of issues that are in the best interest of the public are given by:

1) The oil industry's *public* denial of anthropogenic climate change (Chap. 4, 4.4) has been even more effective, in terms of slowing public acceptance and understanding, to the slowing of public acceptance of the health consequences of smoking tobacco created by the tobacco industry's opposition.

2) Religious, economic, and political resistance to climate change is still contributing to a more than two-decade delay in public acceptance of the issue. Missing are the realizations that the underlying guidelines for sustainability (climate change) espoused by science and those prescribed for spiritual behavior by all major religions are coincident, chiefly the requirement that we live in harmony with nature and in equality with other humans (Chap. 5, E.5).

Efforts by the media and government to minimize these interferences would help reduce much of the confusion and polarization existing on issues. Improved environmental and social reporting would also help policymakers with their personal learning curves on issues, clarify their interactions with external influences, improve their dialogue with their constituents, and increase their capacity to respond appropriately to issues. In the case of a global problem like CC, it would be political folly for a politician to lag public consensus on the CC awareness learning curve. The fact that many politicians, especially in the US, *do* lag behind—or actively dig their heels in, as virtually the entire Republican congressional delegation did into 2016—on the CC issue is an indicator of their (well-funded) resistance to considering CC as a reality. It indicates that many do not understand the magnitude of the consequences or

the need for urgent action. There is also a perceived risk to politicians in pushing an agenda that to them is still controversial and that many of their constituents have the same hesitation about. However, for an issue of this magnitude that threatens national security (the Department of Defense in 2015 in fact labeled global climate change as the number-one threat to US national security) politicians should be cognizant of the scientific facts and should keep up with the changes in the public will for action on CC.

Improving the efficacy of policy on social issues requires objective information on both the responses to and the needs of the public involved. In other words, efficacy increases when the public trusts that local, state, and national government are serving its needs (cf. Chap. 4, D.5.3). This condition requires that policymakers have a higher level of awareness and responsibility regarding what is best for the society as a whole. But in a society of extreme economic inequality, for a politician to act for the common good can equate to career suicide, as enormous financial resources are brought to bear against him or her via the funding of primary challengers or the candidate of the opposing party. In this context, an objective assessment of the policy options available to resolve the issue in a way compatible with other issues linked to it is difficult. Such an assessment also requires an information base derived from monitoring changes in public awareness of any particular issue (cf. Chap. 5, E.4).

1.b. Improving Participatory Discussions. The media's poor performance with environmental issues is somewhat offset by the expanding scale of information dissemination (see above on internet news outlets and social media) which can potentially facilitate a wider, more diverse base for discussions that are of fundamental value to the democratic process. The success of societal discussions of issues depends on the authenticity of the available information, on how the discussion was conducted, and on the level of consensus and practicality of the conclusions reached. Hence, encouraging a culture of authenticity in discussions of political or community issues is essential. Conducting smaller-scaled discussions requires proven methodology[23] and trained personnel with a working knowledge relevant to the issue discussed. It is important to establish who wants the information produced by the discussion, such as a local political leadership, a labor union, or a neighborhood or community group. To ensure efficacy of the results of the issue addressed the individual or entity that sponsors the discussion must

participate and ensure that the relevant stakeholders are represented and that they participate in the discussion and commit to the results.

For larger-scale, multidisciplinary issues, national research institutions are giving more recognition to the so-called "science-policy interface". Improving this interface is inhibited by its very complexity. From the point of view of disseminating scientific information, readable and accurate description requires both journalistic skill and scientific knowledge. Achieving the right balance is difficult. Although usually willing, research scientists often feel that condensing their results down to the vernacular awkwardly oversimplifies their descriptions. This difficulty can be lessened if there are multidisciplinary scientists directly involved in a study of the issue. Policymakers often want more than a description of an environmental or issues; they want projections on how it might be solved, which constitutes a less common and much more difficult task than issue description alone (cf. Chap. 5, E.4).

1.c. Role of Advocacy Groups. The lack of good media coverage of environmental issues has strengthened the rationale for advocacy groups, nonprofits, and institutions to undertake the task of raising public awareness and political will on environmental issues threatening our society. This is especially true for the recent advocacy on the climate change issue. CCL[24], 350.org, Climate Reality, and other advocacy groups are taking a responsible stance by utilizing all forms of communication, through personal letters to governing politicians, providing information through public speaking, to protest marches to demonstrate their concern. Interestingly, they are introducing new methodologies for extended group discussions that define common ground, set priorities for action, establish cooperative partnerships, and improve the dialogue between science, policy and the public. Most CC advocacy groups include participants that are familiar with the science and that have specific knowledge about the legal and social aspects of the pending issue. They are striving for greater recognition as an objective and constructive voice for action on CC, and to strengthen and widen the public's attention to this dire problem. To accomplish this, CC groups are experimenting with innovative strategies for explaining CC without generating negative backlash, e.g. using techniques like Consensus Building or Nonviolent Communication[25] (cf. Chap. 1, A.3.).

A recent panel discussion organized by *Orion* magazine provides thoughtful ideas on how CC might be covered to make it more effective[26]. Another successful effort to improve the language and approach to

communication involving conflicts and/or serious differences in opinion is explained by Rosenberg[27]. AmericaSpeaks[28] offered a methodology for finding common ground on controversial issues, for defining priorities, for consolidating options for solution, and for building a sense of community among a cross section of the American public. They integrate the results of many small-group discussions and present them back to the general audience. In another study, it was demonstrated that policy-makers' participation is essential for them to share ownership of information deriving from the public, scientists, and stakeholders[29] CCL has understood the benefit of the redundancy of the same message from different sources especially in application to policy-makers; that is, a person after hearing new information from another, one puts it on 'hold'; then on hearing similar information from another apparently separate person, one puts it on 'wait & see;' and on hearing independently from a third person, one internalizes it and puts into action[30]; but when these messages conflict they tend scrabble the factual information into a personal negative opinion about the whole issue. Another dynamic in play is that "media outlets have treated climate change like a policy debate with two equal and opposing sides, even as the vast weight of science has stacked up on one side of the debate. This tendency to equate unequal arguments, to validate inaccuracies and spin, has undoubtedly slowed much-needed progress toward both broader awareness and better policies"[31].

1.d. Issue Complexity. The Global Change issues, including Climate Change, are all problems of complex systems that cannot be resolved through a single policy or regulation; that is, they cannot be simply fixed, but the solutions can be simply initiated with a good understanding of the complexity involved. Resolving complex problems like CC requires complex adaptive leadership[32] to generate comparably complex solutions. What is needed is much more than the quick technical fixes, new regulations, single-issue focus, or a non-representative consensus of a few, to achieve changes in collective behavior. Human behavior and social responsibility are at the crux of addressing the changes needed. The responsibility for implementing these changes cannot and should not be left to 'market forces' alone, which are mostly directed towards short-term material wealth or individual convenience without respect for environmental or social values (cf. Chap. 4, E.4). In sum, leadership for change must knowledgeably practice actual experimentation and scientifically designed simulations in order to predict the outcomes both of potentially appropriate solutions and of non-solutions, like continuing on the

present course. And they must do this in partnership with the citizenry for the long-term common good.

3. Surveying Public Opinion on Factual Information.

1.a. Public Opinion Polling. Opinion polls are a primary instrument of governance to determine how the public is reacting to policy issues and of their relative importance to the public. The goal of polling is to extract measurable results on public opinion concerning controversial issues. Because of their inherent subjectivity and intensity, they are difficult to quantify and interpret objectively. Polls fall into two general categories: the informal voluntary solicitation (such as radio call ins or polls on social media) and scientific non-biased polls that are statistically designed to sample a random portion of the population (such as Field[33] or Gallup polls). Casual polling can be interpreted only as an indication of the opinions of those polled at that time and for that specific question, that is, they are not necessarily random or independent of the viewpoint of the questioner. Scientific polls are serious attempts to provide objective percentages and error margin[34] on the results of questions that are framed without bias. Errors in polling commonly occur due to biases in the respondents or misunderstandings of the questions. Some common causes of polling error are: a significant percentage who choose not to not to respond, a significant percentage who answer falsely due to a misconstrued question, or a distorted selection of respondents. Besides casual polling and scientific polling, there is the pseudoscientific technique of "push polling," which is used to dishonestly advance a political agenda by framing the question in a way designed to produce the desired response.

Public opinion polling is a still a developing discipline due to the expanded sampling options via the Internet, which greatly increases the potential sampling size and the capacity for disseminating the knowledge gained from the results. Over the last five years, polling has in general become much more accurate because of the development of sophisticated algorithms used both in the analysis of the "big data" obtained and of the poll results. However, it remains also prey to the same types of response errors, and to an unavoidable preference for those respondents who want to have their opinion heard. A recent instance was the pre-election polls in the 2016 Michigan Democratic primary, which Hillary Clinton was projected in multiple respected

polls to win by as much as 20 points; instead, she lost to Bernie Sanders by almost 10.

Face-to-face surveys with trained interviewers from a randomly selected respondent pool can provide much more information and greater reliability. One-dimensional questions of 'in-favor-or-not' are not reliably definitive: they don't reveal the thinking behind the Yes or No. For emerging issues like CC, the second dimension of questioning, 'why,' provides important additional information; but this information must be interpreted through an objective analysis, a more difficult process. For the effectiveness of CC advocacy, understanding why people resist acknowledging the reality of CC and/or oppose action it is essential to designing presentations for diverse audiences. This understanding also can locate a person on a learning curve; and this location, in turn, can help specify the sequence of information needed for that person.

4. Surveying for Subjective Opinions.

Well-conducted surveys can reveal useful information and sometimes-unexpected results on how people think and react to controversial issues. Examples of inequality and climate issues follow.

1.a. Subjective view of threat strongly differs from reality. A common issue facing at least 90% in the U.S. population is that of excessive wealth inequality (cf. Chap. 4, D.5.3). Fig. 4 shows the results of how wealth in the U.S is actually distributed compared to how people think it is, and how they would like it to be. The policies significantly underestimated the wealth of the top quintile and similarly overestimated the wealth of the bottom quintile relative to the actual distribution and relative to their preferred distribution. Clearly, public opinion on all issues affecting society needs to be grounded and explained with respect to some verified reference base and not on second-and-third hand interpretations in the media, in order that they can form their own more objective opinions on issues during elections, and in between them, as active citizens.

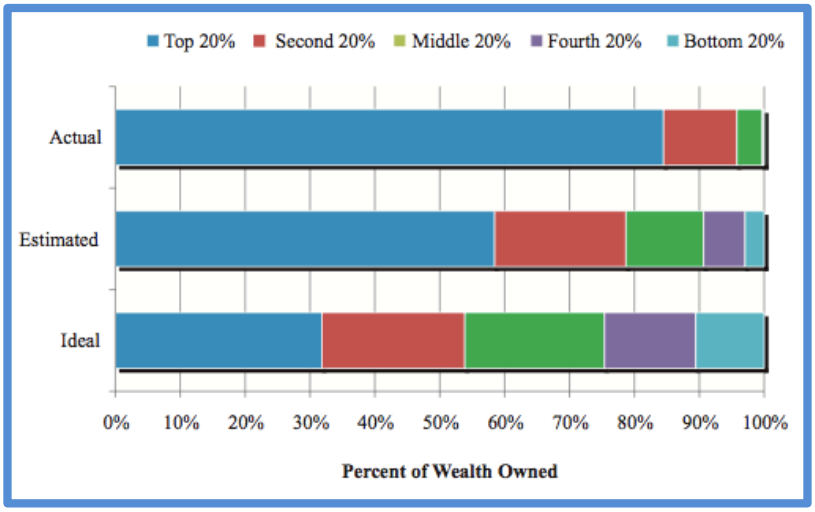

Fig. 4 Example about confusion of a public Issue. The actual United States wealth distribution compared with the estimated and ideal distributions across all respondents of a survey. Two behavioral scientists, Norton and Ariely (2010)[35] conducted this survey of 5,522 Americans on what they thought the wealth distribution was and what they thought it should be. Note that for the "Actual" distribution, the bottom two quintiles (purple and light blue, which constitute 40% of the population) are not visible because the lowest quintile owns 0.1 percent of all wealth and the second lowest quintile owns 0.2 percent.

Given that the public are misinformed to this degree about of financial inequality, which is certainly of personal concern to them, one would not expect them to be informed about CC, which is not readily obvious to most people. Much of this uncertainty comes from the lack of awareness and understanding of objectively derived scientific information. An underlying psychology affects how a person responds to threatening messages: one rejects, accepts, or ignores the content depending on whether one can link it to one's own knowledge base or worldview. Helpful in this regard are clear explanations in nonscientific terms; also helpful are redundant messages received from independent sources. Inspiring people to action usually requires giving them more information on how the conveyed consequences will affect them personally, or in some cases how action would conform, or would not, to the dictates of their worldview. An individual, who lacks personal exposure to CC impacts (or to what they can understand from their local exposure to severe weather events), would need to learn that impacts do exist on a larger scale and will eventually affect their daily life in increasingly obvious and harmful ways.

C. Surveying public responses to Climate Change.

1.a. Clarifying Questions from Audiences. When information on an issue is publicly presented, the audience often responds by asking questions or making comments, which can reveal their concerns or lack of information about the issue. Ellie Whitney[36], a member of Citizens' Climate Lobby and guest op-ed writer for the *Trenton Times* (New Jersey*)* has identified critical information the public needs in order to become convinced of the seriousness of the CC issue and of CCL's objectives. Even though her survey was a casual, it provides important indicators, useful to the CCL's advocacy on what information they should include in their local talks and letters to editors. The following lists these questions and gives brief examples of explanatory comments.

1) **Is Climate change is already happening?** Convincing evidence of this does exist and is essential to gaining support for understanding CC: for example, the observed trends, in sea-level rise, average temperature, floods, droughts, and so forth.
2) **Are the rising concentrations of carbon dioxide in the atmosphere from our combustion of fossil fuel (FF) due to human activities?** That humans are responsible is a more difficult aspect to address, since the concept of man changing nature is contrary to some beliefs. However, European and subsequent immigrants have obviously changed nature in the North American continent, i.e. from genocide of native cultures, to species extinctions, to heavily impacting land and aquatic ecosystems. There is no rational basis to assume that the human combustion of fossil fuel has not also changed the atmospheric system. Carbon emissions are only half of the cause, the other half is less well recognized. It is the other side of the carbon cycle; the part that sequesters (or draws down) CO2 from the atmosphere, such as plants, water surfaces, the ocean. Here again humans are damaging the capacity of earth's surface to absorb carbon and thereby not compensating for excess emissions of CO2 and balancing the cycle, for example, through deforestation, industrial agriculture, urban development, warming water surfaces (cf. P. Hawkin[37]). The solutions to these damaging practices all relate to the need to implement sustainable development (cf. Chap. 5).
3) **While some of the other air pollutants from fossil fuel combustion are readily visible, why isn't CO_2.** Even though CO2 is invisible, and we breath it in and out every day, we emit it driving our

cars, but we don't notice it. This invisible aspect of CO2 does make it harder conceptualize its impacts on humans, especially when several other gases emitted by FF emissions have more visible impacts, such as sulfur dioxides, nitrogen oxides and methane are much more chemically reactive or short-lived in the atmosphere than is carbon dioxide. Sulfur dioxide emissions are quite visible in the form of white clouds outpouring from the smokestacks of coal power plants which on contact with water vapor forms sulfuric acid, and precipitates as acid rain causing damage to plants and building structures. Nitrogen oxide emissions on contact with water vapor also produce acid rain; and on contact with oxygen generate other forms of nitrogen oxides that react with water vapor to form acid rain. N_2O also reacts with the volatile organic compounds (gasoline fumes) to form smog (brownish sky), contributes to CC as a greenhouse gas, and as well as to the depletion of stratospheric ozone. With these in mind, the emission of CO_2 would seem to be a comprehensible addition to human-induced changes. The impacts of excess CO_2 become visible when the climate exceeds historic levels of temperature, precipitation, and sea levels. and, which are kept in balance by natural biochemical cycles. Simply put, it is this narrow window of acceptable CO_2 concentration that allows the continuation of life, as we know it, on the Planet. With this information in mind, it is understandable why it has taken such a long time for humans to recognize the threat of and need to stop burning FF.

4) **But how is the CO_2 balance linked to the Greenhouse effect?**
Understanding the greenhouse effect is easily understood by considering two commonly experienced analogies. Two examples are: the heating up of an automobile parked in the sun with the windows rolled up, or a greenhouse for growing plants at warmer temperatures. This phenomenon occurs because the visible portion of the sun's energy has very short wavelengths that can penetrate glass, but the heat inside the cannot radiate back through the glass because its wave lengths are much longer causing the interior of the car or greenhouse to heat up until it comes in balance with the heat escaping through air leaks to the outside from the back radiation and reflection from the car's outside. In the analogy with the atmosphere, the role of glass is replaced by the four most abundant greenhouse gases (GHG = water vapor, carbon dioxide, methane, and nitrous oxide) that regulate how much back radiation[38]can escape without being trapped in the lower atmosphere (troposphere), making the earth the goldilocks planet where all life lives. Figure 9 illustrates the delicate balance of the carbon cycle[39]; and a further explanation of dynamics of carbon cycle and how it self-regulates itself to maintain this balance is given in Chap. 6 or on the internet.

5) **How is CCL proposing to cut carbon emissions?** CCL proposes a quick, efficient, just, and transparent, way to begin curbing our carbon-dioxide emissions is to put a gradually rising price on carbon at its source. This is as important to public willingness to confront CC as learning about the greenhouse effect. Immediately on learning about a threat, one wants to be reassured that there are solutions; otherwise one is apt to disengage from the discussion. There are multiple and effective scientific-technical ways to confront CC, but the political will to take action does not yet exist, due to the information lag between the reality of CC reality and public acceptance of that reality. Since the visible consequences are growing exponentially, it behooves the government to take some immediate action to slow CO_2 accumulation. The CCL proposal meets this need for an action that would demonstrate a first-step in national commitment to addressing CC, would put pressure on FF energy providers to switch to non-carbon energy sources and on institutional investors to move their own capital also, and would not pass the cost on to the public.

6) **Do we need to burn fossil fuel in order to generate the energy needed to run our economy?** Pricing carbon at its source is much more efficient than trying to price its combustive emissions. Therefore, the challenge we face is to reduce to a necessary minimum the mining and combustion of buried carbon and thereby reduce carbon emissions into the atmosphere. In addition, we must increase the capture of CO_2 by terrestrial photosynthesis and soil conservation, actions that require a transition to sustainable agriculture, land, and forest management.

   The goal is to reduce our fossil-fuel use to a sustainable level while shifting to renewable energy sources. We are now achieving this transition by increasing wind and solar power generation, employing hydrogen fuel cells, generating biofuel from waste, etc. The minimum-emission criterion would allow the atmosphere to return to a global carbon balance less disturbing to the climate and less polluting to our environment. It would also greatly ease the dangerous geopolitical conflicts and inequalities inflicted on our societies by competition for FF (and uranium) sources. In addition, nuclear energy should be off the table, and large dams for power generation should be dismantled or reconfigured to achieve a balance between freshwater availability and ecosystem requirements. Obviously, the transition away from FF will have to be well planned and accomplished incrementally and be in step with the infrastructure needed to distribute renewables.

7) **Are renewable-energy and energy-efficiency technologies ready to replace fossil fuels.** The technologies are proven to have the capacity, but a dedicated ramp-up of production of photovoltaics, hydrogen extraction, and wind turbines needs government support to create the needed market. To provide the necessary supporting infrastructure will also require time and money and requires a well-prepared transition plan.

The US Department of Defense's Strategic Plan has as first goal to "*Catalyze the timely, material, and efficient transformation of the nation's energy system and secure U.S. leadership in clean energy technologies*." However, the DOE report does not provide a sufficient analysis of alternative energy systems, of their infrastructure needs, or of methodologies for transition.

8) **Once the carbon fee is in place, benefits follow.** The immediate benefit is that it will bring about a US commitment to the transition. The President can implement a revenue-neutral Carbon Fee through an Executive Order under the Clean Air Act regulated by the EPA. The IRS could administer the fee through equivalent tax deductions that would offset the increased petroleum prices that consumers pay. Such a carbon fee-and-dividend system will provide diverse and numerous jobs and help to implement an economically efficient and just transition towards sustainable US energy. The long-term benefit is that the total cost of energy will decrease and minimize the social and environmental costs.

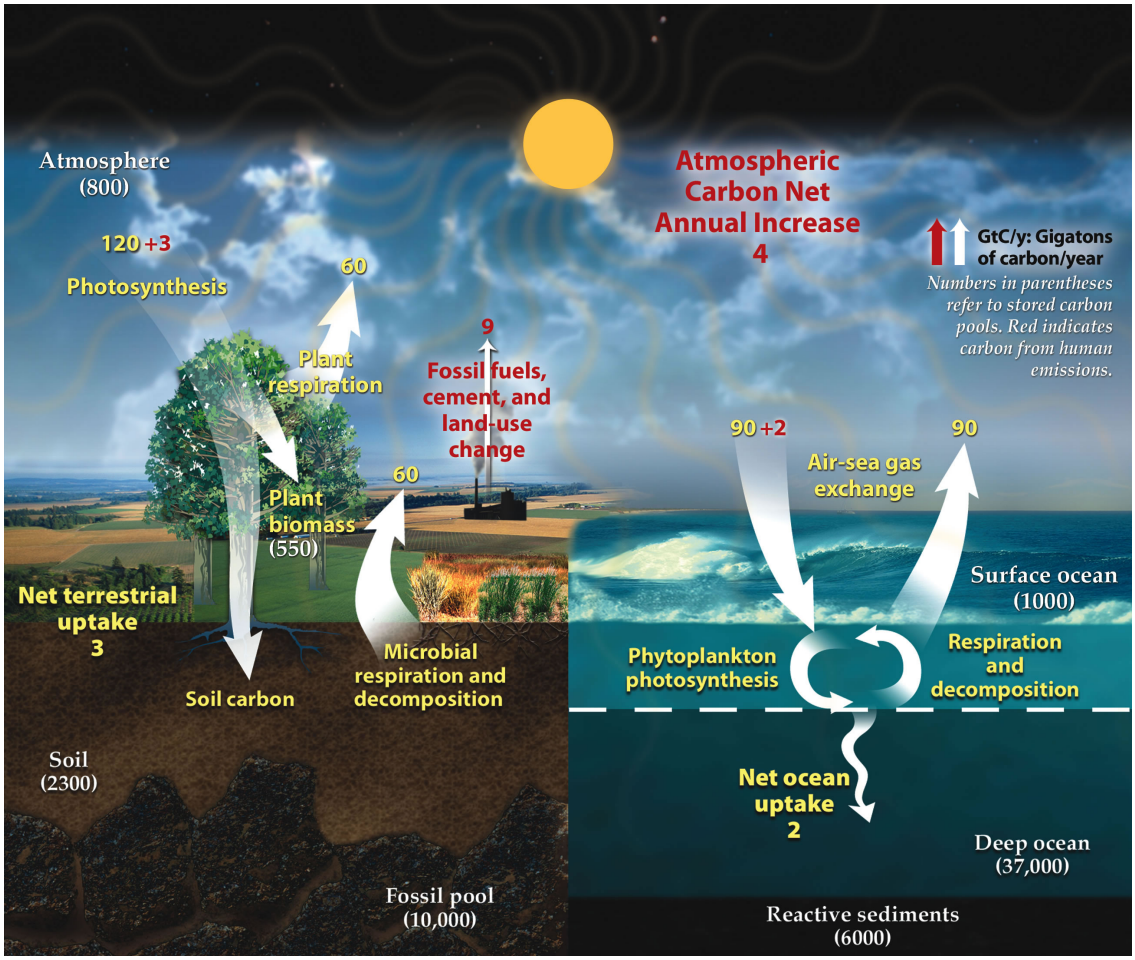

FIG. 5. The Atmospheric Carbon Cycle. The white arrows indicate the main exchanges and their connections of carbon dioxide to and from the Atmospheric and the Marine and Terrestrial Systems. The yellow phrases identify the exchange processes with their associated flux as a yellow number in gigatons per year. The white phrases indicate the location and magnitude carbon stored in gigatons. The red numbers indicate the human produced emissions also in gigatons. This diagram does not account for volcanic and tectonic activity, which also sequesters and releases carbon. From Wikipedia[39].

4. INTERVIEWING FOR PUBLIC RESPONSES TO ISSUES.

4.a. **Interviewing the public** can qualify and track a learning-curve distribution. Yale and George Mason universities are jointly conducting a nationally representative survey, entitled "Climate Change in the American Mind," summarized in two reports by Leiserowitz[40] (2012) and Leiserowitz (2015)[41]. These provide an important example of how scientific surveys are conducted[42]. They also demonstrate how they can extract subjective information through specialized interviews aimed at, in this case, how US citizens think and feel about CC and how and what makes their responses change with time. The interviewers used the term 'Climate Warming' instead of 'Climate Change', because at that time it was more commonly understood name for the phenomenon. Here we use the two terms as synonymous.

4.b The 2012 Report summarizes the results of a series of six surveys of over a thousand interviews each with randomly selected adults from January 2010 to September 2012. An important revelation of this survey is that the public should not be considered as a single entity in terms of what they believe about an issue. The report differentiates "six Americas" based on their differing reactions and beliefs about climate change. These ranged from complete engagement with to complete disengagement from the issue, its causes, its consequences, and its solutions. This finding substantiates that one-dimensional polling questions (3.1a) are insufficient for obtaining useful data when dealing with complex issues. This also implies that policymakers should not treat the public as a collective body but as multiple bodies, each of which responds to an issue differently according to its belief system. This caveat is complicated, because of course these six groups are not clustered geographically but intermingled. For policymakers and advocacy groups, such a mixed distribution greatly complicates any effective communication towards achieving consensus on an issue. The following list provides a brief breakdown of the six groups quantitatively and qualitatively according to their position on

CC, and an interpretive statement regarding what is needed for improving CC advocacy:

Alarmed, 16%. This group understands both the extent and urgency of CC. These people are on board and should be helpful with increasing public awareness of CC.

Concerned, 29%. Members of this group are concerned but not alarmed because they feel it is too distant in time or space from them and from their communities. These need more information on the need and urgency of the CC issue with messages that fill their information gaps.

Cautious, 26%. Members of this group haven't made up their minds. They question the seriousness of CC and that it is induced by human activities. They need more information with a ramp-up approach to the issue, through personal contacts and messages that relate CC to their community or faith-based social responsibility.

Disengaged. 8%. Members of this group have heard about CC but are ignoring the discussion and don't know or care about the causes and solutions. They need explanations of how CC consequences could affect them directly in the future.

Doubtful, 13%. Members of this group are not sure that CC is happening and suspect that it is probably a natural change and that we cannot do anything about it. These may also be confused or feel that CC is probably contrary to their belief system, or they tend to accept it as an act of God. They need an explanation directed toward what is blocking their acceptance, such as that virtually all faith groups espouse stewardship of the earth, preach social responsibility towards other living things, and urge care for the poor who will suffer the most (cf. Chap. 5, E.5.1)

Contrary, 8%. Members of this group dismiss the problem and tend to believe that CC is a hoax. They are often actively involved in discrediting the CC issue. Their tactics need to be exposed with an explanation of why they are denying, how they are countering the scientific facts, and they are acting against the best interest of the country.

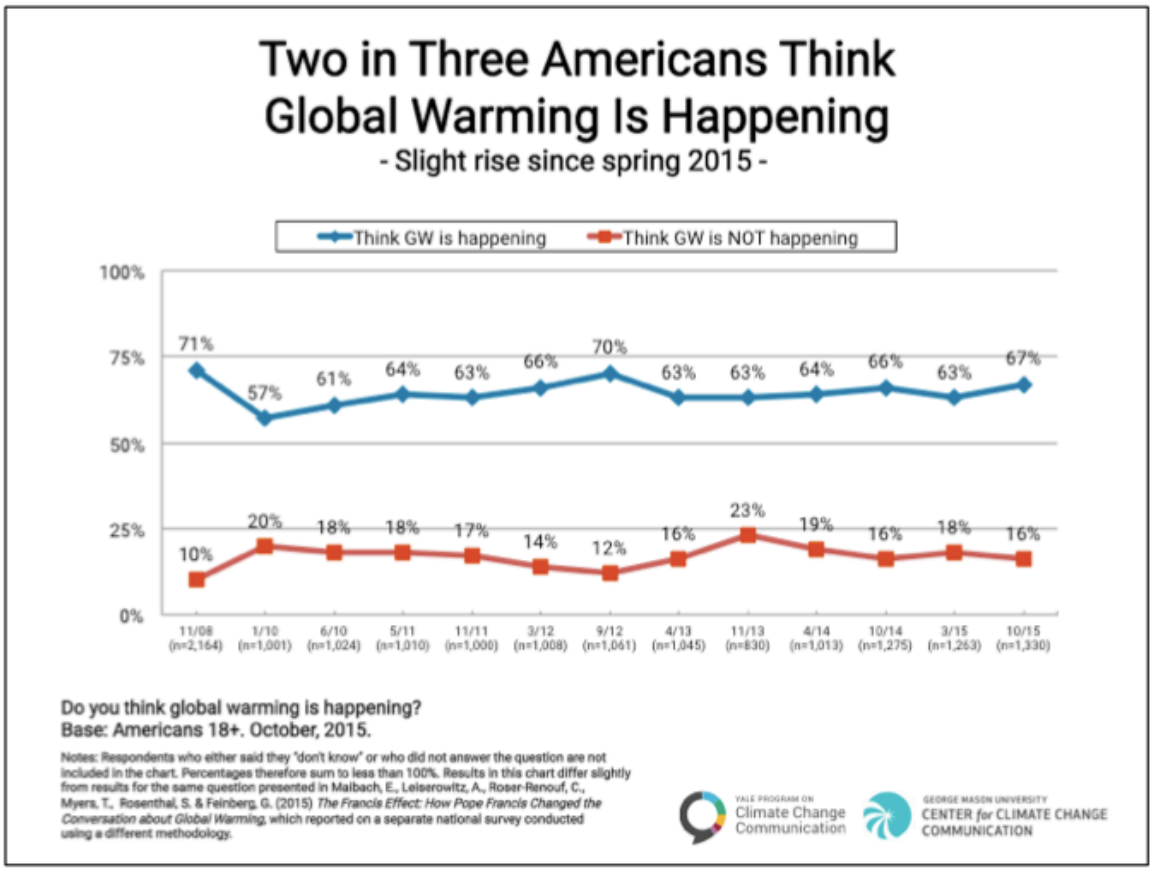

Fig. 6. Response to "Do you think global warming is happening? The blue line indicates those that think it is happening and the red line those that think it is not happening. The points correspond with the dates of the surveys starting with January 2010 and ending October 2015. From Leiserowitz et. al. 2015.

4.c Some Interpretations of the 2012 Report. We present some interpretations of these results by the authors that might be of value for CC advocates.

1) The trend line for acceptance or not of CC is nearly flat, implying very little change over the period. The average was 64.5 $\pm$ 3.7%. However, if the initial Nov 08 point is ignored, being over 1.8 standard deviations from the mean, the annual trend shows an annual increase of 1%. B1)

2) There are three significant data points in the plot that exceed the cited margin of error of $\pm$ 3%; that is, the initial Jan 10 (probable error) the Sep 12 (Hurricane Sandy effect?) and the last Oct 15 (Francis effect?). The Sandy effect is not possible because the September polling extended from August

31 to September 12, whereas Hurricane Sandy hit the east coast in late October.

However, the process of changing opinion after of such an event is further complicated by the transmission of the message about the event and by the individual's threshold of experience with such events. That is, how many events cumulatively convince that individual of the reality and the cause of CC phenomena? The fact that globally every year the number of record-breaking climate events is increasing suggests that the public will eventually associate them with CC.

3). Pope Francis's teachings about global warming have had an impact on the views of Americans, especially Catholics. Pope Francis visited the US for five days on September 22, 2015. He made strong environmental and social statements, arguing that the world's nations should unite to protect the earth and the poorest and most vulnerable people from the effects of CC, and while on visit emphasized his encyclical[43] issued previously in June. In fact, the results of the Pope's messages were surveyed with a follow-on study by Maibach[44]**,** which did confirm that Francis had significantly influenced people's attitude toward CC. For example, they found the following responses to three statements:

- Trust in Pope Francis as an information source on global warming (77% of Catholics versus 56% of non-Catholics)
- The Pope's position on global warming had an impact on my own views about global warming (20% versus 5%, respectively)
- The Pope's position on global warming has made me more concerned about global warming (19% versus 5%).

We don't know to what extent the Francis Effect will endure. It suggests that events that put the spotlight on an issue may not have complete hysteresis after the event, depending on whether the effect, in this case, has increased the trust and understanding of the CC issue.

4) Finally, we note that national opinion polls often can have 'tipping points' when approval/disapproval wavers around 30% until an event precipitates a shift in the consensus. For example, in August 1965, the Vietnam war had a 65% public approval but by May 1971 this had dipped to 28% under the pressure of continued protests against the draft and the war, and of the sustained casualties, and of the war itself. Eighteen months later President Nixon signed the cease-fire agreement. Somewhat similarly, the Iraq war had only 36% approval at end of President G. Bush's term, and Obama had promised to end it.

4.b. The 2015 Report[41] summarizes the total sequence of surveys, which were continued with an additional six surveys from April 2013 to October to November 2015, each of which were conducted in the same manner. The results are very informative on the subjectivity involved in public acceptance of the CC issue, where the percentage given apply to the last polling, unless otherwise stated. Here we present three of the more subjective issues.

1) Question: **How concerned are you about CC as a threat?** Most (70%) consider it a distant threat, and believe that it will cause considerable harm to future generations and to the environment. They are much less concerned about a threat to themselves (42%). This suggests that they are not familiar with the current extent of extreme climate events or of the immediate need to slow the GHG emissions into the atmosphere.

2) Question: **Who should be doing more to reduce Global Warming?** Their responses in descending order were: corporations and industry, citizens themselves, Congress and the President. Fig. 7.

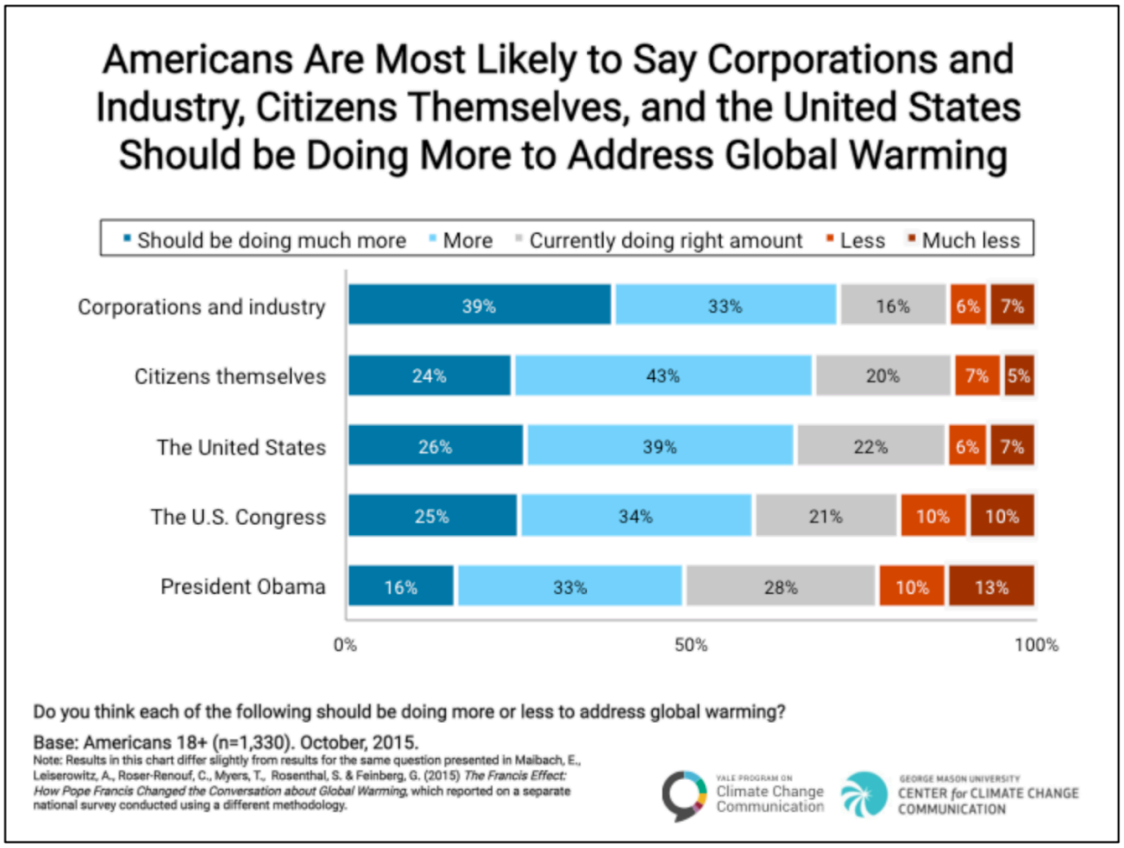

Fig. 7. Who should be responsible for resolving the climate issue. ‘From the 2015 report.

3) Question. **If the US takes steps to reduce Global Warming, will the consequences be more positive or negative?** This question solicited mostly positive responses, as shown in Fig.8. Note that the use of better implies "better than if CC would continue to happen." Most people agreed that reducing CC will provide a better life for our children and grandchildren, improve people's health, and save many plant and animal species from extinction. Also, 45% would like to protect God's creation. These results help underline the importance of specific questions in order to identify why half the people are hopeful (4) above). Advocacy groups should help explain why and how these benefits might be realized during the resolution of CC.

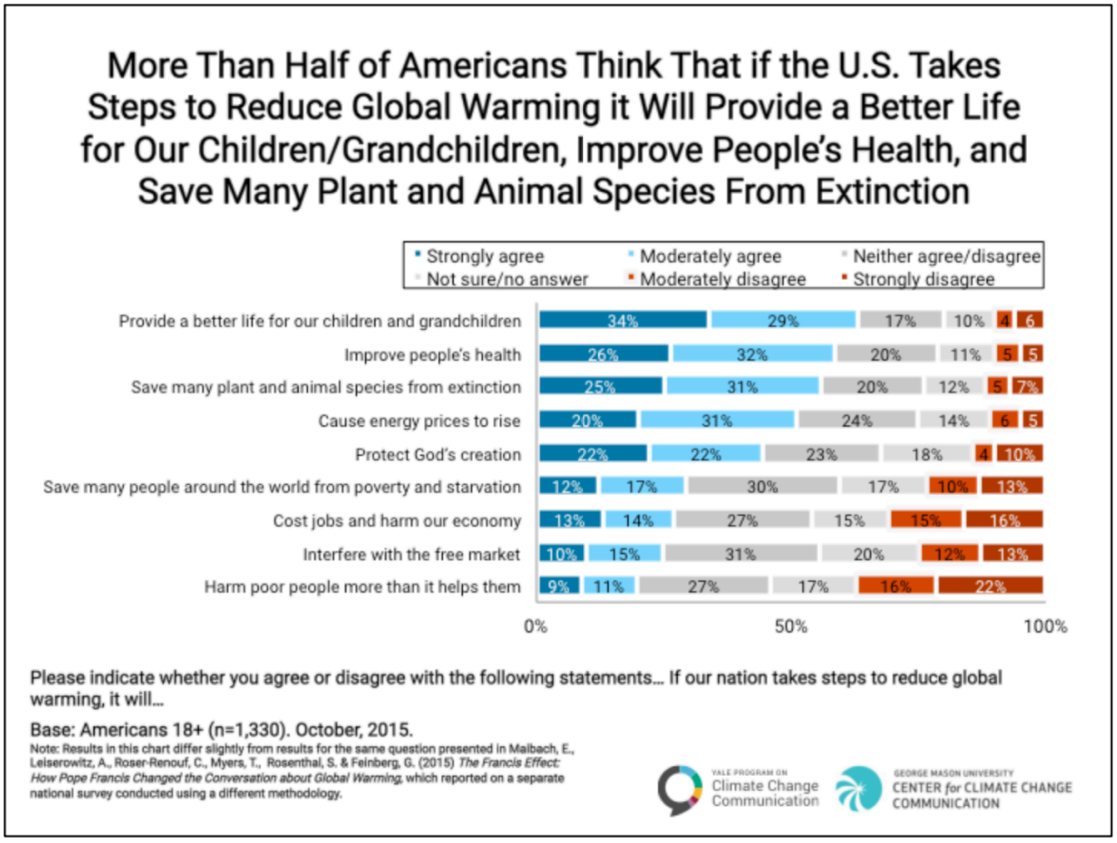

Fig. 8. The level of agreement on benefits of CC reduction. Respondents were asked which of the listed statements would be realized if the U.S. were able to reduce Global Warming. From the 2015 Report[41].

4. GATEWAY BELIEF MODEL.

4.a. The Yale 2015 Report unexpected results. While over the last decade, the scientific consensus that CC is happening has increased from above 90% to 97%, the percentage of those accepting CC reality remained nearly constant (Fig.6). It had been assumed that the high consensus would be a strong factor in raising public awareness of the issue. Instead, there persisted a large gap for the duration of the survey from 2% to 20% between what scientists believe and what people think they believe (3.2.e 3). Apparently, the scientific consensus might have reinforced those who already believed or were interested, but it must have been ignored or not heard by the non-believers, whose numbers also remained fairly constant during the 7-yr survey period (Fig.6). To a significant extent, this is because the majority of stories on climate change published even in the New York Times as well as in other major metropolitan dailies continued to include climate "skeptics" even though 97% of climate scientists concur that human-caused climate change is occurring and getting worse.

An obvious interpretation has been that there is a “knowledge deficit” and that the public needs more information on how and why this phenomenon is occurring (understanding) and how the consequences will impact our environment and societies. Advocacy groups, educators, and scientists have certainly made a concerted effort to help educate the public, which may have increased the knowledge and perhaps contributed to the 1% per year increase in acceptance of CC.

Understanding the science behind CC requires much greater knowledge than that required to understand the single fact that a large group of prominent experts are almost unanimously agreed on CC. Being asked whether CC exists or not requires someone to use whatever knowledge they have to answer a yes-or-no question that they cannot actually comprehend. However, asking them for their opinion on something that has no reality to them gives them the option to make a statement that is a complex combination of self-generated, absorbed from their social milieu, and derived from media exposure. If they were asked a question that did not require any scientific knowledge, just common sense, it would be much easier for them to respond, for example, to the question of “would you be more prone to accept CC if you knew that '97% of climate scientists have unanimously concluded that human-caused climate change is happening'?”

These complementary studies by the Yale Program on Climate Change Communication tested whether the simple perception of scientific consensus could in itself become an important gateway belief, or key psychological motivator for belief in CC[44]. They conducted a randomized online survey experiment of 1104 respondents as to whether these respondents changed their view of CC after repetitive exposure to the message of ""*97% of climate scientists have concluded that human-caused climate change is happening*". They used three different strategies:

1) They repeatedly inserted the statement within several other similar factual statements not related to CC.
2) They used a mix of eight analogies, for example: "If 97% of doctors concluded that your child is sick, would you believe them? 97% of climate scientists have concluded that human-caused climate change is happening" and so on with the 97% always repeated.
3) They used repeated visual images of pie charts with the same statement.

From the pre- and post-sampling, the authors were able to demonstrate statistically significant increases in CC belief of 14 % (average of the eight analogies), 18 % (descriptive text) and 18 % (pie chart), respectively.

In conclusion, the authors suggest that such simple consensus-messaging of CC facts (such as that CC impacts already occurring, or by the consensus of world leaders in Paris) that don't require a scientific knowledge to understand can be effective in strengthening public belief that climate change is real and happening now, that it is mostly human-caused, and that preventive action is needed. These facts can be communicated through simple analogies with other life experiences or visual images that are easy to remember, and that with repeated exposure can erode the misinformation that has retarded the public's acceptance and its solutions needed for this rapidly worsening problem .

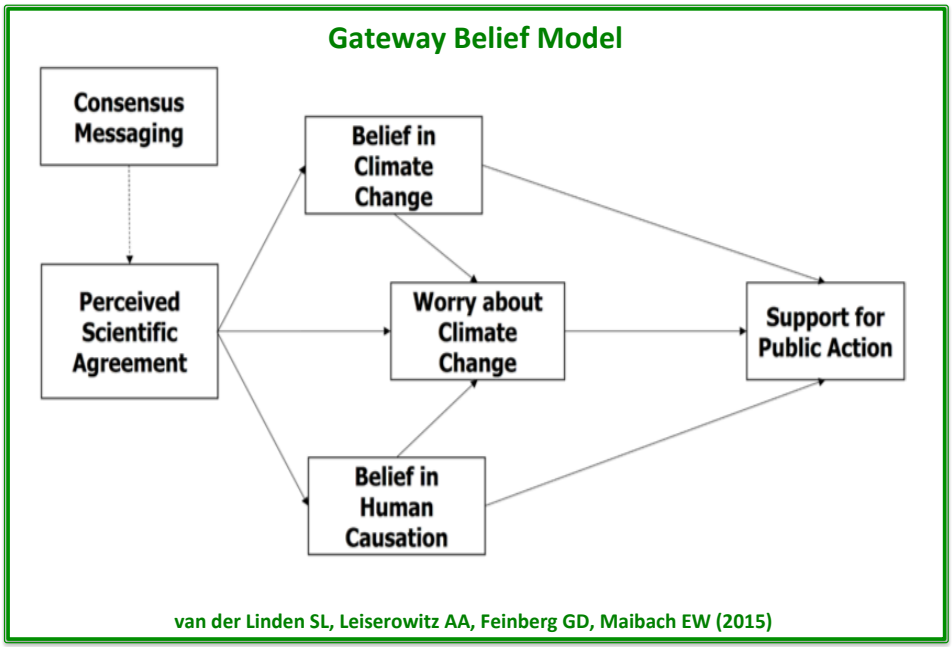

Fig.8. The Gateway Belief Model. If the respondents of a survey are given information of an existing consensus of experts on some issue, like Climate Change, they will be more prone to accept it, be concerned, and be moved towards public action, than if they are questioned without knowing that there exists such a consensus among experts.

4.b. Tipping point? Public opinion can shift significantly with a single strong event or a sequence of events. The dynamic that makes a sudden shift in opinion is the social contagion of not wanting to be among the mistaken or to be wrongly judged. ,As of March 2016), it seemed likely that a synergism between the Francis effect, the scientific consensus, and the Paris summit agreement might push CC acceptance of over 70%. Unfortunately, the 2016 US election brought a retrograde tipping point from the government. Hopefully, the momentum of public recognition of the issue will continue to build in the other sectors of governance, such as in individual states, industry, and in public opinion. This wrong turn may act to clarify the necessity to strongly responding to CC. In any case, it must be understood that any approach must be within the context of global sustainable development, which has not yet been discussed as a governmental goal – because NOW maybe our last chance!

CHAPTER TWO ENDNOTES

1. **Kovach, B. and T. Rosenstiel,** 2007. *The Elements of Journalism: What News People Should Know and the Public Should Expect, Completely Updated and Revised.* Three Rivers Press; Rev. Upd. Edition (April 24, 2007), 268 pp.
2. **Ethical Journalism Network** http://ethicaljournalismnetwork.org/en/contents/5-principles-of-journalism
3. **Galperin, J. 2013** The Continued Decline of Environmental Journalism. http://environment.yale.edu/envirocenter/post/the-continued-decline-of-environmental-journalism/
4. **Scientific Literacy.** "scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity" National Academy of Sciences (1996). National Science Education Standards (Report). National Academy Press.
5. **Program for International Student Assessment. 2012.** Note: PISA, "it assesses the extent to which 15-year-old students near the end of compulsory education have acquired some of the knowledge and skills that are essential for full participation in modern societies. And also like PISA, it examines how well students can apply what they have learned in unfamiliar settings, both in and outside of school" http://www.oecd.org/pisa/keyfindings/PISA-2012-results-US.pdf
6. **OCED.** The mission of the Organization for Economic Co-operation and Development (35 countries) is to promote policies that will improve the economic and social well- being of people around the world. The OECD provides a forum in which governments can work together to share experiences and seek solutions to common problems.
7. **IBISWorld** http://www.ibisworld.com/industry/default.aspx?indid=1231
8. **IBID #3.**
9. **Kansas Experiment** ritholtz.com/2017/09/the-kansas-experiment/**1**
10. **Top Media Corporations.** http://www.businessinsider.com/these-6-corporations-control-90-of-the-media-in-america-2012-6
11. **Freedom of Information Act. Freedom of Information Act.** This law gives you the right to access information from the federal government. **https://www.foia.gov/**
12. **Judith Miller**, New York Times reporter. https://en.wikipedia.org/wiki/Judith_Miller

13. **Corporation for Public Broadcasting** Act of 1967, as amended. http://www.cpb.org/aboutpb/act/
14. **National Public Radio and Public Broadcasting Service.** https://www.npr.org/
15. **Sarita Yardi. 2010**. Dynamic Debates: An Analysis of Group Polarization Over Time on Twitter. Bulletin of Science Technology Society October 2010 vol. 30 no. 5 316-327
16. **Fairness and Accuracy in Reporting** (FAIR) **is** a media criticism organization based in New York City. The organization was founded in 1986 by Jeff Cohen and Martin A. Lee. FAIR describes itself as "the national media watch group". The organization has been described as both progressive and leaning left. https://en.wikipedia.org/wiki/Fairness_and_Accuracy_in_Reporting...
17. **Wikipedia, NewsGuild-CWA,** Depression within the business.
18. **Super PAC**s are officially known as "independent-expenditure only committees." They may not make contributions to candidate campaigns or parties, but may engage in unlimited political spending independently of the campaigns. Unlike traditional PACs, they can raise funds from individuals, corporations, unions, and other groups without any legal limit on donation size.
19. **Center for Responsive Politics.** https://www.opensecrets.org/outsidespending/fes_summ.php
20. **Koch Family Foundations**. "Koch Family Foundations and Philanthropy". June 2013.
21. **Koch Support for Climate Denial www.greenpeace.org**
22. **Union of Concerned Scientists**. **https://www.ucsusa.org**
23. **Community Tool Box** http://ctb.ku.edu/en, Chapter 3
24. **Citizens' Climate Lobby** www.citizensclimatelobby.org
25. **Nonviolent Communication,** 2013. http://www.celebrateempathy.com/NVC_Intro.pdf
26. **Stearns**, **Josh**, 2013. *The Crisis in Climate-Change Coverage*, Free Press Report, 3 March. http://thinkprogress.org/climate/2011/
27. **Rosenberg, Marshall. B. 2013.** Living Nonviolent Communication, Practical Tools to Communicate Skillfully in Every Situation. Sounds True, Boulder CO 80306, isbn:9781604077872
28. **AmericaSpeaks, 2013.** www.americaspeaks.org/
29. **Hopkins, T.S., and Bailly, D. 2013.** The role of science in the transition to sustainability: the systems approach framework for integrated coastal zone management. In: Moksness E., Dahl, E., and Støttrup, J. (ends) Global Challenges in Integrated Coastal Zone Management. John Wiley & Sons, Ltd, pp.1-18.

30. Hopkins, T. S., 2001. *Scientific Concepts and Global Problems*. North Carolina State University, Department of Marine, Earth, and Atmospheric Sciences Course Pac MEA 430, 172 pp. Author generated.

31. Sterns, J. *The Crisis in Climate-Change Coverage, Free Press Report. February 11, 2013*

32.Heifetz, Ronald, 2013. *The Nature of Adaptive Leadership.* www.youtube.com/watch?v=QfLLDvn0pI8 **Complex Adaptive Leadership**. "is a complementary approach to leadership based on a polyarchic assumption (i.e. leadership of the many by the many), rather than based on an oligarchic assumption (i.e. leadership of the many by the few). Leadership in this theory is seen as a complex dynamic involving all subjects rather than only a role or attribute within a hierarchy. The theory calls for skills, attributes and roles which are additional to the demands of traditional leadership." **Wikipedia.org**

33. Field Polling. Field Poll is **"**an independent, non-partisan, media-sponsored public opinion news service. Each year the poll covers a wide range of political and social topics examining California public opinion. Surveys are made at frequent intervals throughout the year. Continuing measures are made of voter support for leading political figures vying for major state and federal offices, job ratings of important political figures and reactions to significant political events, Voter awareness, understanding and predispositions of major campaign issues, and salient statewide ballot propositions are also tracked over time. http://field.com/fieldpollonline/subscribers/

34. Polling Error: "If the results of a scientific poll claiming a 3-point margin of error say that 30% of Americans like ice cream, this means that if we asked all Americans this question, we would expect between 27% and 33% to say they like ice cream." Gallop. ttp://media.gallup.com/muslimwestfacts/PDF/Polling-andHowToUseitR1drevENG.pdf

35. Norton Michael I. and Ariely Dan. **2011.** Building a Better America—One Wealth Quintile at a Time**.** Perspectives on Psychological Science 6(1) 9–12

[1]**36. Whitney, Ellie**. 2013.

37. Hawkin, P. 2017. DRAWDOWN, *The Most Comprehensive Plan Ever Proposed to Reverse Global Warming* New York, New York. Penguin Books*.*

38. Back Radiation. This term is used to simplify the complicated processes that allow heat from the earth's surface to pass through the troposphere (bottom layer of the atmosphere to the stratosphere (upper layer). More technically, back-radiation is the term for the infrared heat radiating from a surface, about 45%, as a stove. Other processes that cause a heat loss from the earth are short-wave solar heat reflected from earth's surfaces and from clouds; and the incoming long-wave infrared that back radiates through the atmosphere, and by that which is

adsorbed by aerosols in the atmosphere and reradiates out to space. Clouds play a major role in these processes.

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https://en.wikipedia.org/wiki/Atmospheric_carbon_cycle

40. Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., Rosenthal, S., & Marlon, J. (2014) *Climate change in the American mind: Americans' global warming beliefs and attitudes in November 2013.* Yale University and George Mason University. New Haven, CT: Yale Project on Climate Change Communication**.**
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41. Sampling methods of Leiserowitz. "The data in this report are based on a nationally representative survey of 1,330 American adults, aged 18 and older, conducted September 30 - October 19, 2015. All questionnaires were self-administered by respondents in a web-based environment. The survey took, on average, about 24 minutes to complete. All samples are subject to some degree of sampling error – that is, statistical results obtained from a sample can be expected to differ somewhat from results that would be obtained if every member of the target population were interviewed. Average margins of error each wave, at the 95% confidence level, are plus or minus 3 percentage points except where noted."

42. Pope Francis Encyclical. 2015. *Laudato si' (24 May 2015) | Francis - La Santa Sede*

43. Maibach, E, Leiserowitz, A., Roser-Renouf, C., Myers, T., Rosenthal, S &

44 Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, S. & Feinberg, G. Rosenthal, S.& Feinberg, G, 2015. *The Francis Effect: How pope Francis Changed the conversation about Global Warming George Mason University and Yale University. Fairfax, VA: George Mason University Center for Climate Change Communication.*

45. Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., & Rosenthal, S. (2015). *Climate change in the American mind: October 2015.* Yale University and George Mason University. New Haven, CT: Yale Program on Climate Change Communication.

46. van der Linden S.L, Leiserowitz AA, Feinberg G.D., and Maibach E.W. (2015) The Scientific Consensus on Climate Change as a Gateway Belief: Experimental Evidence. PLoS ONE 10(2): e0118489. doi:10.1371/journal.pone.0118489

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3.**Galperin, J. 2013** The Continued Decline of Environmental Journalism. http://environment.yale.edu/envirocenter/post/the-continued-decline-of-environmental-journalism/

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http://www.oecd.org/pisa/keyfindings/PISA-2012-results-US.pdf

6. OCED

7. **IBISWorld** http://www.ibisworld.com/industry/default.aspx?indid=1231

8. **IBID #3**