

Climate Plumbing: The Use of Experts in Framing the Geoengineering Controversy in German News Media

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Introduction

Controlling and manipulating the weather is surely a human fantasy as old as the desire to fly. At the beginning of the Trojan War, King Agamemnon sacrifices his daughter Iphigenia to appease Artemis, providing good wind and allowing him to cross the Aegean Sea. Witches were frequently accused of brewing potent potions producing heavy storms and Native Americans like the Zuni made it rain by dancing. More recently, China's high-tech war against rain clouds at the 2008 Olympics and US American research into climatic warfare raised eyebrows everywhere. Tinkering with such elementary forces might sound very much like human hubris – Icarus' fate is well remembered. But humanity's impact on the planet has never been so severe and now seems to reach a critical limit. Adapting to the modern environment we created is probably humanity's greatest challenge. Global warming and the changing climate in general appear to be the most pressing issues today with many people already being under direct threat of droughts, floods and extreme storms.

At the latest since Al Gore's media effective alarmist campaign ("*An Inconvenient Truth*"), the issue of global warming is firmly established in public consciousness. Even if there are still some skeptics, the scientific community now agrees on the fact that the planet's temperature rise is out of the natural cycles and off the charts. In addition, the Intergovernmental Panel on Climate Change (IPCC), the highest authority in these matters, now sees the anthropogenic nature of this development as 95% certain (2013, p.v). How can we cope with this largely intangible and abstract menace? The various suggestions can be placed under three categories: mitigation, adaptation, and intervention. Mitigation simply means the reduction of greenhouse gas emissions by using better filters, alternative energy sources and stricter legal regulations. Adaptation is understood by the European Union as "taking action to strengthen society's resilience to climate change and minimize the impact of its adverse effects" (EU, 2013, p.7) with the help of, for instance, Dutch

land reclamation techniques. Intervention, finally, refers to active human engagement in the planet's energy-balance by technological means. Methods aim at either reducing incoming heat from the sun or trying to keep CO₂, the most prominent greenhouse gas, from reaching the atmosphere. Large-scale technologies ensuing weather modification falling under this last category are grouped under the term *geoengineering*.

Science, Media and the Environment

Such complex scientific-environmental issues are usually transported into the public by the news media. As will be shown, the news does not merely report but is heavily engaged in actively constructing meaning. In social science and media studies in particular, several concepts have been introduced to describe these mechanisms. One of the most important is *framing*. In this context it is used to analyze how journalists embed information about contested technologies into existing cultural perceptions about science. This paper focuses on how experts are used to construct the geoengineering debate in leading German news media. Who are the experts that are given a voice and how are they represented with regard to authority and credibility? How does this choice of representation by the journalist influence the framing of the geoengineering coverage? Which are these frames and, more generally, what could they tell us about the attitude towards science and technology reinforced by the German media? These research questions will be answered using tools developed in media studies. To see why news organizations and journalists choose certain frames over others would go beyond the scope of this research. Here, the focus is only on the message itself and its content. Investigating the news more in depth than the usual reader, notably when it is involved in forming public opinion on particularly sensitive and complex issues, is highly relevant. Especially if we assume that the German philosopher Georg Wilhelm Friedrich Hegel rightly suggested that it is characteristic of modern societies that the news has replaced religion as a source of guidance and authority: "Reading the morning newspaper is the realist's morning prayer" (2002, p.247). Philosopher Alain de Botton describes the news as "the single most significant force setting the tone of public life and shaping our impressions of the community beyond our own walls. It is the prime creator of political and social reality" (2014, p.12). Since the public, including policy makers, receive most of their information about science and technology through the mass media "scrutinizing the media's portrayal of climate change – and exploring how and why information about climate change is translated into news – is imperative" (Boykoff, 2007, p.1191f). Hence, it is relevant to look at how geoengineering as a solution to climate change is represented in the news.

What is Geoengineering?

Originally, the term was coined by Cesare Marchetti in a paper written in 1977 in which he elaborates on the oceans' capacity to take up of CO₂. Since then, the term has been widely used, making it quite ambiguous. Used for the work at hand is the definition of geoengineering by the British Royal Society as "the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change" (2009, p.1). Most work until now has been purely theoretical, with a few exceptions. Particularly important in the German context is the much-cited Alfred-Wegener-Institut für Meeres- und Polarforschung (AWI) – the institute for oceanographic and polar research in Bremerhaven – which conducted two strongly contested experiments on ocean fertilization. The projects known as Eifex (2004) and Lohafex (2009) were disappointing and sobering in their scientific outcomes but very media-effective – a fate that the AWI scientists share with their colleagues from Bristol University. With the difference that the British SPICE project (Stratospheric Particle Injection for Climate Engineering) never entered the testing phase and was put *ad acta* in 2012.

However, only since Paul Crutzen, Nobel laureate in chemistry, published an essay on stratospheric aerosol injection (2006), geoengineering has really emerged from the margins of science. It now plays an increasingly important part in climate-change scenarios seeking solutions to the heating up of the planet. Although only few governments like the United States, Britain and Germany have officially looked into geoengineering, the UN-backed IPCC discusses it as a serious option in its last report (2013). So far, the US, who did not sign the Kyoto protocol and show no intent to lower their emissions, is the only country thinking of actual deployment.

Technologies

Although the boundaries can be fuzzy, most geoengineering methods can be categorized into Solar Radiation Management (SRM) or Carbon Dioxide Removal (CDR), which is sometimes also referred to as Carbon Capture and Storage (CCS). According to the Royal Society SRM methods "attempt to offset effects of increased greenhouse gas concentrations by causing the Earth to absorb less solar radiation" (2009, p.ix). Hence, radiation management is all about reflecting a part of the incoming sunlight back into space. Techniques range from enhancing the Earth's surface reflectivity (albedo) by painting human structures white, planting crops with high reflectivity, or increasing marine clouds. Heavily contested are the ideas to spray sulfur aerosols into the stratosphere, imitating the cooling effect of volcanic eruptions, and to insert one large shield or many small deflectors into orbit. CDR or CCS techniques on the other hand "address the root cause of

climate change by removing greenhouse gases from the atmosphere” (ibid). Carbon can be sequestered from the air using various technologies such as artificial trees, special filters or enhancing natural weathering processes. Problematic is the question of what to do with the carbon once it is parted from the ambient air. Ocean ‘fertilization’ in order to increase CO₂ uptake through algae and other processes using the oceans’ ‘natural pump’, depositing CO₂ on the sea floor, is therefore one of the most interesting and best-researched methods.

According to Germany’s first official report on the matter, issued by its federal environment office (Umweltbundesamt) and carrying the telling title *Geoengineering – effective climate protection or megalomania?*, three points make geoengineering particularly interesting: Society has to change little or nothing in its behavior regarding the reduction of CO₂ emissions, technology is promised to solve the problem and states could decide unilaterally to use certain appropriate geoengineering methods (2011, p.41). Reasons for caution are first of all doubts about the assumption that enough is understood about the workings of the climate to control it. Secondly, geoengineering could be taken as an excuse to decrease important mitigation and adaptation efforts. Lastly, such interventions could break current environmental laws and undo arduously negotiated international agreements (ibid). Security also matters: Not only could controlling the weather offer clear military advantages, but potential upheaval could result from some states benefitting from global warming while others face dire consequences. Additionally, most geoengineering techniques cannot be tested in small-scale experiments. Large-scale experiments, however, would take place in an open system – the planet itself – making their outcomes difficult to assess. Furthermore, international cooperation would be required as most geoengineering methods would be effective across borders. A lot of explosive potential for international conflicts is in store.

Ultimately, the federal environment office reaches the conclusion that “the emphases of climate research, including state promotion, may not be shifted to research into geoengineering measures” (2011, p.42). Comparing this statement with the following assessment by the Royal Society already hints at a difference that is reflected by both countries’ media. The British report claims that most nations have recognized the need to shift to a low-carbon economy and that the main priority should be to reduce global greenhouse gas emissions. “But if such reductions achieve too little, too late, there will surely be pressure to consider a ‘plan B’ – to seek ways to counteract the climatic effects of greenhouse gas emissions by ‘geoengineering’” (2009, p.v).

Uncertainty

Geoengineering, similar to other precarious issues like stem cell research, genetically modified organisms or nuclear power, is characterized by a high level of uncertainty. Risks and benefits are obscured by the sheer complexity of the matter – experts and interests involved in its discussion seem innumerable. “Many proposals for geoengineering have already been made—but the subject is bedeviled by much doubt and confusion”, the Royal Society notes (2009, p.v) and also IPCC reports are composed using degrees of certainty and probability (2012; 2013). Uncertainty is an inherent part of science and is furthermore highly subjective, statistician Dennis Lindley emphasizes in his book *Understanding Uncertainty* (2006). It always depends on the individual’s level of knowledge and is never the same for everybody. What journalists do regularly, however, is to generalize individual (expert) uncertainties. Geoengineering can thus be presented – or framed – as safe or unsafe technology. Moreover, science appears to be more objective and certain, thus helping journalists to present a coherent, meaningful article – a construction scrutinized in this paper. Uncertainty is an interesting factor here because the news media possess the normative power to corroborate or dismiss uncertainties surrounding science and technology through framing, hence promoting or discouraging specific courses of action.

Data

In total, 68 articles from German news publishers were used as primary sources for this analysis. This corpus includes all articles published about geoengineering in *Der Spiegel*, *Die Zeit*, *Süddeutsche Zeitung* and *Bild* until May 1st, 2014. These newspapers were selected because they are the largest in Germany with the strongest influence on public opinion as well as on other news producers, both inside and outside of the country. What makes the four different papers – one weekly magazine, one weekly paper, one daily paper and one boulevard paper – additionally interesting is that they cover a very broad readership in regard to education, income, and age. The main selection criterion for the articles was that they appeared not only in print but were also freely accessible to the public via internet. The purpose of these articles was to inform the general public about developments in the geoengineering debate – a role they fulfil even better through their continuous availability online. Keywords typed into the respective publisher’s own search engine included geoengineering (various spellings), climate-engineering, solar radiation management, carbon dioxide removal, SRM, and CDR. It is noteworthy that none of these news organizations has a distinct environment section. All articles were categorized exclusively under ‘knowledge’ and ‘science’.

Methodology

Although visual elements hugely influence the construction of frames, this was not the case in the selected articles regarding the representation of experts. Therefore, only texts were analyzed. For this purpose, content and frame analysis were used – instruments provided by media studies.

Content Analysis

Content analysis is probably the most straight-forward textual analysis, as it simply counts phenomena prevalent in texts. It is often used to provide a quantitative basis for qualitative evaluation and is primarily concerned with the construction of meaning. Professor Klaus Krippendorf has defined it as “a research technique for making replicable and valid inferences from texts to the contexts of their use” (2004, p.18). He also stresses that texts only develop meaning *relative* to specific contexts, discourses or purposes. In this case, meaning constructed by the news with the help of experts was examined in relation to science and technology.

Media scholar Jane Stokes (2003) lists the most notable advantages of this method to be that it generates reliable, replicable facts in a flexible and creative manner, requiring only a basic level of mathematical skills. It is very adaptable and therefore ideal for inductive research, the results of which can be comprehensibly presented in tables and diagrams. The disadvantages of content analysis, Stokes continues, are that it can be a too descriptive, insensitive and blunt instrument – it is only as sophisticated as the categories defined by the researcher. Minimizing this downside was attempted by adding a more qualitative frame analysis, thereby linking categories specific to this particular body of articles to a larger social reality. Subjectivity is always a problematic issue in this kind of research. Nevertheless, one independent review of the used categories by a ‘lay news consumer’ has confirmed this research’s validity at least a little.

Content analysis is a suitable instrument to investigate such a complex issue as news coverage of the geoengineering debate because it is “a powerful method for making explicit facts about content which may not be immediately obvious” (ibid., p.66). Lastly, content analysis can easily be combined with other methods such as discourse, narrative, or semiotic approaches to produce more specific results. In this case, frame analysis was chosen; partly because “unguided by a framing paradigm, content analysis may often yield data that misrepresents the media messages that most audience members are actually picking up” (Entman, 1993, p.57). More importantly, it was chosen because the significance of framing in the construction of expertise and credibility has been broadly covered by media studies of various fields of news journalism, except for environmental journalism

(Hansen, 2010, p.92). Geoengineering might be the greatest environmental issue there ever has been as it would interfere with the most fundamental ecological processes.

Frame Analysis

Journalists usually have to break down the complex stream of information and make it 'digestible' and comprehensible for audiences. One good way to do that is by giving them something they can relate to. Shared cultural assumptions and worldviews are such 'frames'. Science, technology, climate change and geoengineering are highly abstract structures, which is why, according to Alain de Botton, we need to be able to 'put' new information somewhere to grow interested in it in the first place. We need to find "some way of connecting it to an issue we already know how to care about" (2014, p.26). Frame analysis is important because it illuminates the precise manner in which influence over a human consciousness is exerted by the information transfer from one locus – such as the news report – to that consciousness (Entman, 1993, p.51). Another relevant point is that framing and reframing of scientific knowledge and its limits subliminally promotes one course of action over another. Hence newspapers discursively construct fields of action and fields of inaction (Carvalho, 2007, p.238). The method allows scrutinizing how exactly texts exert power and what they evoke in the reader. Framing is quite an ambiguous concept. Firstly, because it is used across disciplines for various purposes and secondly, because it is directly related to subjective perception and applicable to many different situations in which communication takes place. The basic assumption is that the manner in which something is said determinates how it is perceived. Together with gate keeping, agenda setting and priming, framing belongs to a media analyst's most important tools. The main difference is that "framing focuses not on which topics or issues are selected for coverage by the news media, but instead on the particular ways those issues are presented" (Price & Tewksbury, 1997, p.184). Despite this narrowing, authors have described the phenomenon in various ways. As part of persuasion processes, for instance, professor Herbert W. Simons defines framing as one way amongst others of seeing something and reframing as seeing something differently (2001, p.120). Framing and reframing, or the "organizing of a perceived reality" (p.131), are hence very important concepts in understanding how journalists create and alter meaning, often unconsciously. Scholars Scheufele and Tewksbury fittingly describe frames as "invaluable tools for presenting relatively complex issues, such as stem cell research, efficiently and in a way that makes them accessible to lay audiences because they play to existing cognitive schema" (2007, p.12).

According to prominent framing scholar Robert Entman, to frame means to "select some aspects of a perceived reality and make them more salient in a communicating text,

in such a way as to promote a particular problem definition, causal interpretation, moral evaluation and or treatment recommendation for the item described” (1993, p.52). These four functions can all be performed by one single sentence but have not to be present in every frame. Special attention has been paid to the last two functions because the articles did not differ much in their representation of climate change or geoengineering as such and anthropogenic climate was invariably seen as the cause for the current dilemma.

Long before the internet era, Edward Bernays, nephew of Sigmund Freud, wrote extensively on the power of modern media. Applying his uncle’s insights to manipulate the public, Bernays is often portrayed as the father of public relations and subliminal marketing. In his seminal book *The Engineering of Consent* he states that “we must recognize the significance of modern communication not only as a highly organized mechanical web but as a potent force for social good or possible evil” (1969, p.113). To prevent the latter from happening it is crucial to stay vigilant towards media. Especially in controversies where uncertainties abound it is indispensable to make frames explicit and examine their effect.

“The news knows how to render its own mechanics almost invisible and therefore hard to question. It speaks to us in a natural unaccented voice, without reference to its own assumption-laden perspective. It fails to disclose that it does not merely report on the world, but is instead constantly at work crafting a new planet in our minds in line with its own often highly distinctive priorities” (de Botton, 2014, p.11).

An inductive coding approach (defining categories) was chosen because the novelty of geoengineering would make the application of generic frames ill-suited. Induction allows for much more detailed and authentic results to be obtained from a body of text. Deductive methods on the contrary would be better for cross-national comparative studies.

What is an expert?

At this point it is necessary to define who qualifies as expert. Many definitions have been put forward from different fields, showing that expertise and its legitimacy are often dependent on situation and analytical approach. For environmental studies scholar Roger A. Pielke (2007), for instance, only natural scientists seem to qualify as experts. Pure science is seen here as highest authority, legitimating its practitioners in their influence.

“More than ever, science and scientists are being asked by society to play an important role in decision-making. Science matters for how we make decisions. And decisions matter for real-world outcomes – who benefits at whose expense, who (or what) lives or dies, how they live and how they die” Pielke writes (ibid., p.38).

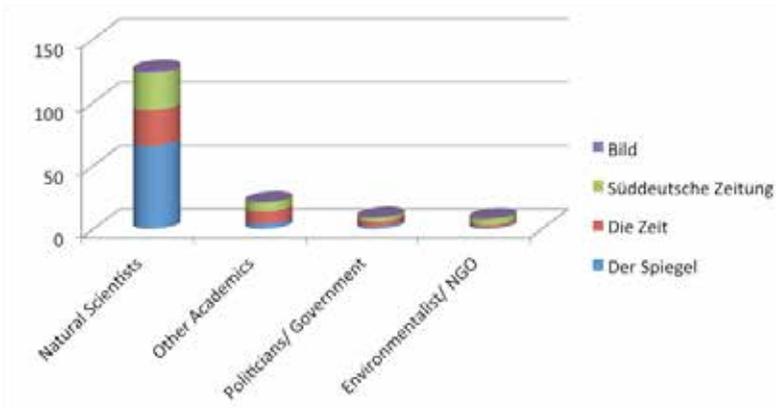
Science and technology scholar Brian Wynne on the contrary acknowledges the role lay-

knowledge can play in decision making (1996). Usually based on first hand, local experience laymen are often capable of contributing valuable information to scientific debates. Danish physicist Niels Bohr famously defined an expert as someone who has made every possible mistake within a very narrow field. For this analysis, however, all those classify as expert whose expertise in regard to geoengineering is used by the journalist in form of quotes or paraphrases to build frames. The mere fact that they are used by journalists, whose own credibility is at stake, to report on the complex issue of geoengineering establishes them as experts. In other words, the journalist has already taken the decision of whose expertise should be consulted in this debate. “The construction of ‘legitimate’ expertise and authority”, Anders Hansen writes, “is thus closely linked to questions about setting/ forum/ arena in which sources (experts) are placed” (2010, p.92). Therefore, anyone whose expert opinion on geoengineering is quoted or paraphrased in the articles is regarded as potentially relevant for frame building and the subsequent construction of meaning.

Climate Plumbing

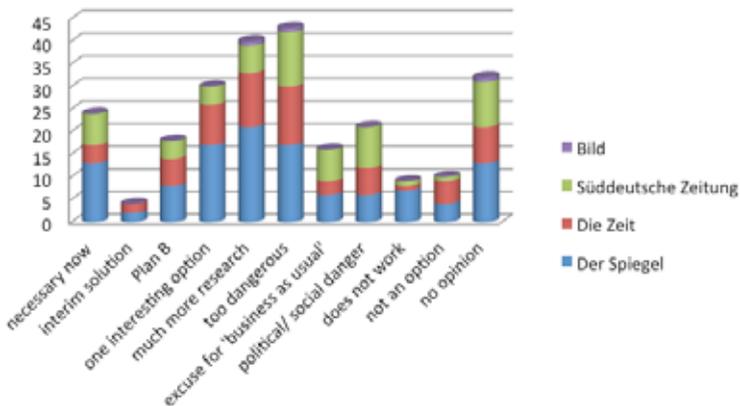
Generally, this analysis has shown a high level of journalist influence in constructing meaning. In most cases discrepancies were observed between what experts were actually reported to say and the overall message of the text. Predominantly across all papers, although to varying degrees, journalists reframed the experts’ prevalent techno-optimism and calls for more research as dangerous hubris. They did so by textually surrounding expert opinions with derogative terms and highlighting risks and uncertainties, presenting geoengineering as quick ‘techno-fix’. Journalists, as the driving force in constructing meaning of their articles, presented geoengineering as a scientific topic but framed it as being not sophisticated enough to be actually used – the experts’ prevalent mechanistic view of the Earth was thus challenged by the media. Most articles therefore elicit a somewhat Romantic view on science, best expressed in Mary Shelley’s portrayal of the megalomaniac Doctor Frankenstein: “Frightful must it be, for supremely frightful would be the effect of any human endeavour to mock the stupendous mechanism of the Creator of the world” (2002, p.19).

It is noteworthy that no big shifts or significant reframing of the issue is observable over time. Political alignment did also not appear to play a role in the divergence and occurrence of frames. There were no significant patterns in what kind of experts with what sort of authority said what. In all newspapers there is a clear dominance of natural scientists being used as experts, physicists with different specializations in particular.



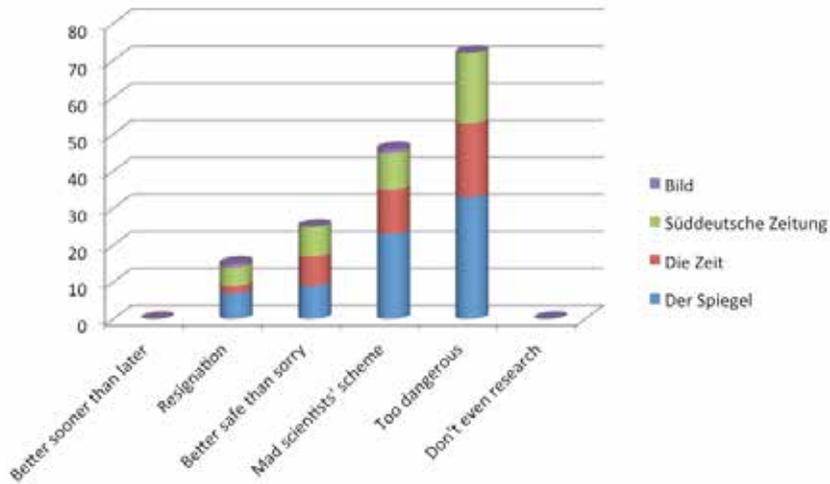
Most of them were individual Americans presented as serious and credible scientists, pointing out risks and benefits. Many others were represented as either pushing for soon deployment or as just doing basic research but both positions were reframed by the journalists to corroborate the main frames, reflecting a strong skepticism towards new technologies. Science and technology of geoengineering are too dangerous, feature too many unpredictable uncertainties and smack of mad scientist's phantasms. Besides the high level of uncertainty this hesitating attitude is amplified through the scale of the intervention – it is difficult to grasp that we could actually create a new artificial climate custom made to our needs.

What experts are reported saying



While most experts were actually represented as being hesitant or skeptical, calling for more research and the consideration of all possibilities, journalists made it seem like geoengineering is far too dangerous and unpredictable in its outcomes to be considered as option. If not even the scientists, who are expected to be reliable, know exactly what is going on, risks clearly outweigh potential benefits – in particular because Germany does not experience actual detrimental effects of climate change yet. Risks of geoengineering were highlighted at the expense of risks of continuing climate change.

Progress seems to be perceived as somewhat determined by science and technology, developing on their own, detached from the thousands of researchers, engineers and scientists. Faces and names only appear when the debate materializes in form of the news. Using more sociologists, for example, would suggest that progress is seen as something ultimately society-driven. But in German media a trench is dug between the general public and its political representatives and the scientific community – who are nevertheless seen as responsible. It is of course debatable whether news reflects society's attitude as a whole. The question of how they mutually influence each other in this case remains.



Frames used by journalists accord to some shared cultural attitudes of society but the media reinforces certain frames and discards others, again exerting influence on society which then again might shift in perception to which the media then again would have to adjust and so forth. Further research on the subject could be done by applying methods used in this

paper to other European news media or publications by international news agencies; even applying them to other German media might yield interesting results. Most interesting, naturally, is the question of why these frames were created. Of course other instruments from media studies could also be used to investigate the issue, such as narrative or semiotic analysis. Because geoengineering is surrounded by so much confusion and uncertainty it would surely be interesting to analyze and compare the official side to the abundant unofficial, conspiracy side. Political and scientific documents and reports could be contrasted to sites like *geoengineeringwatch.org* or *whyintheworldaretheyspraying.com*. Who are the experts and laymen involved in the larger public debate outside mainstream news media?

Humanity has always exhibited a great talent to come up with rash ideas in times of crisis – the more threatening the crisis, the more radical the ideas. Climate plumbing, however, as represented by German news, is an idea born out of desperation and should not be considered as an alternative to other strategies against climate change in the near future.



References

1. Bartley Stewart, J. (2002). *Miscellaneous writings of G.W.F. Hegel*. Chicago: Northwestern University Press.
2. Bernays, E. L. (1969). *Engineering of Consent*. Norman OK: University of Oklahoma Press.
3. Boykoff, M. T., & Boykoff, J. M. (2007). Climate change and journalistic norms: A case-study of US mass-media coverage. *Geoforum*, 38, 1190–1204.
4. Carvalho, A. (2007). Ideological cultures and media discourses on scientific knowledge: re-reading news on climate change. *Public Understanding of Science*, 16, pp. 223–243.
5. Crutzen P., (2006). Albedo Enhancement by Stratospheric Sulfur Injections: A Contribution to Resolve a Policy Dilemma? *Climatic Change*, 77, 211–220.
6. De Botton, A. (2014). *The News. A User's Manual*. London: Penguin.
7. Entman, R. M. (1993). Framing: Towards clarification of a fractured paradigm. *Journal of Communication*, 43(4), 51–58.
8. European Commission, Directorate-General for Communication, Publications, (2013). *The European Union explained: Climate action*. Brussels: European Union.
9. Ginzky, H., Herrmann, F., Kartschall, K., et al (2011). *Geoengineering - Effective Climate Protection or Megalomania? Methods – statutory framework – environment policy demands*. Dessau-Roßlau: Umweltbundesamt. 34
10. Hansen, A. (2010). *Environment, Media and Communication*. London: Routledge.
11. Hegel, George Wilhelm Friedrich. (2002). *Miscellaneous Writings of G.W.F. Hegel*. Translation by Jon Bartley Stewart. Evanston: Northwestern University press
12. IPCC, (2013). Summary for Policymakers. In: *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.
13. IPCC, (2012). *Meeting Report of the Intergovernmental Panel on Climate Change Expert Meeting on Geoengineering* [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, C. Field, V. Barros, T.F. Stocker, Q. Dahe, J. Minx, K. Mach, G.-K. Plattner, S. Schlömer, G. Hansen, M. Mastrandrea (eds.)]. IPCC Working Group III Technical Support Unit. Potsdam, Germany: Potsdam Institute for Climate Impact Research.
14. Krippendorff, K. (2004). *Content analysis – an introduction to its methodology*. Thousand Oaks: Sage.
15. Lindley, D.V. (2006). *Understanding Uncertainty*. Hoboken, NJ: John Wiley & Sons.
16. Marchetti, C., (1977). On geoengineering and the CO₂ problem. *Climatic Change* 1, 59–68.
17. Notholt, J., Platt, U., Leisner, T. (2012). Climate-Engineering - Eingriff ins Erdklima. *Physik Konkret*, Nr. 13. Bad Honnef: Deutsche Physikalische Gesellschaft (DPG).
18. Pielke, R. A. (2007). *The Honest Broker: Making Sense of Science in Policy and Politics*. Cambridge: Cambridge University Press.

19. Price, V., & Tewksbury, D. (1997). News values and public opinion: A theoretical account of media priming and framing. In G. A. Baret & F. J. Boster (Eds.), *Progress in communication sciences: Advances in persuasion* (Vol. 13, pp. 173–212). Greenwich, CT: Ablex.
20. Scheufele, D. & Tewksbury, D. (2007). Framing, Agenda Setting, and Priming: The Evolution of Three Media Effects Models. *Journal of Communication*, 57, pp. 9–20.
21. Shelley, M. (1831, 2002). *Frankenstein*. New York: Zorba Press.
22. Simons, H. (2001). *Persuasion in Society*. Thousand Oaks: Sage.
23. Stokes, J. (2003). *How to do media and cultural studies*. Thousand Oaks: Sage.
24. The Royal Society, (2009). *Geoengineering the Climate. Science, Governance and Uncertainty*. London: Royal Society.
25. Wynne, B. (1996). May the sheep safely graze? A reflexive view of the expert-lay knowledge divide. In: Scott Lash et al. (Eds.) *Risk, Environment and Modernity*, pp. 44-83. New York: Sage.

Picture:

Title page: 'Earthwrench', Retrieved May 29th, 2014, from <http://www.etcgroup.org/content/abcs-ensuring-precaution-geoengineering>