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DOUBLE IMPACT

THE CLIMATE BLOCKBUSTER
'THE DAY AFTER TOMORROW'
AND ITS IMPACT ON THE
GERMAN CINEMA PUBLIC

Fritz Reusswig, Julia Schwarzkopf, Philipp Pohlentz



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Authors:

Dr. Fritz Reusswig*

Dipl. Soz. Julia Schwarzkopf

Dipl. Soz. Philipp Pohlenz

Potsdam Institute for Climate Impact Research

P.O. Box 60 12 03, D-14412 Potsdam, Germany

Phone: +49-331-288-2576

Fax: +49-331-288-2642

E-mail: Fritz.Reusswig@pik-potsdam.de

*(corresponding author)

Herausgeber:

Dr. F.-W. Gerstengarbe

Technische Ausführung:

U. Werner

POTSDAM-INSTITUT
FÜR KLIMAFOLGENFORSCHUNG
Telegrafenberg
Postfach 60 12 03, 14412 Potsdam
GERMANY

Tel.: +49 (331) 288-2500

Fax: +49 (331) 288-2600

E-mail-Adresse: pik@pik-potsdam.de

Abstract

When *The Day After Tomorrow* was released by end of May 2004 in more than 80 countries world wide, a huge media debate was already underway, putting forward the pros and cons of the impact of a highly spectacular and fictitious disaster movie on the public. Many environmental activists and public agencies expected support for their issue, while many climate scientists remained more sceptical and even expected backlashes. A study by the *Potsdam Institute for Climate Impact Research* (PIK) in the framework of the *European Climate Forum* (ECF) tries to answer these and other questions. In six German cities a total of 1118 cinema visitors were asked before and after watching the film with regard to their perceptions of climate change, dangers associated with it, public and personal policy consequences, and film related issues. In addition, 149 telephone interviews were conducted with a subset of the sample about four weeks after the first two waves, controlling for persistency effects. The results show that the film surprised people by adding new, somewhat paradoxical features of climate change to the well established picture of slow and steady temperature increases with dangerous impacts distant in time and space. Climate change in the film is abrupt, close, and leads to a new ice age. People reacted with a drop in perceived probability of climate change. Nevertheless, the film did not lead to climate pessimism, but reinforced peoples' willingness to act, respectively to ask for political action. The film seems to have improved the public perception of science and the political role of scientists. The film might have opened a window of opportunity for (improved) environmental communication.

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1. Introduction

By end of May 2004 20th Century Fox released a rather new type of disaster movie in about 80 countries around the world. *The Day After Tomorrow*, directed by Roland Emmerich, put abrupt climate change right in the center of action and depicted a new ice age on the Northern hemisphere. Production costs amounted to about 125 Mio. US \$, and additional marketing costs of probably 50 Mio. US \$. By mid September 2004 about 70-100 Mio. people had seen *The Day After Tomorrow* (TDAT) worldwide.¹ It had earned 540 Mio. at the box offices, 65,5% of which overseas. In the post-modern era of individualization, film distributors make most of their turnover via home entertainment and additional supplementary business activities; the classical cinema covers about 25% of a film's earnings (Stiftung Lesen 2004: 15). So the DVD of TDAT, released by October 7th in two different versions², might reach an even larger public. From a purely business point of view TDAT has to be counted as a success: it is rated as No. 5 of all disaster movies, and No. 1 of both all environmentalist and all global warming movies.³

The advertising budget seems to have been a good investment. The film was announced and debated weeks before its initial launch by very different media in Germany: (i) daily and weekly mass public newspapers, (ii) weekly and monthly mass public magazines, (iii) film magazines, (iv) scientific magazines, (v) web pages of scientific institutes, governments, and NGOs, (vi) educational material edited by governments or other institutions, (vii) TV magazines and talk shows.

Roland Emmerich, himself a German, was very often interviewed and guest in many talk shows. After his 1996 success with *Independence Day*, where a US-lead coalition of the willing (a really global one that time) defeats malicious extraterrestrial invaders, and after his epic about the American Revolution (*The Patriot*, 2000), Emmerich was publicly perceived as an illustrator of excessive US patriotism. His *Godzilla* (1998), a huge dinosaur frightening and destroying Manhattan consolidated his reputation as an excellent (though inexpensive) creator of disaster movies. But in the run-up to TDAT Emmerich created a very distinct image of himself: the environmentally concerned director, trying to raise public awareness of the perils of a changing global climate, and especially critical towards the environmentally damaging American way of life in general. Furthermore he criticized the stand of the Bush

¹ Exact figures are hard to get. Ours are calculated from box office reports on the film's turnover across the world, based on different assumptions on US \$ prices for movie theater tickets.

² One version is going to cover just the movie, whereas another version of the DVD will have a lot of extra features, e.g. cut out scenes etc. In addition, the extended version will provide more scientific background information.

³ See Box Office Mojo (<http://www.boxofficemojo.com/movies/?id=independenceday.htm>)

administration towards climate policy in particular, mocking at his flag-waving patriotism of earlier days. In an interview with the influential weekly political magazine *Der Spiegel* Emmerich criticized the attitude of Americans towards the environment and the climate and environmental policies of the U.S. government. Emmerich is aware of the political dimension of his film. Although not as ‘radical’ as e.g. Michael Moore, who’s *Fahrenheit 9/11* was a success in Cannes 2004, *The Day After Tomorrow* might well indicate a more critical view towards the Bush government more widely held in Hollywood.

But how did TDAT influence the public? Some commentators raised this question in advance. Especially climate scientists displayed a significant skepticism: the film would so much trivialize global climate change that the public would then dismiss the whole issue. Others hoped that TDAT could contribute to environmental consciousness raising, somehow halting the slow but long-term downturn of the whole issue in Germany (Kuckartz et al. 2004).

2. Illustrating Climate Change in *The Day After Tomorrow*

In any case the film in itself displays a very critical judgment of leading U.S. politicians' ability to adequately perceive the dangerous potential of climate change and their ability to act adequately. The story in brief: A National Oceanic and Atmospheric Administration (NOAA) paleoclimatologist (named Jack Hall, played by Dennis Quaid) detects clear evidence for the possibility of a breakdown of the North Atlantic thermohaline circulation due to anthropogenic climate change. In the starting scene he is witness of the breakup of a large Antarctic ice shelf, an event that really happened in early 2002 (the Larsen-B ice shelf). The next scene shows Hall giving a talk about the possible risk of a shutdown of the North Atlantic Current and abrupt climate change at a climate policy conference in New Delhi. It is already snowing--a very unusual event for the Indian capital. The scientist makes an urgent plea for drastic cuts in greenhouse gas emissions. The politicians are surprised to hear about the possibility of a cooling climate due to global warming. Especially the U.S. vice president reacts skeptically and even with open hostility. To give the gist of his interventions: “What about remaining scientific uncertainties? And did you ever think about the economic and political costs of the Kyoto protocol?” By answering these questions Hall delivers a brief risk assessment, weighing future expected (yet uncertain) damages in the case of non-acting against avoided climate change damages due to pro-active climate policy. Hall has to concede remaining uncertainties, but still pleads for action. A few weeks later, scientists monitoring the North Atlantic thermohaline circulation discover a rapid shutdown, alarming Hall and his

research group at NOAA and asking for computational support. Despite being a paleoclimatologist Hall has developed a climate model, the only one that can be upgraded and used as a global prediction model. Hall's group—assisted by a female NASA specialist for tornadoes—comes up with frightening news, hardly believable even in the eyes of the experts: the world is on the verge of a major climate shift, a new ice age will arrive very soon. Hall's attempt to warn the U.S. vice president fails—his assessment of the situation is still that of a global-warming naysayer: “Didn't you tell us at the New Delhi conference that this was only to happen 100 or even 1,000 years from now?” Hall: “I've been erroneous.” Vice president: “What if you are erroneous again?” While his warnings go unheeded, weather anomalies across the globe accelerate: grapefruit-size hail in Tokyo, tornadoes destroying downtown Los Angeles, and ultimately, a storm-surge tidal wave drowning Manhattan. In the latter place Dr. Hall's teenage son (played by Jake Gyllenhaal) has arrived with friends for a scholastic decathlon. Getting caught by one of the massive, hurricane-like super cells that form across the Northern hemisphere, the teenagers take shelter with others in the New York Public Library, where they have to make critical decisions with regard to what books to burn in order to survive the cold. Before leaving for New York in his Antarctic expedition suit, Dr. Hall is allowed to give advice to the U.S. president and high government members (including the vice president) with regard to adaptation measures; he suggests to draw a line across the U.S., and to evacuate everybody south of the line to Mexico. Those north of the line could not be saved any more—a recommendation opposed by the vice president, but due to lack of time and alternatives accepted by the president. The rest of the movie follows Dr. Hall and two members of his group, trying to make their way through ice and snow to rescue Hall's son. The end of the movie leaves the viewer with somewhat mixed feelings: the son is saved, like many others who survived in downtown Manhattan, but the new ice age has established a very unfavorable climatic regime and humankind—especially U.S. politicians—with the terrible insight of former faults, own vulnerability and the fragility of the climate system.

The visual design of *The Day After Tomorrow* is dominated by special effects, in particular in the Los Angeles tornado and the Manhattan tidal wave, and by the quick-freezing effects of the super cells. Emmerich and his team paid utmost attention to a hyper-realistic appearance of these scenes (Magid 2004). They did so successfully: most critics, even those really criticizing the poor story and/or scientific underpinning of the film, conceded TDAT superb visual effects.

There are at least two major conflict lines that TDAT shows: (1) the conflict between science and policy with regard to the correct meaning and understanding of scientific results, and (2) the conflict between the public role of a scientist and his/her private role as an average citizen and family member. The first conflict holds mainly between the climate scientist versus the vice president, the second one is indicated as being held by Jack Hall and his wife and son, but it also exists within Jack Hall himself. Long working hours, long research trips to the polar ice caps, and homework during ‘free’ time have lead to tensions between Hall and his wife (both living in different apartments) and son. The latter feels slightly neglected by his father, and Jack is occasionally suffering from pangs of conscience. These are an additional motivation for him to save his son.

It is a challenge to portray the world of climate research to a broader public. Stefan Rahmstorf, an oceanographer at PIK, is valuing the efforts of the filmmakers in this respect (cf. http://www.pik-potsdam.de/~stefan/tdat_review.html). Science in the mass media, especially in films, has long been subject to various stereotypes: dangerous, power seeking, manipulating, or sometimes silly (e.g. *The Nutty Professor*, played by Jerry Lewis). Very few exceptions give a more attractive picture (cf. Jack Goldblum in *Jurassic Park*). In *The Day After Tomorrow*, a great deal of time is invested to display the daily work and problems involved experienced by scientists: long or unusual working hours, conflicts between scientific objectivity and the needs to ‘please’ funding agencies, time pressure, team work, getting surprised by your own findings and models, and the like. It is hard to deny that *The Day After Tomorrow* has a tendency to idealize science, especially in the confrontation with stubborn politicians. It still gives a far more realistic picture from the bread and butter of scientific work than most other movies that address the issue.

3. The Scientific Background of the Film

Much has been said with regard to the scientific underpinning of the film, and most critics pointed towards exaggerations and even false facts. Typically enough, the assessment of the scientific realism (or its lack) of the film is derived from the natural sciences (climatology, oceanography). Of course climate change is a phenomenon with clear natural science aspects. But one cannot ignore the anthropogenic component, ranging from proximate and underlying causes to perception and adaptation/mitigation. But climate change might well be regarded as a ‘hybrid object’ (Latour 1995), and its study asks for innovative inter- and transdisciplinary research, thus involving the social sciences for assessing impacts, mitigation strategies and

costs, the adaptive capacity of societies etc. Interestingly, the social science part of such a hybrid climate science did not play a significant role in the public debate about the film. This cannot be attributed to *The Day After Tomorrow*, as it offers aspects of both ‘sides’ of climate change. Taking all these aspects into account, we come up with a different assessment of the scientific realism of the film, but a much more positive one than others who only have the natural science side in mind:

Statement of <i>The Day After Tomorrow</i>	Assessment of Scientific Realism
There is climate change	True
There is anthropogenic climate change	True
Due to global warming polar ice caps will melt	True
Global warming might lead to a shutdown of the thermohaline circulation in the North Atlantic	Contested, but cannot be excluded
Global warming will lead to more weather extremes	True/very probable
Global warming will lead to a new ice age in the Northern hemisphere	Very improbable/false
Global warming will lead to Tsunami-like storm surges	False
Rapid temperature drops of 150° Fahrenheit in super cells will occur	False
U.S. climate policy is rather skeptical towards the scientific basis of climate change	True
U.S. climate policy is against ratifying Kyoto mainly for economic reasons	True
Due to climate change a substantial amount of U.S. citizens will become environmental refugees heading to Mexico	Very improbable, but cannot be excluded
The U.S. will grant major debt releases to the developing world	Improbable, but cannot be excluded
The president of the U.S. is apologizing to the world for false policies	Very improbable, but cannot be excluded

Table 1: Statements of the film and assessment of their scientific realism.

If one takes the hybrid character of climate change serious and thus the social (science) aspects into account, the overall assessment of the scientific realism of *The Day After Tomorrow* is mixed, but it is by no means the case that it lacks a sound basis in reality. Especially for Europeans and other non-U.S. citizens, the last points in our table, were relevant in the public perception of the film. Given the conflicts between the U.S. and many

European governments with regard of the Iraq war in 2003 and the raise in anti-Americanism not only in Europe, the TV speech of the former U.S. vice president (now being president) was a very noticeable piece of Hollywood cinema, especially in the case of Roland Emmerich. In *Independence Day*, which was launched well after the first war of a U.S.-led coalition against Iraq, the American president himself enters a fighter plane and flies an attack against extraterrestrial UFOs, making the 4th of July a global holiday. It is hard to imagine a comparable scenario in 2004. Right before the movie was released the photographs of Abu Ghraib shocked the world, and heavy criticism of U.S. hegemony in world affairs was expressed even in the United States (see the public resonance to *Fahrenheit 9/11*, Michael Moore's documentary on alleged ties between the Bush family and Saudi Arabia and the consequences of the Iraq War).⁴ In this situation, a humble U.S. president, grateful to the developing countries and self-critical towards former own positions was something like wishful thinking for many Europeans.

4. Study Design

In order to assess the impacts of *The Day After Tomorrow* on the public we designed a panel study and interviewed people right before and right after they had seen the film. The study was performed by members of the Social Science Department at PIK and supported by the *European Climate Forum* (ECF) and the *German Environmental Ministry* (BMU).

The survey was conducted between 9 June and 6 July 2004 in six movie theaters in Germany. The cities selected (Berlin, Bremen, Magdeburg, Marburg, Munich, Potsdam) should give a good North-South transect through Germany, represent big and small cities, and East and West places.⁵ After purchasing the ticket and before entering the theater, people were asked if they would like to take part in a survey on climate, conducted by the Potsdam-Institute for Climate Impact Research. People who agreed to take part filled out one questionnaire before entering the movie theater and gave it back to the survey team. For returning the first questionnaire they received a questionnaire to be filled out directly after the movie. They were also given a sheet that asked for their telephone number, for a survey taking place about four weeks after the movie. After seeing the movie and coming out of the theater, the audience was expected by the survey-team, as a reminder to fill out the after-questionnaire. Upon returning this questionnaire, regardless whether they gave out their phone number or not, participants

⁴ A survey of media coverage in the U.S. from end of December 2003 to end of July 2004 displays higher values (entries) for Abu Ghraib, *The Passion of the Christ*, and *Fahrenheit 9/11* than for *The Day After Tomorrow*—and even lower for the 2001 IPCC report (Leiserowitz 2004).

⁵ We wish to thank our student assistants in these cities for their great job!

received a movie voucher. We would like to note that most interviewees participated even before recognizing that a voucher was their reward, and many were interested in the study, especially when noticing that it had no commercial background, as most studies in cinemas do have.

1330 people were motivated enough to fill out a questionnaire *before* entering the movie theater. 1283 people handed in a questionnaire *after* seeing the movie. We were able to bring out a total of 1118 matches.

About four weeks later we tried to contact the 234 persons who had given us their telephone number. We were able to reach 149 and match 101 persons to the exiting waves.

The panel-mortality lies within the expected range and can partly be explained through people not taking part in one of the waves, completely or partly missing or varying (by incident or choice) identifying codes. Furthermore there can be changes in the total number of people who gave answers to the individual items due to rejected single variables.

The survey dealt with a wide range of items regarding climate, climate change, climate policy, mitigation and adaptation options. We further more asked about certain media preferences of the audience as well as for socio-demographic items—in line with the lifestyle approach performed in another study (Lantermann et al. 2003), though with a somewhat reduced questionnaire. We did some expert interviews and focus groups with people that had seen the film in order to get some more in-depth information and narratives about how the film was affecting peoples' views on climate change. In this report, however, we will only marginally refer to this material.

Despite the fact that our focus was on the possible impact of the film one should be cautious with the word 'impact'. A full-fledged impact study would have needed a control group of people that had not taken notice of the film. Given the short time horizon from the idea to the study to its implementation, and the notorious question of financial resources, we had to choose and decided to dismiss the control group. So our only 'non-viewers' is the audience right before entering the film. Here, however, one has of course to be aware of the fact that this audience was self-recruiting, which holds especially for the volunteers that were willing to answer the additional telephone wave.

4.1 Socio-Demographics and Motives for Viewing the Film

Our interviewees were asked to fill the forms and rewarded by a free ticket if both questionnaires were returned. 47,3% of the participants were female and 52,7% were male.

The average age of the participants was 29,72 years at the date of seeing the film; the youngest participant was 11 years, the oldest 69 years. 23,0% had kids under 18 living with them in the same household. Most of the participants had a medium (*Realschule*, 10. grade etc. 23,1%) or high (*Abitur* 43,0%; *FH-Reife/Fachoberschule* 16,5%) school certificate. 10,7% of the people taking part in this survey were still going to school at the date of the questioning. This explains the over sampling of lower incomes in the survey:

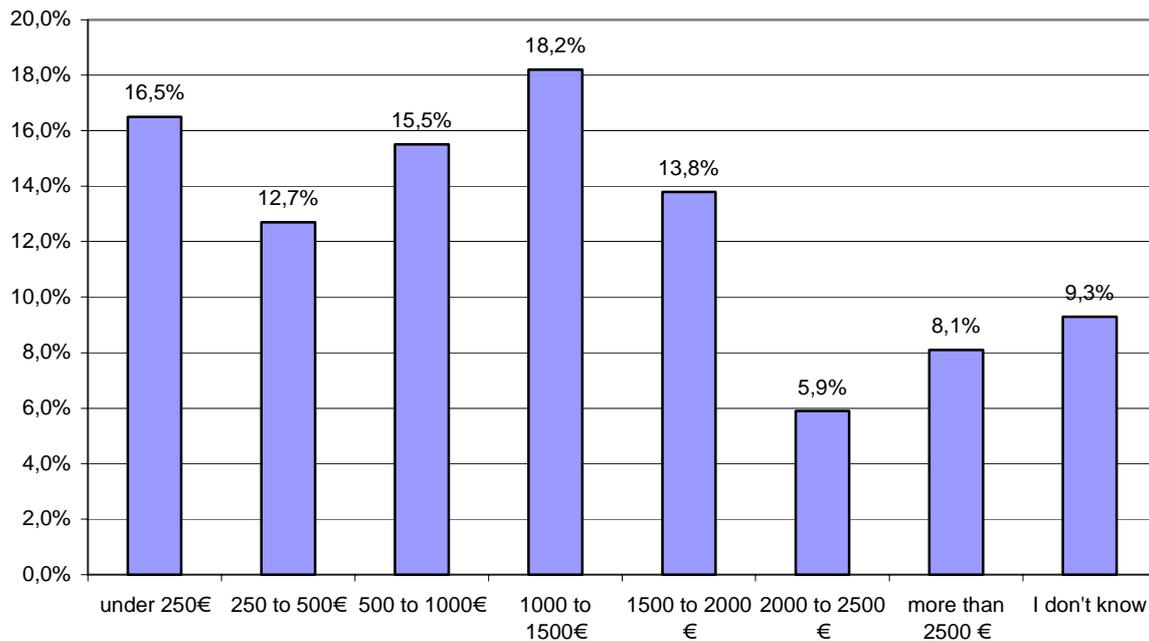


Fig. 1: Net income distribution of study participants.

In order to find an easy entry point for the questioning, we started with a few questions regarding the motivation for seeing *The Day After Tomorrow* that very day. We asked for the frequency of going to the movies and for certain TV broadcasting type preferences, the latter being a standard tool in sociological and marketing research with regard to lifestyles. The first question addressed their motivation for seeing specifically *The Day After Tomorrow* (the participants were allowed to choose more than one option):

- 34,5% *I like disaster movies.*
- 23,5% *I like films by Roland Emmerich.*
- 23,5% *I went along with friends.*
- 35,9% *I'm interested in the climate-issue.*
- 22,7% *something else.*

Given the 25 Mio. \$ budget for advertising and the media attention to Emmerich and his new film, and of course viewer's memories for say *Independence Day* or *Godzilla*, the values for

the first two answers are not very surprising. People tend to select films by genre or director preferences. And the “went along with friends” answer is not surprising too, as decisions for going to the movies are often taken spontaneously and by small groups, especially of young people. The more surprising to us is the fact that most respondents choose the climate issue. Even if the social expectedness of such an answer is taken into account, one has to note that climate and climate change - issues that still don't carry a well-established record of film coverage - are subjects that motivate people to watch a specific movie. Of course motivations usually are mixed entities, but we conclude that adequately ‘packaged’ visual climate change information with a more serious scientific background might well be attractive to at least some segments of the cinema public. Again, this answer might be indicative for the self-recruitment pattern of our study.

4.2 The Main Message of *The Day After Tomorrow*

We rarely leave a cinema without being able to give a main message of the film we have been viewing. Sometimes it is a more lengthy and complicated one, but very often the message of a film can be summarized rather briefly. Especially in the genre of disaster movies long messages are rather rare, and the short ones dominate—if the special effects leave room for messages at all. In the case of *The Day After Tomorrow*, a disaster movie, a short message could have been expected, especially when one takes into account what Emmerich and others had launched as the good intention of the film beforehand.

After seeing the movie, the audience was asked to give a judgment about the main message of the film. The following three answers were provided: (1) *Climate change is coming and we can't do anything about it.* (2) *Save the climate in order to avoid a climate disaster!* (3) *Other, namely ...* If the third option was chosen, people were asked to write down what they think the main message of the film actually was.

9,6% of the interviewed persons agreed, that the main message of the film was message (1). 82,1% stated that message (2) was correct. People who stated a different message varied in their opinions about this message quite a bit. Some people mentioned the special effects or other film elements, whereas others made rather cynical comments like: *buy now cheap real estates in the third world.* The topics Hollywood, the trashiness of the film (story), family and aspects of career making were all mentioned. Others found the presented solutions with regard to the environment and the climate not drastic enough: *we have to do everything to*

protect the climate was a typical answer. Some interviewees mentioned that the exaggeration of the movie was the real topic of the film.

With regard to the provided answers it can be concluded that *The Day After Tomorrow* suggests the idea of preventing climate change to happen as imperative. The fatalistic view that nothing can be done about it is only seen by about 10% of the interviewees as the essence of the film. With regard to the issue that the film focuses on a rather drastic and fast climate change and a small group of people in New York, and with regard to the circumstance that in the movie almost nothing is said about climate change mitigation, this can be seen as a positive result. One can remain doubtful whether a scientifically sounder product with extensive examples for what ordinary people can do in order to mitigate climate change might have received the same reaction. It can be stated, that effective environmental communication doesn't necessarily have to explicitly show the action-goal it is aiming at: it could take sidesteps (in this case rather drastic and personal ones) and still be successful.

4.3 Probability of Climate Change

The classic way of framing climate change as a risk issue is to decompose it into the probability of the occurrence of the event(s) on the one and the degree of expected damage(s) on the other hand. The complexity of the issue, however, makes it difficult to simply assign numbers to the two elements, and remaining uncertainties have to be taken into account. We were interested in the subjective or expected probability of a change in the global climate. By purpose we did not specify single aspects, and we did not qualify the time horizon. We simply wanted to get a rough picture of the subjective probabilities that are around, and if people thought that climate change was already under way (we asked that separately in a latter question), they were able to answer here with a very high probability.

The participants were confronted with four answering possibilities: a climate change is *almost probable*, *rather probable*, *rather unlikely*, and *totally unlikely*.⁶ Our hypothesis was that the participants would see climate change as probable and that the drastic and fictional elements of the film would support this feeling even more. But it came differently (cf. Fig. 2 and Tab. 2):

⁶ The IPCC is quantifying its own synoptical assessments of climate change, e.g. very probable equals a chance of 90-99% for an event to happen, probable equals 66-90% etc. Although one might relate our answer categories to the IPCC numbers, we deliberately dismissed that sort of quantification. People usually give fuzzy answers with regard to complex and scientifically delicate issues, and confronting them with numerical ranges would have produced pseudo-exact results.

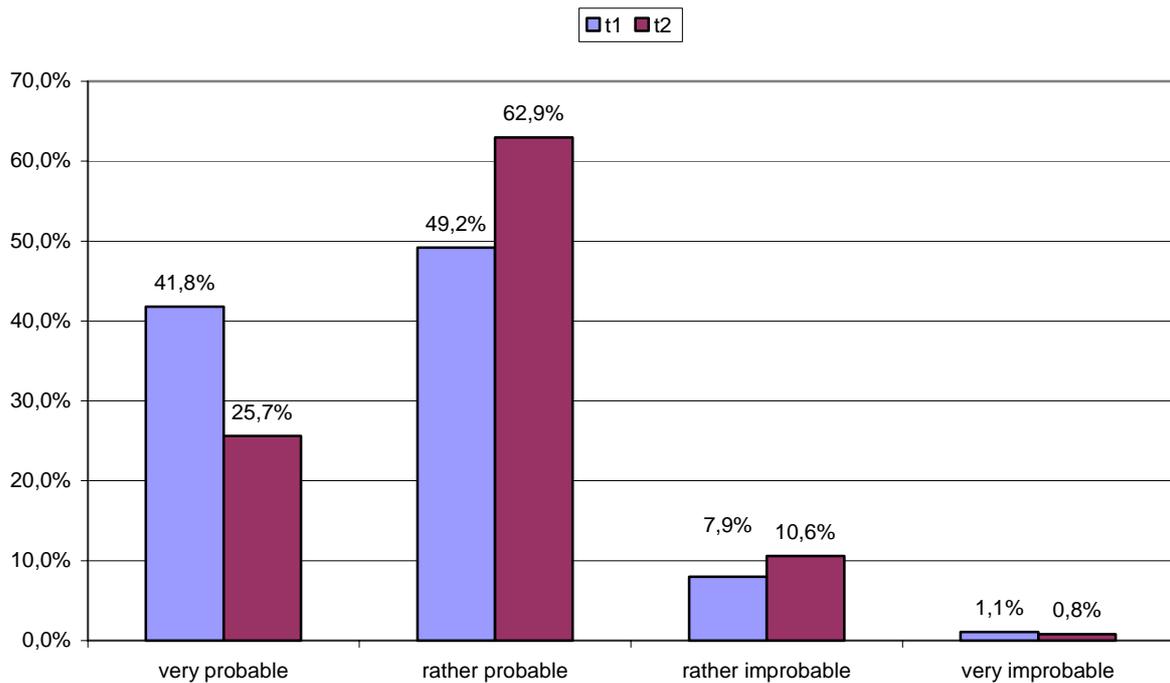


Fig. 2: Subjective probability of climate change before (t1) and after (t2) viewing The Day After Tomorrow.

Table 2: Cross tabulation probability of global climate change before (rows) and after (columns) seeing the movie.

Probability of global climate change?		Probability of global climate change?				Total
		very probable	rather probable	rather improbable	very improbable	
very probable	Frequencies	214	230	16	1	461
	% of total	19,4%	20,9%	1,5%	0,1%	41,8%
rather probable	Frequencies	63	419	57	4	543
	% of total	5,7%	38,0%	5,2%	0,4%	49,2%
rather improbable	Frequencies	3	43	39	2	87
	% of total	0,3%	3,9%	3,5%	0,2%	7,9%
very improbable	Frequencies	3	2	5	2	12
	% of total	0,3%	0,2%	0,5%	0,2%	1,1%
total	Frequencies	283	694	117	9	1103
	% of total	25,7%	62,9%	10,6%	0,8%	100,0 %

As seen in figure 2 and table 2 our hypothesis was falsified and we were more or less surprised. The moviegoers state *before* in a vast majority that they think climate change is *very* or *rather probable*, but this judgments varies *after* seeing the movie in two ways: (1) the two ‘camps’ of ‘climate believers’ (*very* and *rather probable*) and ‘climate skeptics’ (*rather* and *very improbable*) slightly changed their relative weights (skeptics on the rise from 9.1% to 11.4%); but more importantly (2) the film seems to have reduced the degree of certainty of the ‘believers’, many of them moving from *very* to a more moderate *rather probable*. The

differences for the answering categories *very* and *rather probable* as well as *rather improbable* between t1 and t2 are significant.

If the aim of the film was to raise sensibility with regard to possible dangers of a climate change (and this is the case: see <http://www.thedayaftertomorrow.com/>), the film has in a way missed this goal at first sight. Fewer people *after* seeing the movie find climate change probable, and more people think climate change *unlikely* *after* seeing the movie. This is especially true for the people who thought of climate change as *almost probable* *before* seeing the movie. When looking at the actual numbers of people who changed their mind about this question, this should not lead to much of a concern – but we are concerned about the direction of the change, although the ‘damage’ done by the movie is rather small.

How could this change of opinion be explained? Our explanation is that moviegoers were surprised by the film, given the scenario of climate change they had in mind before they entered the cinemas: slow and linear changes, higher temperatures, melting ice caps, maybe more floods and other weather extremes, but no role of the oceans, no complex and paradoxical feedbacks, and definitely no ice age. Confronted with a very different climate change scenario by *The Day After Tomorrow*, people attributed the questions and doubts they have regarding the events shown to the real object ‘climate change’ they were asked for in our questionnaire. Their argumentation might have run as follows: ‘If *this* (TDAT) is climate change, I’m not so sure any more that it will occur in the future.’ Of course this is highly speculative, but the answers to the question ‘What did you learn from the film’ (see below) support our view.

We should add that the relatively high degrees of probability people assign to climate change (especially before they saw the film) are a surprising result in itself. The vast majority of the respondents is more or less convinced that our climate is about to change! Given the high complexity of the scientific underpinnings of climate (change) research and the low readership of scientific journals in the general public, this high degree of certainty is only attributable to the mass media (TV, press, radio) that most people indeed consult in order to inform themselves about scientific issues such as climate change (see Eurobarometer 2001).

Mass media have a specific way of communicating science. Often scientists complain about journalists’ low capacity or willingness to grasp the full complexity of their results, being highly selective, simplistic, and with a clear tendency to spectacular news. Furthermore many media formats (especially talk shows) are in a way alternativelessly ‘addicted’ to personalization and to stimulating debates, confrontation and polarization (a scheme taken

over from the field of politics). If issues like climate change are subject to media coverage they are very often presented not only in a simplistic and dramatized manner (in order to get the attention of the public), they also are presented in a polarized way, e.g. by selecting a pro and a con-representative. In the case of climate change we then often are confronted with the warning climate scientists and a climate skeptic (e.g. Brian Lomburg or other 'eco-optimists'), suggesting a neutral stand of the media representatives, giving the floor to competing views. However, a closer look at the scientific discourse in the serious scientific journals reveals that this equal representation of different positions is in fact a misrepresentation, i.e. an overstatement of the skeptics and an understatement of the climate scientists.

Despite all this the general public in Germany seems to be little impressed by these media rituals. The majority has 'bought' the climate issue, a remarkable success for the climate scientists. Our results are supported by representative studies of the German population. Kuckartz et al. (2004) report that 34% of the interviewees were totally convinced of the predicted climate change to happen, 51% were rather convinced, 13% were rather not convinced, and 2% not at all.⁷ We assume that climate change has taken a specific role in the German environmental discourse (Brand et al. 1997): like the *Waldsterben* in the 1980s, it operates as a kind of master-frame for a lot of environmental problems, a key issue that links local to global facets, that is able to symbolize a high degree of environmental vulnerability (up to apocalyptic undertones), is quotable as a standard example for anthropogenic causation and guilt, and covers a broad range of pro-environmental attitudes and behavior in case of mitigation. As we will see later, the high degree of probability assigned to climate change might well last upon false assumptions. Nevertheless it does still indicate a success story of environmental communication of a complicated issue.

Therefore *The Day After Tomorrow* reached a rather highly sensitized public, and the impact it had is surprisingly a slightly 'negative' one: reducing subjective probabilities assigned to climate change, the issue the film wanted to raise awareness for. Weingart et al. (2002) have summarized the development of the German climate discourse in the media, in science and in politics as a movement 'from hypothesis to catastrophe'. To some extent, Roland Emmerichs film has triggered the opposite move: climate change has evolved from catastrophe to hypothesis for many viewers - from a very probable thing to happen to something only rather probable, if not rather improbable.

⁷ This result is again indicating a slight self-recruitment of slightly more 'believers' and less 'skeptics' in our study.

4.4 Learning Effects

People enter cinemas primarily to get entertained, not to learn something. Still, learning occurs, although mostly in a more subliminal way. We asked the people whether or not they learned something new by watching *The Day After Tomorrow*. We thought that this question would be important since the film talks about issues with regard to climate change that weren't passed on to the public in a vast way so far (e.g. possible cooling effects). The participants were asked *Have you learned something new about climate change?* The provided answering categories were *yes, a lot*; *one thing or another*; *just a few things* and *I learned nothing new*. In a next step people were asked to write down an example for what they had learned.

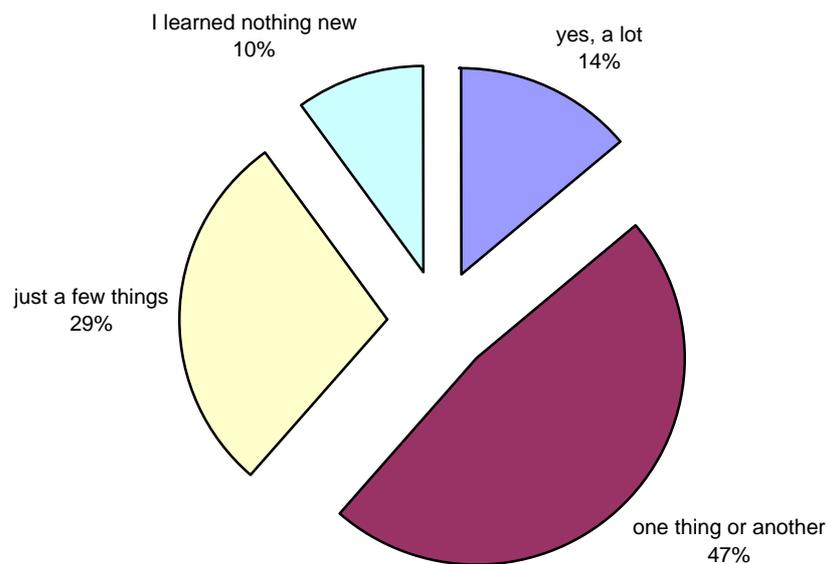


Fig. 3: Did you learn something from the film?

We find it rather remarkable that just 10% of the participants said, that they *didn't learn anything new* by watching the film - especially when one remembers that 'learning' isn't the primary goal of going to the movies. 14% agree that they have learned *a lot* and 47% stated that they learned *one thing or another*. By interpreting these answers one has to keep in mind that people tend to understate the degree of their personal learning, as the answer *yes, a lot*

might let a person look ‘dumb’ or uninformed, so that *one or another thing* is easier chosen even if one wants to indicate that you have learned quite a lot.

But what did the people learn? Our audience was asked to give an example of what it had learned. We categorized the open answers and came up with the following schema:

- (1) *Speed*: Climate change can take place with a higher speed than expected. Excluded are the rapid drops in temperature. Example: *it can go faster than one thinks*. Result: 8%.
- (2) *Cold, Ice age*: all aspects dealing with the (rapid) drop in temperature and the answers that deal with a possible new ice age: *possibility of an ice age; rapid drops in temperature; coolness-wave*.⁸ Result: 15%.
- (3) *Thermohaline Circulation (THC)*: aspects with regard to the meaning of the oceans and their circulation for the world climate as well as changes due to the shown breakdown of THC: *climate change depends on ocean circulation; balance between sweet and salty circulations; the role of THC*. Result: 19%.
- (4) *General Sensitiveness*: answers dealing with a higher consciousness with regard to the vulnerability of the world climate, as well as answers dealing with the role of humans with regard to climate and environment. Furthermore we put answers in this category that concluded a risen awareness to the role of experts and scientific results: *lean to value and protect nature; pay attention to changes in the climate worldwide; climate research in detail; I now know how important it is to look after the nature*. Result: 16%.
- (5) *Mitigation*: action oriented statements with a focus on avoiding climate change through fighting against the causes on an individual and on a societal level: *Kyoto must be ratified; engage more for the environment; we have to deal in a better way with our energy resources; ride the bike more often*. Result: 22%.
- (6) *Adaptation*: action oriented statements which deal with an adaptation to a probable or unavoidable seen climate change: *be prepared; how to survive; what shall I do when it is time?* Result: 2%.
- (7) *Fatalism*: statements with regard to the unavoidedness of climate change and the senselessness of avoiding and adapting behavior: *one can't do anything if there is a climate change; it comes at any time and one doesn't know when nor what to do against it; stay calm – one can't do anything about it*. Result: 3%.

⁸ Note that all aspects of rapid temperature change were subsumed here, and not in the *Speed* category.

(8) *USA*: There were several statements with a direct link to the USA and its role in climate policy, as well as statements that dealt with assumingly Hollywood-specific issues of interpretations: *don't use the USA as a role model in every case! Where is Europe?; The US-government is incapable! (but I knew this before); All Americans are heroes!; exaggerating US-movie!* Result: 2%.

(9) *Others*: diverse and other learning issues with a heterogeneous content, including partly sarcastic statements: *New York has a Gutenberg-bible; wolfs are dangerous animals.* Result: 13%.

The clear and unpredicted ‘winner’ of the openly asked question is the mitigation option, with 22% of open answers. This is surprising, given the fact that *The Day After Tomorrow* does not offer any explanation for climate change (only marginally human GHG emissions are mentioned), and not a single mitigation option is shown.⁹ The film focuses clearly on a rapid and anthropogenic caused new ice age. Only the poor man in New York – Jack Halls sons and his friends are in a taxi and stuck in traffic – states when strolling by to his dog: *look at all the cars that are stuck in the streets and contaminate the air with their emissions.* But this is just a side comment and not directly linked to climate change.

The theme *learning from earlier mistakes* plays an on and off role in the movie – in a private and in a political context. Nevertheless this theme never evaporates to actual actions and measures taken. *The Day After Tomorrow* doesn't offer connecting points from which mitigation options can be drawn directly. The mitigation options are thought of mainly and only through the background knowledge of the movie viewers. It is obvious that the film stimulates the audience to “dig out” their background knowledge on mitigation options for solving the problems shown in the movie – this is remarkable since the movie shows that it is too late for any actions to be taken against climate change. The adaptation option wasn't chosen by nearly anyone. This could mean that nobody really is awaiting a new ice age in the real world.

Nevertheless it has to be made clear, that a lot of the statements regarding learned issues deal with coolness and ice age – together with the answers with regard to the thermohaline circulation. Both themes are *the* things learned by the moviegoers. From a lot of comments by the moviegoers it also becomes clear that most of them had never heard of this mechanism or

⁹ Jack Hall is driving a hybrid car, but the scene is short, and most viewers might not catch the car's technical design. Besides, the black Manhattan homeless man refers to stinking cars in a downtown traffic jam.

this option before. It can clearly be said, that the film, at least for the German audiences, made the audience aware of these mechanism, of which they had never heard of before.

Also new for the moviegoers and participants was the fact that there could be rather fast changes in the climate. This perception is generally in line with current climate change science, which states that there could be non-linear as well as abrupt and irreversible changes within the climate system. The learning effects mentioned with regard to *speed* therefore can be seen as in accordance with the current scientific status quo.

With regard to the answers in the category *general sensitiveness* it can be seen that the moviegoers stated their astonishment about the complex and vulnerable earth system (stated as the environment or the earth) and in particular the climate. This astonishment goes most times hand in hand with a raising consciousness to the outputs of science. These participants state that one should listen more to scientists and pay more attention to their findings. We find such statements motivated by one of the central themes of the movie: the discussion between the scientist and a, at first ignorant, political power (in the movie represented through the US vice president). The statements with regard to *general sensitiveness* weren't counted as mitigation options, because they didn't have an explicit action option. Nevertheless we find them an important learning effect, since they put forward a more aware person, which can be valuable for climate policy. This mode is further more valuable since it makes the person not believe everything seen in the movie to be true. We assume that people who gave answers within this category are more prone to get themselves further information about the topic.

Certainly new for quite a number of people was the fact that a climate change doesn't only bring warmth to everyone everywhere, but that instead it could get colder in some regions due to rather complex mechanisms (THC). This goes hand in hand with scientific findings (see IPCC 2001, Working Group I), but only to a certain extent. The predicted ice age in the movie is certainly not predicted by current scientific findings and therefore over exaggerating.

From comments by the audience and questions asked within the context of the survey we do know that quite a number of the participants has doubts about the shown ice-age in general and with regard to the time within it is appearing. But for most of the audience the phenomenon that it could get cooler was as new as the information about THC and a general rapid climate change – which are based on scientific findings.

4.5 Reality of the Film

The participants were asked to judge how realistic the movie is. Due to money and time constraints we didn't ask this question with regard to certain elements of the film, but asked an overall and rather general question. The participants were given the following three answering options:

- *The film has nothing to do with reality. The shown happenings a truly movie fiction.* 9,8%
- *The film is exaggerating, but has a scientific reliable basis.* 79,0%
- *The film just shows what climate science has found out so far.* 11,3%

These answering options were chosen since they represent the differences of opinions with regard to the movie as seen in the media and scientific discussions before the movie started. It is obvious that the vast majority of the people asked (almost 80 %) sees the movie, despite exaggerations, as realistic, meaning based on scientific findings.

We were wondering how the people judge the reality of this movie, keeping in mind the probability they assess to climate change. See below cross tabulation of probability of climate change *after* seeing the movie and the reality of the movie (see Table 3).

Table 3: Cross tabulation probability of climate change (rows) and reality of the movie (columns).

		Is the movie realistic?			Total	
		truly movie fiction	movie is exaggerating	movie shows what science has found out		
Probability of global climate change?						
	almost probable	Frequencies	18	206	51	275
		% within probability	6,5%	74,9%	18,5%	100,0%
		% of within reality	16,8%	24,1%	42,9%	25,4%
		% of total	1,7%	19,0%	4,7%	25,4%
rather probable		Frequencies	53	573	57	683
		% within probability	7,8%	83,9%	8,3%	100,0%
		% within reality	49,5%	66,9%	47,9%	63,1%
		% of total	4,9%	53,0%	5,3%	63,1%
rather improbable		Frequencies	32	73	10	115
		% within probability	27,8%	63,5%	8,7%	100,0%
		% within reality	29,9%	8,5%	8,4%	10,6%
		% of total	3,0%	6,7%	0,9%	10,6%
very improbable		Frequencies	4	4	1	9
		% within probability	44,4%	44,4%	11,1%	100,0%
		% within reality	3,7%	0,5%	0,8%	0,8%
		% of total	0,4%	0,4%	0,1%	0,8%
total		Frequencies	107	856	119	1082
		% within probability	9,9%	79,1%	11,0%	100,0%
		% within reality	100,0%	100,0%	100,0%	100,0%
		% of total	9,9%	79,1%	11,0%	100,0%

It can be stated that even the people who see the movie as a realistic picture of climate change knowledge don't agree that climate change is all fiction at the same time, but rather agree that the film is more or less realistic because the scientists are right.

Nevertheless it has to be made clear that more scientific communication with the public is needed, since 11,3% of the German interviewed moviegoers state that the films really shows just scientific findings.

5. Climate change

5.1 What is dangerous climate change?

A focus point of this survey was to find out which climate change consequences were seen as dangerous by the audience. We asked the audience *before* and *after* seeing the movie to evaluate which would be the most dangerous outcomes of a human caused climate change.

The provided answering categories, it was allowed to choose more than one, were:

- heat
- droughts
- depletion of the ozone layer
- food shortages
- storms
- waves of coolness
- flooding
- raise in the sea level
- environmental fugitives
- pests
- losses in biodiversity

Pictured below are the frequencies for the answers *before* and *after* seeing the movie in comparison.

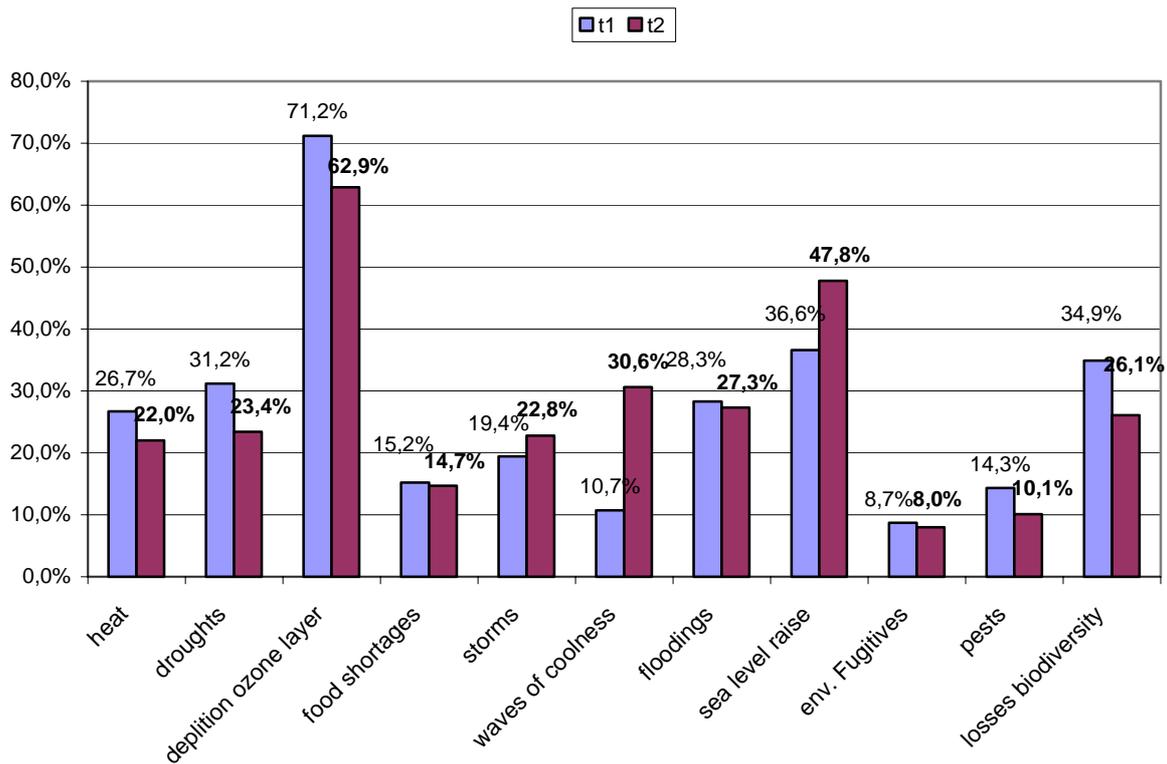


Fig. 4: Dangerous outcomes of a human caused climate change before (t1) and after (t2) seeing the movie.

We find the following findings rather interesting:

- (1) Regardless the time of being questioned, the most named dangerous climate change outcome is the depletion of the ozone layer. This is scientifically wrong, since the (stratospheric) ozone layer has not been thinned out by climate change but by chemical bindings, which have also a climate damaging potential (CFCs). We do know from other studies that the depletion of the ozone layer and climate change are often seen as going together or seen as interchangeable. This mix up could be caused by the fact that the tropospheric ozone pushes climate change. Furthermore, measures to be taken for saving the climate, e.g. reducing the car use, are broadly communicated for both protecting the climate and the ozone layer. It becomes clear that environmental communication has to deal better with this objective and educate the public.
- (2) A lot of participants see raising sea levels caused by climate change: 36,6% of the participants *before* and 47,8% *after* seeing the movie. The high level of this issue can be explained by the attention paid to it in media discourses: it gets warmer and warmer, the polar caps are melting, sea levels are rising. This coherence is also nurtured by the movie. What astonishes in this context is that the frequencies for

floodings were fewer *after* seeing the movie. It could be that the moviegoers see the flood wave that goes over Manhattan is more caused by sea level rise than viewed as flooding. Flooding is more or less seen as a problem with regard to inland waters.

- (3) In accordance, *heat* and *droughts* are seen less dangerous *after* seeing the movie, as well as the *loss in biodiversity*. *Food shortages*, *the depletion of the ozone layer* and *pests* were also seen as less dangerous *after* seeing *The Day After Tomorrow*. All these consequences of climate change are not mentioned in the movie.
- (4) There are some negative results from climate change, which are reported more often *after* the movie than *before*. These are *sea level rise*, *storms* and *waves of coolness*. With regard to the shown tornados over Los Angeles, the rise in the counting for *storms* (plus 3,4%) can be explained through pictures shown in the movie. The frequencies rose rather drastically for *sea level rise* (plus 11,2%) and *waves of coolness* (plus 19,9%). The audience had rated *waves of coolness* *before* seeing the movie, and despite the information they had had over the movie, as basically not a consequence of climate change. Since the whole movie was about this issue, it doesn't surprise us that *after* seeing the movie a lot of participants see this consequence as an option.
- (5) It seems to be astonishing that the issue *environmental fugitives* seems not to be an issue at all – and even less *after* the movie, although US citizens are fleeing over the Mexican boarder due to the coming ice-age. This can partly be explained through the circumstances that in real life environmental fugitives look more like fugitives in other humanitarian catastrophic regions (Darfour, Tschad). The pictured US fugitives are probably seen as unreal.

5.2 Is climate changed caused by nature or by humans?

There is a discussion whether or not the observed or forecasted changes in the climate are caused by humans or if they are result of natural coherence or cycles (e.g. sun activity, volcanism). The movie itself doesn't pay much attention to this issue, but due to the statements by Jack Hall at the shown climate conference as well as the theme "learning through mistakes" it becomes clear that in *The Day After Tomorrow* the climate skeptics obtain the role of anti-heroes. We therefore wanted to know from the participants: *changes the human the climate or is it a natural change?* The given answering categories were *the*

humans are in charge, nature is in charge, both are in charge and I don't know. The following frequencies were given *before* and *after* the movie:

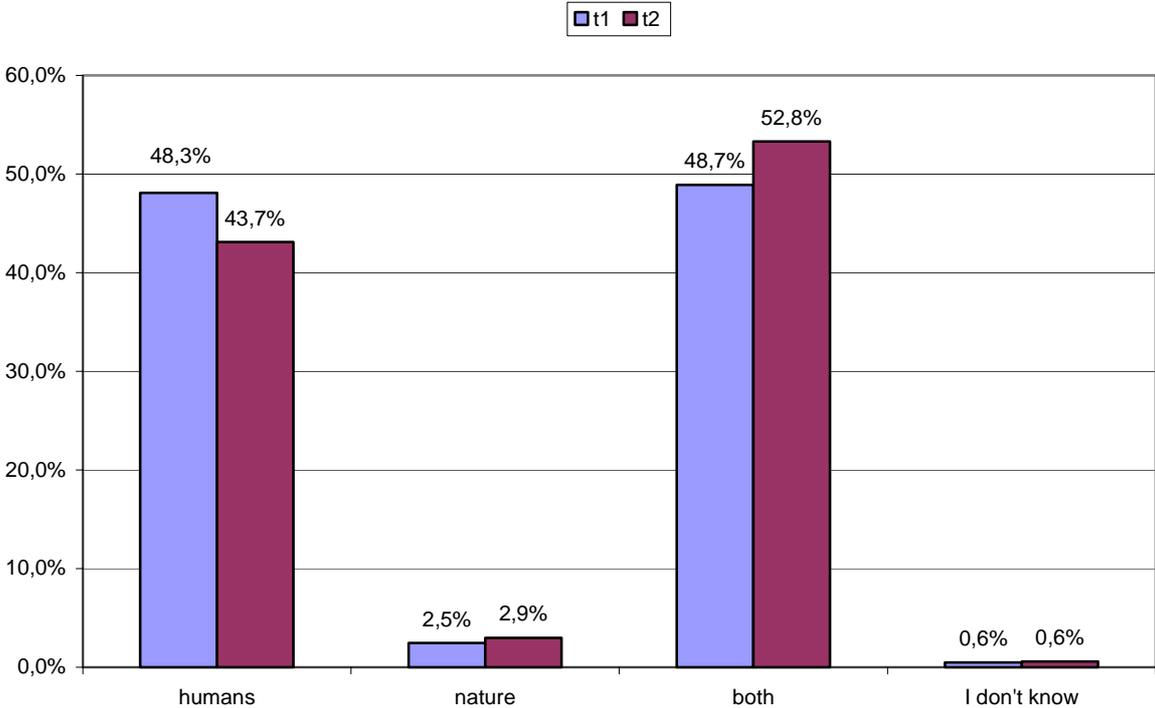


Fig. 5: Responsibility for climate change before (t1) and after (t2) seeing the movie.

It is obvious that there are similar, but not identical, answering categories *before* and *after* seeing the movie. The moviegoers give the responsibility to parts either to the *humans* alone or to both *humans and nature*. It is remarkable that *after* seeing the movie fewer people state that *humans* are responsible, which is a statistically tested significant difference, and that more people say that *both* are responsible.

We are going to have a look at the cross tabulation, as before, for the answers *before* and *after* the movie to be able to identify people who changed their mind.

Table 4: Cross tabulation responsibility for climate change before (rows) and after (columns) seeing the movie.

						total
		humans	nature	both	don't know	
humans	Frequencies	415	10	93	3	521
	% of total	38,5%	0,9%	8,6%	0,3%	48,3%
nature	Frequencies	8	11	8		27
	% of total	0,7%	1,0%	0,7%		2,5%
both	Frequencies	46	9	467	3	525
	% of total	4,3%	0,8%	43,3%	0,3%	48,7%
don't know	Frequencies	2	1	2	1	6
	% of total	0,2%	0,1%	0,2%	0,1%	0,6%
total	Frequencies	471	31	570	7	1079
	% of total	43,7%	2,9%	52,8%	0,6%	100,0%

It can be seen positively that a number of participants agrees that at least in part humans are causing climate change. At the same time it can be seen skeptical that *after* seeing *The Day After Tomorrow* the number of people rises that believe that *both humans and nature* are causing climate change. This is also mirrored in the comments that were written, unasked for, by the participants that there always have been changes in the climate system and there always will be.

One can only speculate about the reasons for the “winning” of nature being responsible. Our guess is that the film itself focuses on dangerous natural shifts and leaves the causing mechanisms unexplained. Together with, to the moviegoers, several new items with regard to climate change, this could cause moviegoers to rate the power of nature higher than without seeing the movie. *Before* seeing the movie it was likely that the audience thought that evil humans are causing damage to the climate, which causes several unpredicted and unwanted outcomes, e.g. sea level rise, which will be a problem for future generations. Instead, in the film director Roland Emmerich puts the power of nature in the empty space left by Godzilla or aliens in *Independence Day*. Therefore nature itself becomes the main character of the movie. Nature brings bad surprises to the people that know nature best – scientists as Jack Hall-, and puts the re-acting humans constantly in danger, so that any thought on co-authorship by humans seems certainly unreal. The film “upgrades” nature from to a certain kind of “monster” which reacts to the damages done to it earlier – this reaction could take place at any time. The way nature is presented in the movie could make the moviegoers see nature as a more causing factor of climate change.

5.3 Climate change and the media

The majority of at least the European citizens has learned about climate change through the media. Regarding to a Eurobarometer-survey (Eurobarometer 2001), the most important source to gain “scientific” knowledge is TV (EU: 60,3%, Germany (G): 67,7%), followed by newspapers and magazines (EU: 37%, G: 43,9%), the radio (EU: 27,3%, G: 25,5%), schools and universities (EU: 22,3%, G: 14,2%), scientific journals (20,1%, G: 15,4%) and the internet (EU: 16,7%, G: 13,7%). It can clearly be seen that audio-visual media reaches more people than print-media.

We do know at the same time that the satisfaction with the media coverage of environmental issues is low and has gone lower within the last several years (Kuckartz et al. 2004: 53). Keeping this in mind, it was interesting for us to ask whether or not the moviegoers are satisfied with the role of the media with regard to climate change issues: *The consequences of climate change are covered by the media in an exaggerating way*. We offered the answering categories *absolutely yes*, *partly yes*, *partly no* and *absolutely no*.

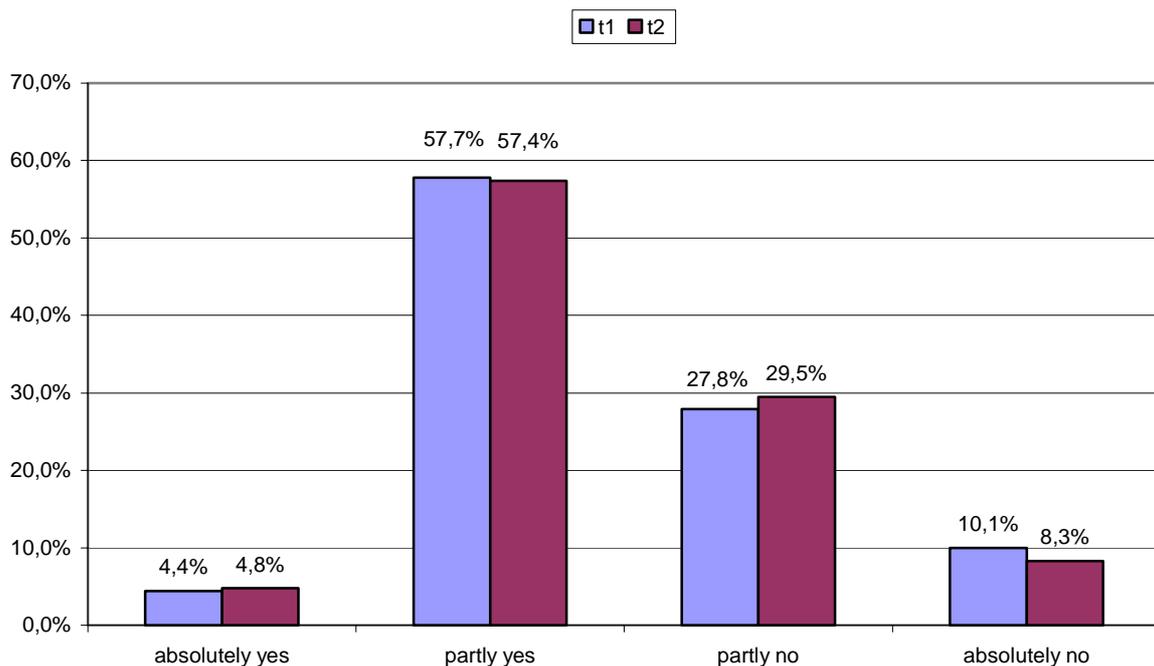


Fig. 6: Climate change and the media before (t1) and after (t2) seeing the movie.

Regardless whether this question has been asked *before* or *after* seeing the movie, quite a number of participants agrees that at least in part the coverage of the media is exaggerating. There are some slight changes from *before* to *after* within the group of people who more or less disagrees with this statement.

Table 5: Cross tabulation climate change and the media before (rows) and after (columns) seeing the movie.

		The consequences of climate change are covered by the media in an exaggerated way				total
		absolutely yes	partly yes	partly no	absolutely no	
The consequences of climate change are covered by the media in an exaggerated way	absolutely yes	Frequencies 19	21	5	4	49
		% of total 1,7%	1,9%	0,5%	0,4%	4,4%
	partly yes	Frequencies 25	504	95	13	637
		% of total 2,3%	45,7%	8,6%	1,2%	57,7%
	partly no	Frequencies 5	94	184	24	307
		% of total 0,5%	8,5%	16,7%	2,2%	27,8%
	absolutely no	Frequencies 3	15	42	51	111
		% of total 0,3%	1,4%	3,8%	4,6%	10,1%
total	Frequencies 52	634	326	92	1104	
	% of total 4,7%	57,4%	29,5%	8,3%	100,0%	

It can be seen that the total numbers *before* and *after* seeing the movie don't vary much (they are not significantly relevant) – and there is no clear tendency of changes within the different categories.

5.4 The Dangers of climate change

The participants were asked to judge how dangerous they think climate change is or could be a) with regard to humanity in general and b) with regard to Germany in particular. These questions were asked both *before* and *after* seeing the movie.

5.4.1 The Dangers of climate change to humanity

How dangerous is climate change for humanity? Given were the answering categories *extremely dangerous, more or less dangerous, more or less safe and extremely safe.*

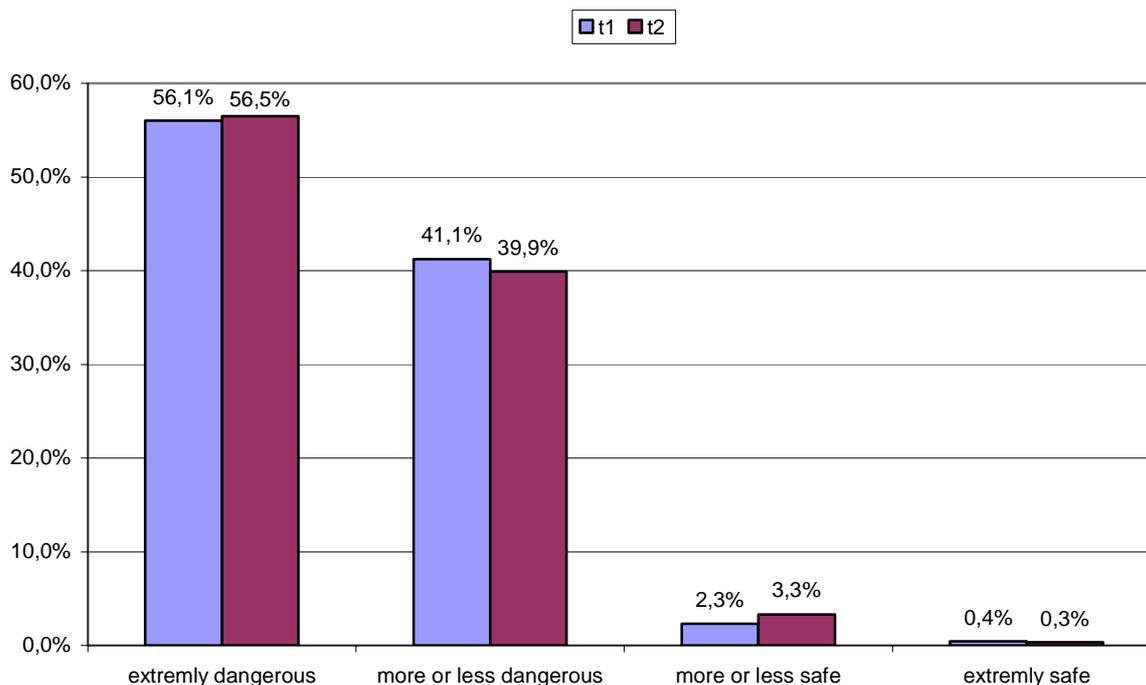


Fig. 7: Dangers of climate change to humanity before (t1) and after (t2) seeing the movie.

The majority of our participants believes that climate changes is *extremely dangerous* or *more or less dangerous*. A rather small minority states safeness. The moviegoers had this opinion when they went into and came out off the movie. The changes seen in this table are not significant.

Table 6: Cross tabulation dangers of climate change to humanity before (rows) and after (columns) seeing the movie.

		Dangers to humanity				total
		extremely dangerous	more or less dangerous	more or less safe	extremely safe	
extremely dangerous	Frequencies	502	115	6	1	624
	% of total	45,1%	10,3%	0,5%	0,1%	56,1%
more or less dangerous	Frequencies	122	315	20		457
	% of total	11,0%	28,3%	1,8%		41,1%
more or less safe	Frequencies	4	13	9		26
	% of total	0,4%	1,2%	0,8%		2,3%
extremely safe	Frequencies		1	2	2	5
	% of total		0,1%	0,2%	0,2%	0,4%
total	Frequencies	628	444	37	3	1112
	% of total	56,5%	39,9%	3,3%	0,3%	100,0%

The table shows that the relative stable numbers are provided by changes in the answers *before* and *after* seeing the movie in certain answering groups:

1. 624 persons *before* and *after* seeing the movie agreed that climate change is *extremely dangerous* for humanity. But “just” 502 persons were stable in their opinion. 115 persons change their opinion *after* seeing the movie to *more or less dangerous*.
2. From the 457 persons who *before* seeing the movie stated that climate change is *more or less dangerous* to humanity, 315 stay with their opinion. 122 persons state *after* seeing the movie that they find climate change *extremely dangerous* and 20 persons change into the category *more or less safe*.
3. Of the people who agreed *before* the movie that climate change is *more or less safe* for humanity (N = 26), only 9 kept the opinion. 13 changed *after* the movie to thinking that climate change is *more or less dangerous* to humanity.

It can be seen that changes in opinion shift towards both directions. It doesn't seem surprising that people think it more dangerous *after* seeing the movie, due to the scenes seen.

5.4.2 The Dangers of climate change for Germany

How dangerous is climate change for Germany? We provided the same answering categories as for the dangers of climate change to humanity: *extremely dangerous*, *more or less dangerous*, *more or less safe* and *extremely safe*.

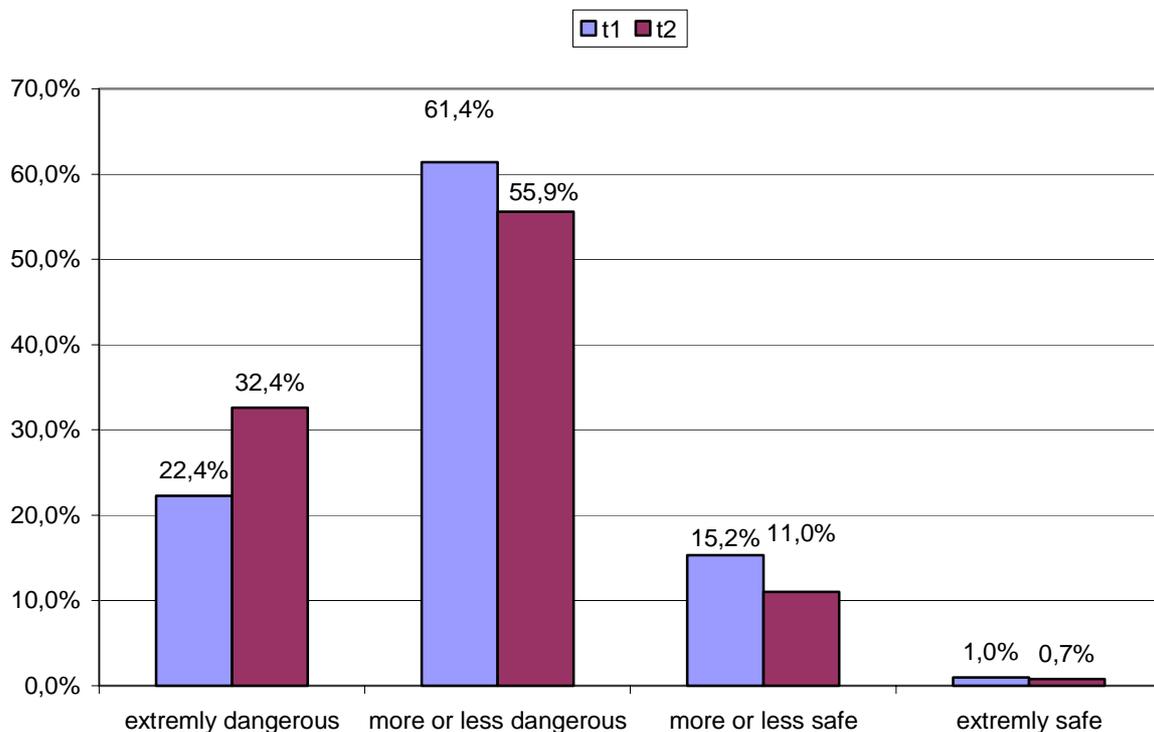


Fig. 8: Dangers of climate change for Germany before (t1) and after (t2) seeing the movie.

In general climate change is not nearly seen as dangerous for Germany as for humanity. This result was somewhat expected since others (i.e. Kuckartz et. al. 2004: 18) report that climate change is seen more dangerous the further away the dimension asked for.

As can be seen from figure 8, there are changes in the risk perception of climate change with regard to Germany from *before* to *after* seeing the movie. The risk perception *after* seeing the movie is higher than *before*. A minority of the people agreed upon that climate change is *more or less* or *extremely safe* with regard to Germany. The changes in the answering pattern with regard to the answering possibilities *extremely* dangerous, *more or less* dangerous and *more or less safe* are significant. The changes in detail:

Table 7: Dangers from climate change to Germany before (rows) and after (columns) seeing the movie.

Climate change for us in Germany is ...		Climate change for us in Germany is ...				total
		extremely dangerous	more or less dangerous	more or less safe	completely safe	
extremely dangerous	Frequencies	191	52	4		247
	% of total	17,3%	4,7%	0,4%		22,4%
more or less dangerous	Frequencies	158	485	35	1	679
	% of total	14,3%	43,9%	3,2%	0,1%	61,4%
more or less safe	Frequencies	9	79	77	3	168
	% of total	0,8%	7,1%	7,0%	0,3%	15,2%
completely safe	Frequencies		2	5	4	11
	% of total		0,2%	0,5%	0,4%	1,0%
total	Frequencies	358	618	121	8	1105
	% of total	32,4%	55,9%	11,0%	0,7%	100,0%

As can be seen in table 7, climate change is seen a bit less dangerous with regard to Germany *after* seeing *The Day After Tomorrow*. This could be explained through the circumstances that the actions of the film mainly take place in the USA and the only actions that take place in Europe play in Scotland. It has to be remembered though, that if there were a breakdown of THC this would mainly affect Europe and not the US. The actions of the film tend to wash away the awareness for dangers of climate change for Germany – this has to be kept in mind when creating environmental communication strategies.

5.5 Stability of the climate system

In accordance with cultural theory, the participants were asked to evaluate the stability of the climate system. Four items were provided, of which the participants were asked to choose one (question asked *before* and *after* the movie).

How stable/ sensible is the climate system against human operations?

- *The climate system is very stable and tolerates human operations without any problems.*
- *The climate system is stable within certain limits. Only when certain limits are crossed serious consequences will take place.*
- *The climate system is very sensitive. Even small inputs can have severe consequences.*
- *The climate system is unpredictable. One can't predict what the consequences of measures taken will be.*

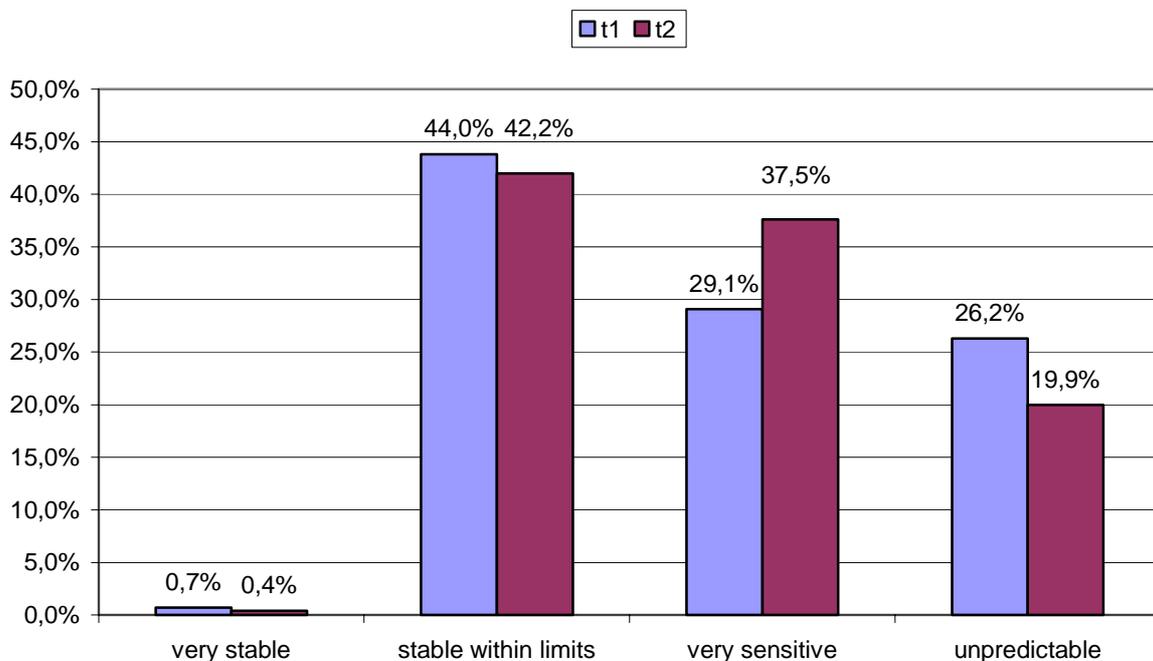


Fig. 9: Stability of the climate system before (t1) and after (t2) seeing the movie.

As can be seen from figure 9 the climate system is seen *very stable* only by a very limited number of people – both *before* and *after* the movie. Most people agree both *before* and *after* the movie that the climate system is *stable within limits*. At second place lies the judgment that the climate system is *very sensitive and that even small inputs can have severe consequences*. The changes seen in this category are significant as well as the changes in the category *unpredictable*, which take third place. The following changes in the answers can be seen from the first to the second questioning:

Table 8: Cross tabulation stability of the climate system before (rows) and after (columns) seeing the movie.

		Climate system (CS) very stable	CS stable within certain limits	CS very sensitive	CS unpredictable	total
CS very stable	Frequencies		5	2	1	8
	% of total		0,5%	0,2%	0,1%	0,7%
CS stable within certain limits	Frequencies	3	364	79	39	485
	%of total	0,3%	33,0%	7,2%	3,5%	44,0%
CS very sensitive	Frequencies	1	55	227	38	321
	% of total	0,1%	5,0%	20,6%	3,4%	29,1%
CS unpredictable	Frequencies		41	106	142	289
	% of total		3,7%	9,6%	12,9%	26,2%
total	Frequencies	4	465	414	220	1103
	% of total	0,4%	42,2%	37,5%	19,9%	100,0%

As can be seen from table 8 the changes in the answering pattern that are taking place are not taking place in a systematic way. In general it can be seen that the answering patterns are, as assumed, pretty stable from one point of questioning to the other – this is in accordance with the cultural theory, which sees these items as relative stable and rather solid patterns of views upon nature/ the climate system.

Since a few years there are representative studies with these items in Germany, done by BMU/UBA. In the latest version of these surveys Kuckartz et al. (2004: 52) came forward with the following results:

- *The climate system is very stable and tolerates human operations without any problems. 5%*
- *The climate system is stable within certain limits. Only when certain limits are crossed serious consequences will take place. 51%*
- *The climate system is very sensitive. Even small inputs can have severe consequences. 20%*
- *The climate system is unpredictable. One can't predict what the consequences of measures taken will be. 24%*

The studies of BMU/ UBA, conducted by Kuckartz, asked for nature but we asked for climate. Our here presented study is non-representative, the study of Kuckartz is. Differences in the results are therefore explanatory. Nevertheless, the range of the answers is about the same. The climate is seen a little less stable than nature and is seen a bit more likely as being unpredictable.

After seeing the movie our participants tend to see the climate a bit less stable and a bit more *sensitive* – which is understandable given the things pictured in the movie. We were surprised

though that the number of people seeing the climate as *unpredictable* is slightly higher *before* seeing the movie than *after*. This is surprising to us since the movie gives a lot of examples for the unpredictable “nature” of the climate system. Jack Hall is constantly confronted with unforeseen changes: he had made a forecast for the climate system for the next 100 to 1000 years, but yet this forecast becomes real within days and sometimes even within minutes. So why see our moviegoers the climate system less unpredictable *after* seeing the movie? One explanation could be that the surprising “actions” by nature could be the revenge of a “hurt” climate system, which is usually rather sensitive and has a moral right to launch back to humanity. It could therefore be not an attribution to the climate system but rather a moral logic behind it that come forward in the judgment of the climate system.

6. Climate protection

6.1 Can mankind still hold back climate change?

We were wondering whether or not our participants believe that mankind can still hold up climate change. This was important to us because the film doesn’t mention the complex mechanisms that cause climate change but instead enters a pretty drastic climate change scenario at a point where there is actually no return and where it is too late to take action against it. We therefore asked: *Can mankind hold back climate change?* The provided answering categories were *absolutely yes*; *partly yes*; *partly no*; *absolutely no* and *I don’t know*. The question was asked *before* and *after* seeing the movie.

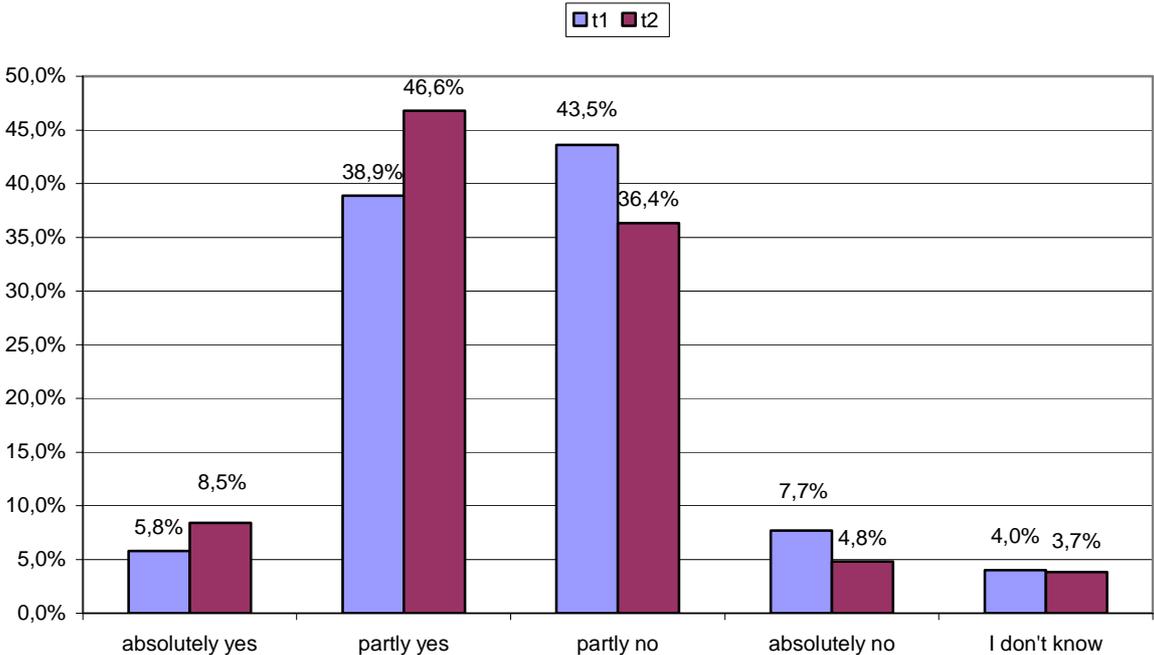


Fig.10: Can mankind still hold back climate change? (before (t1) and after (t2) seeing the movie).

It can clearly be seen at a first glance that our participants split up in approximately two half's: one half believes that humankind can still hold climate change back, whereas the other half doesn't believe this. Keeping the happenings taking place in the movie in mind, we do find it remarkable that *after* seeing the movie more people than *before* think that climate change can still be held up. But: these statements say nothing about which measures should be taken and about their acceptance. Nevertheless, the changes seen in every answering category, except for *I don't know*, vary significantly from *before* to *after* seeing the movie.

Table 9: Cross tabulation can climate change be held up before (rows) and after (columns) seeing the movie.

		absolutely yes	partly yes	partly no	absolutely no	I don't know	total
absolutely yes	Frequencies	37	22	4	1		64
	% of total	3,4%	2,0%	0,4%	0,1%		5,8%
partly yes	Frequencies	45	314	55	1	13	428
	% of total	4,1%	28,5%	5,0%	0,1%	1,2%	38,9%
partly no	Frequencies	8	150	293	15	13	479
	% of total	0,7%	13,6%	26,6%	1,4%	1,2%	43,5%
absolutely no	Frequencies	2	9	36	35	3	85
	% of total	0,2%	0,8%	3,3%	3,2%	0,3%	7,7%
I don't know	Frequencies	1	18	12	1	12	44
	% of total	0,1%	1,6%	1,1%	0,1%	1,1%	4,0%
total	Frequencies	93	513	400	53	41	1100
	% of total	8,5%	46,6%	36,4%	4,8%	3,7%	100,0%

How come that our participants state *after* seeing the movie that climate change can still be held up? One possibility are the rather unrealistic and exaggerating elements of the film itself. They could be perceived as so unreal that they are not linked to climate change: the happenings in the film minus the unrealistic exaggerations leaves the “normal” raise in the mean global temperature and there could be something done about this. Against this hypotheses can be put that the film is perceived as being rather realistic and that the audience reports that they have learned a lot about the sensitiveness of the climate system. Another explanation therefore could be: it must be what can't be (according to the film) – credo quia absurdum: keeping everything that took place in the movie in mind, it still must be possible to hold back climate change. This view could be supported by the moral message of the film: learning through mistakes. This hypotheses is also be supported by the fact that mitigation options were stated the most as learning effects from seeing the film. The mitigation options were mentioned although (or despite?) the fact that the film itself didn't offer such options.

6.2 Who should do how much to hold back climate change?

Who should play how big a role when it comes to take actions against climate change? We asked the participants to give numbers to certain groups (economy, environmental NGOs, government/state, individual citizen) who could be involved in climate change to address how big a role they should play: 3= big role, 2 = medium role, 1 = little role, 0 = no role.

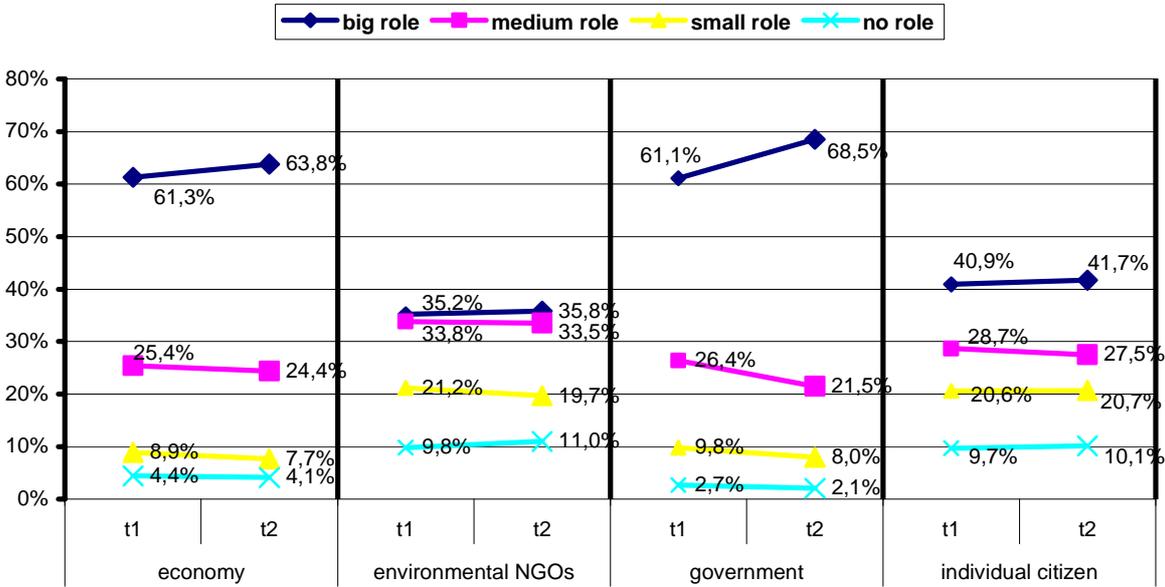


Fig. 11: Who plays how big a role when it comes to climate protection before (t1) and after (t2) seeing the movie.

It can clearly be seen that regardless of the time of the questioning, the biggest role should be played by the *economy* and the *government/state*. The *individual citizen* or *environmental NGOs* clearly should play a smaller role. These results are in accordance with quite a number of other studies which found out that the individual is not really likeable to tell themselves to become active with regard to the issue climate change (NIMBY-phenomena) and that the economy and the government/ the state should become active.

The biggest changes that took place in the answering pattern from *before* to *after* the movie were in the answering category *big role*. The film has put forward even more people who agree that the *economy* or else *the government/ the state* should play a big role in climate change issues. This can be understood when keeping in mind that the biggest conflict line within the movie is between science and politics – and economic issues that keep the politics from taking actions. It can be seen positively that there are some more people *after* the film that think that the *individual citizen* also has to put in his or her share when it comes to holding back climate change. Our guess is that the main character of the film, Jack Hall (although as being a scientist probably not a role model for most of the moviegoers) can be a

motivation in terms that the individual can do something about climate change – or else about other (family) issues.

When looking at the answering categories *no* or *little role*, it can clearly be seen that these are mostly ascribed to the *individual citizen* or *environmental NGOs*. The film doesn't mention NGOs and does therefore not give a realistic picture of the NGOs work in climate change issues. The only time NGOs are visible in the movie is in New Delhi. Here the NGOs are protesting outside the conference building, whereas in the real world the NGOs are actually are taking part in the conferences. Despite this, and despite the fact that the audience doesn't ascribe too big of a role to the NGOs, it can be stated that the audience didn't forget about them totally.

6.2.1 The role of the individual citizen

We wanted to know from the audience whether or not they would personally be willing to take actions against climate change. We didn't ask what these personal actions could be, but rather wanted to know whether or not they are in a general way willing to do something about climate change: *For me personally it is hard to do something about climate change*. We provided the answering categories *completely agree*; *partly agree*; *partly disagree*; *completely disagree*.

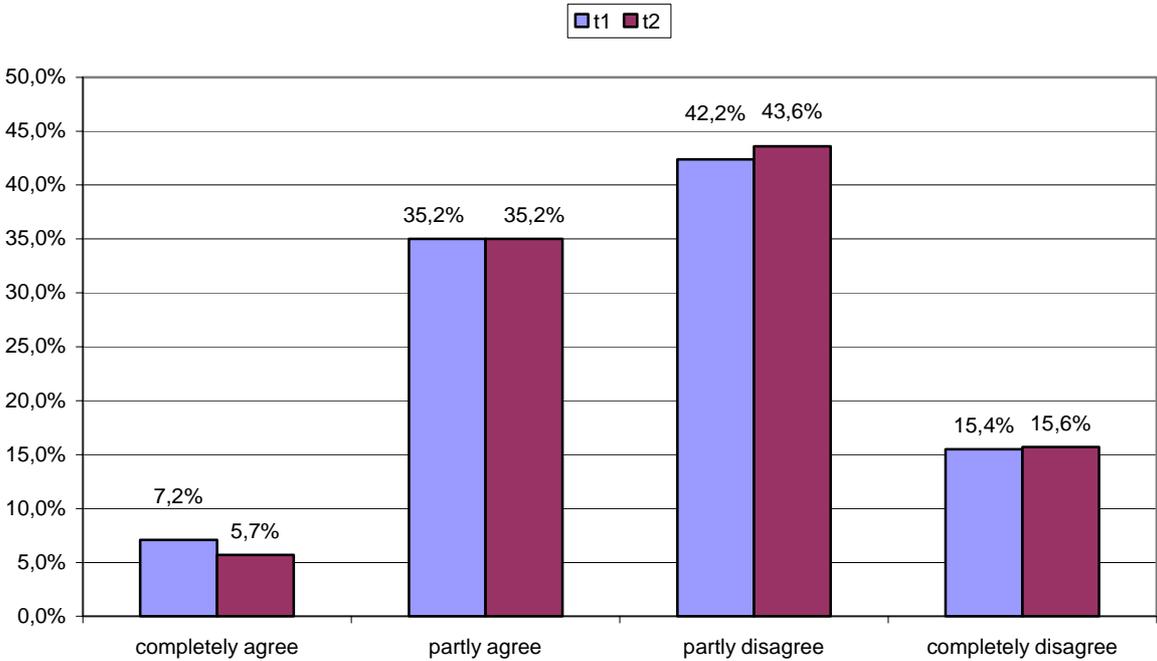


Fig. 12: Role of the individual citizen with regard to climate protection before (t1) and after (t2) seeing the movie.

As can be seen from figure 12, the individual is willing to do something about climate change, but the moviegoers split more or less in two half's: about 60% of our participants state that they can do something about climate change, whereas about 40% state that for them personally it is not possible to do something about climate change. Figure 12 suggests that *after seeing The Day After Tomorrow* a few more participants agree that they could do something about climate change, although none of these changes are relevant when looking at tests for significance.

Table 10: Individual action readiness when it comes to climate change before (rows) and after (columns) seeing the movie.

		It is hard for me to do something about climate change				total
		completely agree	partly agree	partly disagree	completely disagree	
completely agree	Frequencies	30	29	13	7	79
	% of total	2,7%	2,6%	1,2%	0,6%	7,2%
partly agree	Frequencies	17	258	101	9	385
	% of total	1,6%	23,6%	9,2%	0,8%	35,2%
partly disagree	Frequencies	9	87	311	55	462
	% of total	0,8%	7,9%	28,4%	5,0%	42,2%
completely disagree	Frequencies	6	11	52	100	169
	% of total	0,5%	1,0%	4,7%	9,1%	15,4%
total	Frequencies	62	385	477	171	1095
	% of total	5,7%	35,2%	43,6%	15,6%	100,0%

6.3 Take actions despite uncertainties?

The participants were asked *if* actions against climate change should be taken despite the uncertainties of climate change research: *The uncertainties in climate change research are so big that we should wait to take measures against climate change.* The provided answering categories were: *completely agree; partly agree; partly disagree* and *completely disagree.*

The relevance of the question is at hand: how can one act in a rational way keeping in mind the still existing uncertainties? Is the current state of the art in climate change research sufficient enough to take far reaching climate protection measures or should we wait until we know more or have more secured insights into climate system mechanisms?

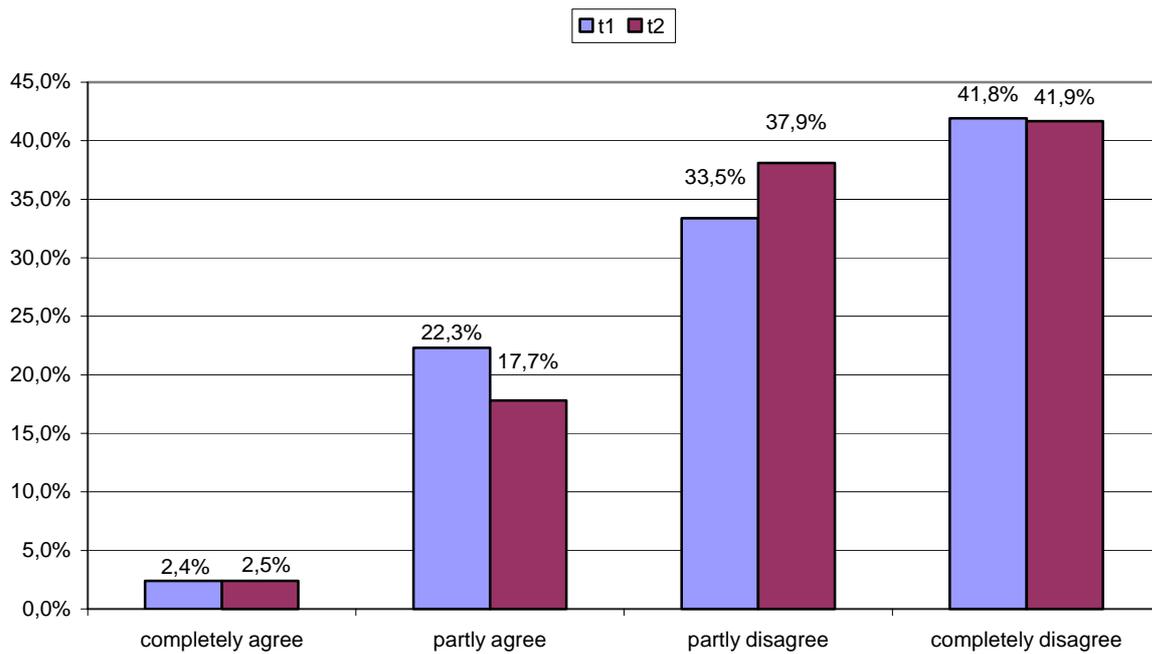


Fig. 13: Take actions to protect the climate despite uncertainties before (t1) and after (t2) seeing the movie.

When looking at figure 13 it becomes clear that most of the participants agree to this questions at both measuring points. Nevertheless there exist quite a number of changes, which are significant in the answering categories *partly agree* and *partly disagree*, in the answering pattern between the first and the second time of being interviews:

Table 11: Take actions despite uncertainties before (rows) and after (columns) seeing the movie.

		Uncertainties of climate change research are so big that we should wait before we take measures against climate change				total
		completely agree	partly agree	partly disagree	completely disagree	
completely agree	Frequencies	7	9	6	4	26
	% of total	0,6%	0,8%	0,5%	0,4%	2,4%
partly agree	Frequencies	12	103	93	36	244
	% of total	1,1%	9,4%	8,5%	3,3%	22,3%
partly disagree	Frequencies	4	60	206	97	367
	% of total	0,4%	5,5%	18,8%	8,9%	33,5%
completely disagree	Frequencies	4	22	110	321	457
	% of total	0,4%	2,0%	10,1%	29,3%	41,8%
total	Frequencies	27	194	415	458	1094
	% of total	2,5%	17,7%	37,9%	41,9%	100,0%

In total the category *partly disagreed* gained the most “net votes”. The total rejection of this statement loses “voters” from *before* to *after* seeing the movie. This can partly be explained through the circumstances that there is a willingness to act despite uncertainties or that the climate change research isn’t seen as unreliable. It can be seen that some of the audience was influenced by the movie in the way of an in dubio pro reo argumentation, due to the conflict between science and politics in the movie: the vice president in the movies sees just the uncertainties and costs of climate change research. We do understand that *after* seeing the movie not a whole lot of moviegoers would sign the provided statement, since in the movie climate change research is confronted with a lot of surprising uncertainties.

Nevertheless: our questioned audience is willing to take measures against climate change despite some uncertainties.

6.4 German and international climate policy

We ask to evaluate German climate policy with the help of two items, which were both asked *before* and *after* seeing the movie: a) people were asked to give a school grade to the German climate policy and b) *It is said that Germany plays a leading role in international climate policy. How should Germany act in the future regarding climate change issues? Germany should ...*

- *strengthen its ambitions*
- *don’t change their position*
- *wait and see what others are doing*

Before seeing the movie people gave a mean score of 3,43 to German climate policy and reduced this score *after* the movie to 3, 24.

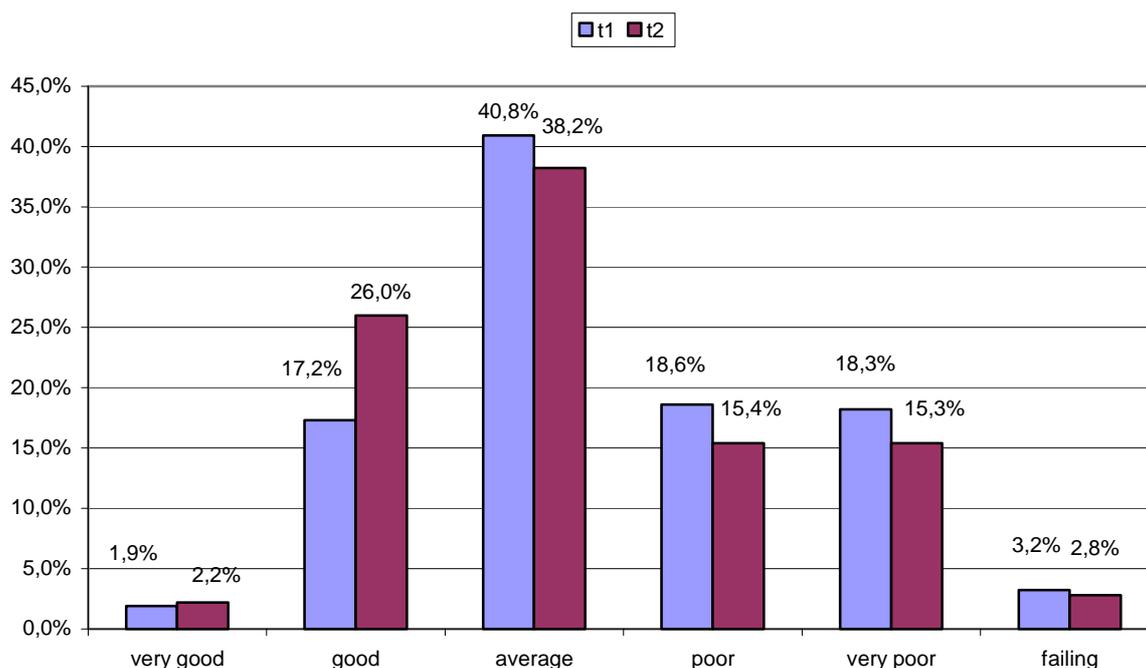


Fig. 14: Grades for German climate policy before (t1) and after (t2) seeing the movie.

Table 12: Grades for German climate policy before (rows) and after (columns) seeing the movie.

		Grades for German climate policy						total
		very good	good	average	poor	very poor	failing	
very good	Frequencies	5	9	7				21
	% of total	0,5%	0,8%	0,6%				1,9%
good	Frequencies	15	139	29	4	2		189
	% of total	1,4%	12,6%	2,6%	0,4%	0,2%		17,2%
average	Frequencies	2	105	288	33	19	2	449
	% of total	0,2%	9,5%	26,2%	3,0%	1,7%	0,2%	40,8%
poor	Frequencies		20	60	101	23	1	205
	% of total		1,8%	5,4%	9,2%	2,1%	0,1%	18,6%
very poor	Frequencies	2	10	34	30	119	7	202
	% of total	0,2%	0,9%	3,1%	2,7%	10,8%	0,6%	18,3%
failing	Frequencies		3	3	2	6	21	35
	% of total		0,3%	0,3%	0,2%	0,5%	1,9%	3,2%
total	Frequencies	24	286	421	170	169	31	1101
	% of total	2,2%	26,0%	38,2%	15,4%	15,3%	2,8%	100,0%

Although the shifting in the answering patterns a rather small and are taking place to a big extend in neighboring grades, only the changes in the categories *good* and *poor* are significant, it seems as if Germany's climate policy is seen a bit more positive *after* seeing the movie – although the German climate policy doesn't play any role in the movie. The explicit critique on the US climate policy seems to provoke a slightly re-thought judgment of Germany's policy: compared to the USA – we are better than I think we were.

When asked for Germany’s role in international climate change politics, the participants answered as follows:

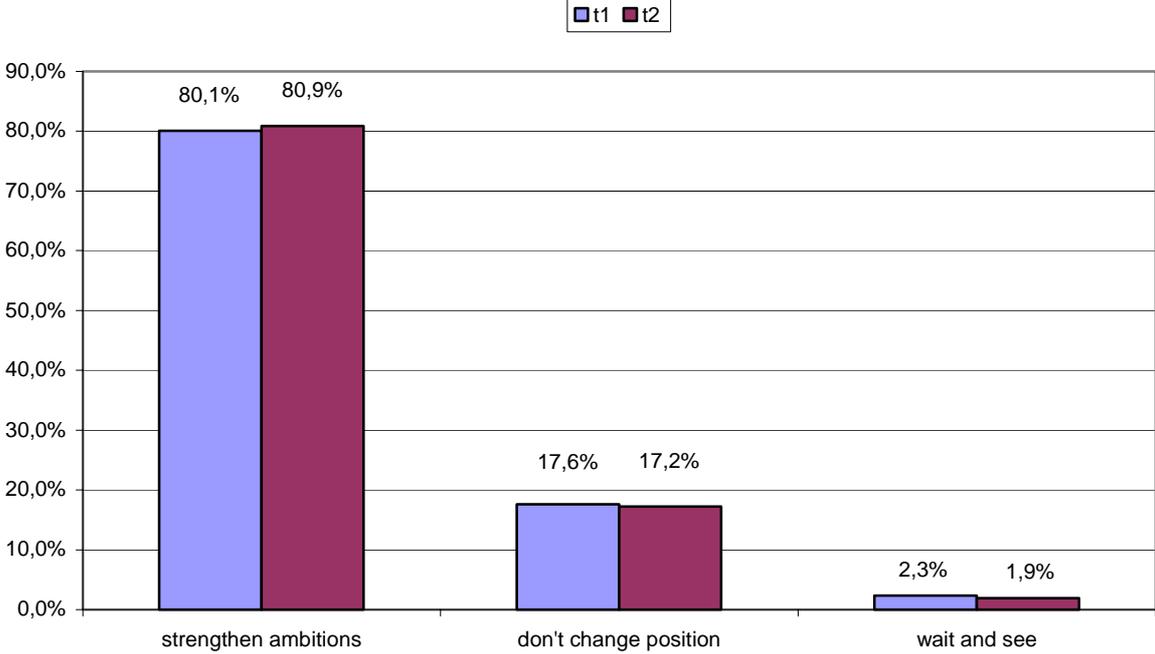


Fig. 15: Outlook on Germany’s future climate policy before (t1) and after (t2) seeing the movie.

The vast majority of our participants’ states *before* as well as *after* seeing the movie that Germany should *strengthen its ambitions* in international climate change politics. This is in accordance with the unasked for statements the participants wrote on their questionnaires. From these statements it can be concluded that a bad grade for Germany’s climate policy goes usually hand in hand with a *strengthening of the ambitions*. The participants further more write down on the questionnaires that Germany’s climate policy is quite good when compared to the climate policy of other countries, especially when compared to the USA, but that the ambitions should be strengthened and that Germany should do a lot more with regard to climate change. When looking at the answering patterns *before* and *after* the movie we were able to see that these were rather stable – the participants already had a good opinion of Germany’s efforts and a bad one about other countries’ efforts.

6.5 Costs and benefits of measures taken against climate change

There exists an ongoing debate about costs and benefits of measures against climate change. The participants were asked to answer a rather general statement with regard to this discussion: *There are many arguments about the costs and benefits of measures against*

climate change. We are interested in what you personally think about this. Effective climate change measures are ...

- ...so expensive, that we overtax our economy.
- ... expensive, but necessary and affordable.
- ... not all that expensive and they could open up new economic chances and bring more quality to life.

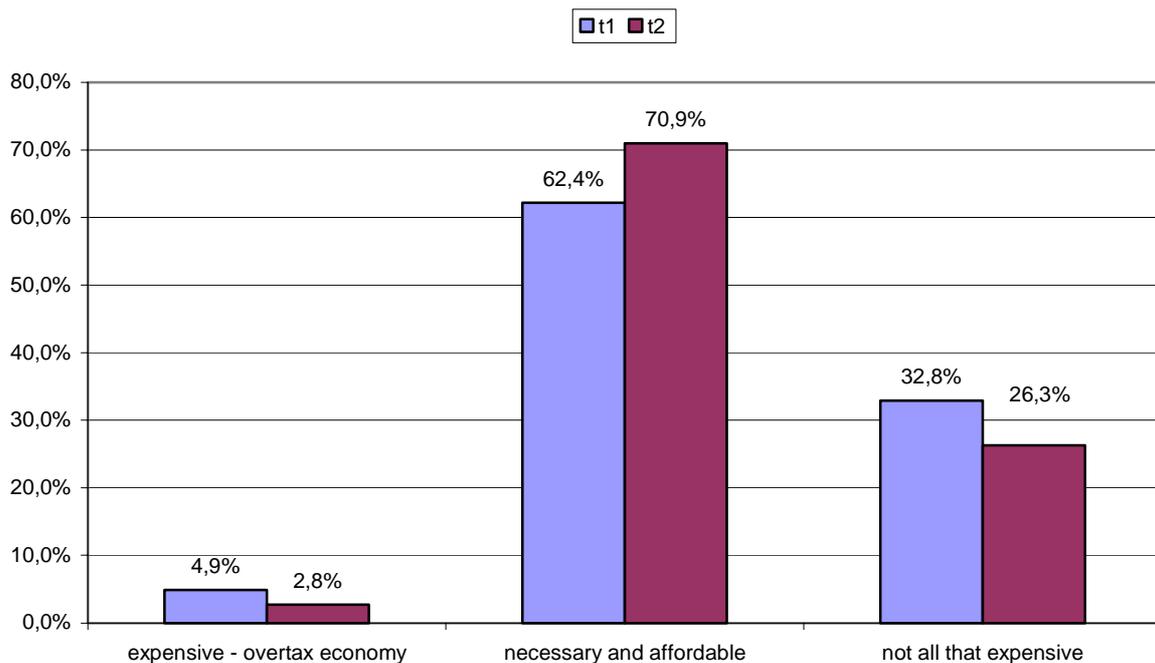


Fig. 16: Costs and benefits of measures taken against climate change before (t1) and after (t2) seeing the movie.¹⁰

It can be deducted as positive that only a minority of the people asked thinks of climate change being too expensive. The majority thinks of climate change as an expensive measure, but the benefits (the avoided damages) are seen as worthwhile. 32, 9% of the participants *before* seeing the movie think that effective climate change measures are not all that expensive, but think of them as being affordable. These results should motivate Germany's policy makers to come up with a forward climate protection policy.

¹⁰ The changes in the answering categories are significant.

Table 13: Cross tabulation costs for measures against climate change before (rows) and after (columns) seeing the movie.

		Effective climate protection is ...			total
		expensive, overtaxes economy	necessary & affordable	not all that expensive	
expensive, overtaxes economy	Frequencies	22	29	2	53
	% of total	2,0%	2,7%	0,2%	4,9%
necessary & affordable	Frequencies	7	614	59	680
	% of total	0,6%	56,3%	5,4%	62,4%
not all that expensive	Frequencies	1	130	226	357
	% of total	0,1%	11,9%	20,7%	32,8%
total	Frequencies	30	773	287	1090
	% of total	2,8%	70,9%	26,3%	100,0%

It seems obvious that *The Day After Tomorrow* has reduced the possibility for win-win-situations when it comes to climate change – climate change is *after* seeing the movie seen as a necessity.

7. Telephone interviews

7.1 Study Design

Aside from the 1118 motivated persons who took place in the survey directly *before* and *after* seeing the movie, we were able to generate 149 persons who were willing to be questioned at a third point in time, about four weeks after seeing the movie and by telephone.

Out of these 149 persons we were able to match 101 to existing cases for both *before* and *after* seeing the movie. For these 101 persons we have results for *three* points in time. The following results will relate to these 101 persons. Due to the rather small number we are going to present the actual frequencies instead of percentages and leave out tests for significance.¹¹ The participants of the telephone-sample were asked to answer a limited number of questions, which they had been asked before.

7.2 Sociodemographics and general issues

Out of the 101 people who took part in all three interview waves, 42 are female and 59 are male. The average age is 31,64 years, which is a bit higher than for the first two waves. In 26

¹¹ Differing total numbers in the answering patterns are due to not answering certain asked questions.

households live children under the age of 18 and most of these participants have an available income in the range of 500 to 2000 Euros. About one Fourth of these participants gets along with less than 500 Euros per month. Really high-income categories are rather random in this sub-sample.

55 persons hold the Abitur as highest school examination, 34 persons have a completed university degree.¹²

30 participants saw the movie in Berlin, 18 in Potsdam, 5 in Bremen, 22 in Marburg, 10 in Munich and 15 in Magdeburg.

7.3 Probability of Climate Change

The participants were asked at all three times to give estimation about the probability of a climate change.¹³

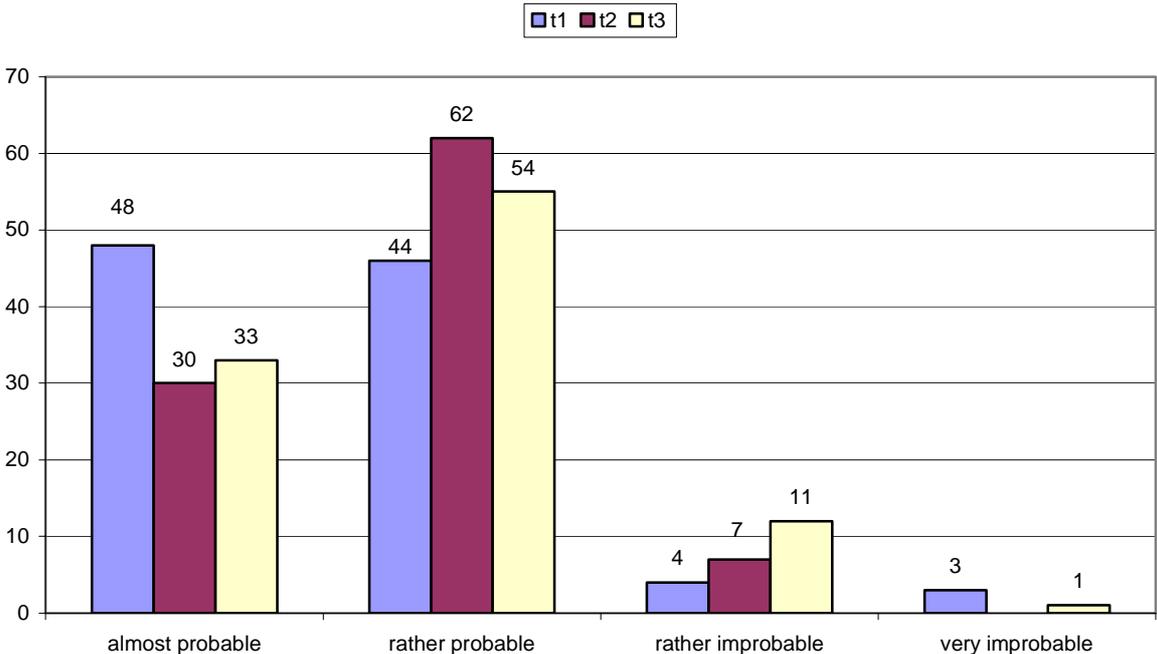


Fig. 17: Probability of Climate Change before (t1) and after (t2) seeing the movie, telephone-interview (t3).

In general, the probability of a climate change is seen by most of the participants at all three points in time as *extremely* or *rather probable*. The answers given in the telephone survey tend to arrange with the answers given *before* seeing the movie. What worries us a little is the

¹² New in the Telephone questioning was the questioning regarding university education, since there seemed to be some confusion in the first two waves.

¹³ For the exact wording see above.

fact that from the first to the last interview there is a raising number of participants who agree that climate change is *more or less improbable*.

Table 14: Cross tabulation probability climate change before (t1, rows) and after (t2, columns) seeing the movie.

		t2 probability of global climate change?			Total
		almost probable	rather probable	rather improbable	
t1 - probability of global climate change?	almost probable	22	25	1	48
	rather probable	7	33	4	44
	rather improbable	0	3	1	4
	very improbable	1	1	1	3
Total		30	62	7	99

Table 15: Cross tabulation probability climate change after (t2, rows) seeing the movie and at the telephone interview (t3).

		t3 probability of global climate change?				Total
		almost probable	rather probable	rather improbable	very improbable	
t2 probability of global climate change?	almost probable	12	15	2	1	30
	rather probable	20	36	6	0	62
	rather improbable	1	3	3	0	7
Total		33	54	11	1	99

The tendencies seen when looking at just the first two waves are supported in the overall when looking at all three waves. In the third wave the people tend to near to the answers given *before* seeing the movie – seeing climate change as *probable*. About four weeks after seeing the movie the moviegoers are still reporting that they don’t think climate change as probable as before seeing the movie. The audience therefore is slightly more skeptic with regard to climate change after seeing *The Day After Tomorrow*.

Within our telephone subset the movie provoked that the number of people who thought of climate change being *totally improbable* got less and less. The film seems to be able to shaken rather hard-line climate change skeptics and make them re-think their opinion about climate change and puts climate change within a certain probability range – but the rather low number of participants aren’t a good indicator for this.

These findings have to be seen in combination with some other trends. The number of participants who see climate change as *rather improbable* gets bigger and bigger from time to time. Most people who change into this category state at the earlier waves that they think of climate change being *rather probable*. The film seems to reduce the probability of the expectancy rate for climate change.

What are possible explanations for these findings? The moviegoers take what they see in the movie and put it into their known schemas of climate change. What they see in the movie, new ice age, they find rather unlikely to take place. The task for environmental communication therefore is to make clear that there could actually be local colder spots with regard to scientific based climate change scenarios and that a global warming is not the only possible scenario. Clear statements are needed, because otherwise the important topic climate change could be seen as rather unreal and out of space.

7.4 Stability of the climate system

The participants were again asked to give an evaluation of the stability of the climate system, using the same item as before with regard to cultural theory.

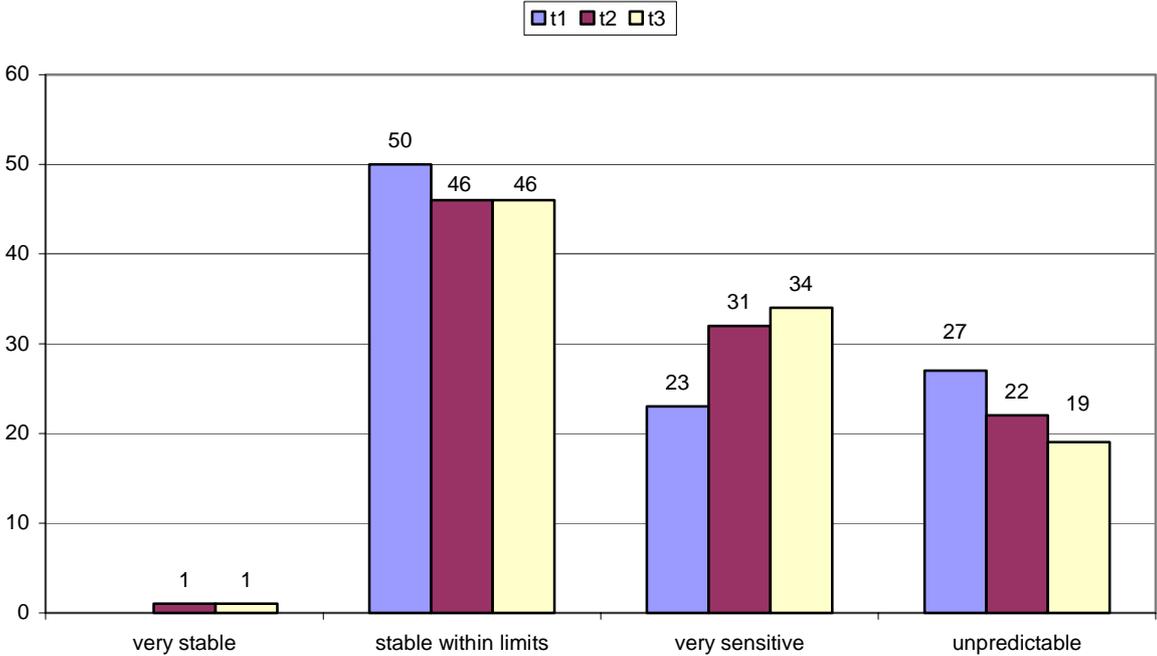


Fig. 18: Stability of the climate system before (t1) and after (t2) seeing the movie, telephone-interview (t3).

When looking at the results of all three waves, a constant small number of people thinks of the climate system being *very stable*. As seen when looking at just the first two waves, the favored answering category is a *stable climate system within certain limits* – although the number of people agreeing to this statement gets a bit smaller from *before* to *after* seeing the movie and in the telephone survey. It is at the same time interesting to see that from the first to the third wave the number of people who see the climate system as being *very sensitive* raises – and vice versa for the *unpredictable climate system*.

Table 16: Stability of the climate system before (t1, rows) and after (t2, columns) seeing the movie.

		t2 Stability of the Climate system (CS)				Total
		CS very stable	CS stable within certain limits	CS very sensitive	CS unpredictable	
t1 stability of the CS	CS stable within certain limits	1	38	8	3	50
	CS very sensitive	0	2	18	3	23
	CS unpredictable	0	6	5	16	27
Total		1	46	31	22	100

Table 17: Stability of the climate system after seeing the movie (t2, rows) and at the telephone interview (t3, columns).

		t3 stability of the Climate system (CS)				Total
		CS very stable.	CS stable within certain limits	CS very sensitive	CS unpredictable	
t2 stability of the CS	CS very stable	1	0	0	0	1
	CS stable within certain limits	0	37	5	3	46
	CS very sensitive	0	3	24	5	32
	CS unpredictable	0	6	5	11	22
Total		1	46	34	19	101

Since cultural theory suggests that these myths of nature are rather stable categories, we didn't expect too big changes in the answering patterns and they didn't take place either.

7.5 Who should do how much to hold back climate change?

As in the previous two waves we asked the participants who should play how big a role in holding back climate change. Due to the feeling that some of the participants in the first two waves tried to put the provided groups in order, we clearly stated in the telephone wave that no order is necessary.

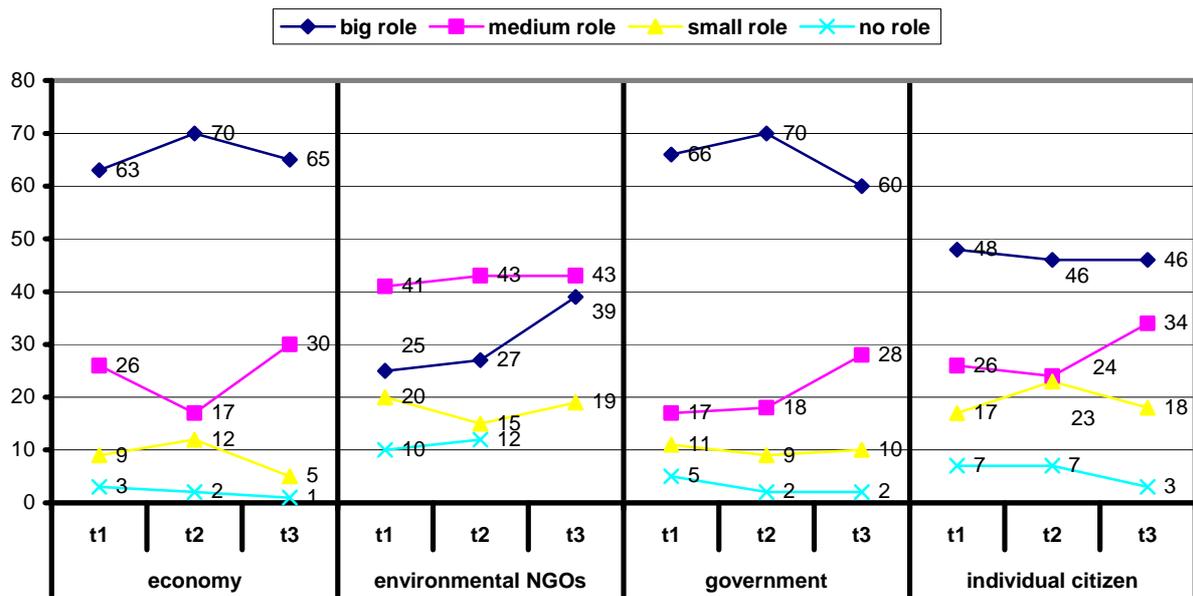


Fig. 19: Who should play how big a role when it comes to climate protection? (before (t1) and after (t2) seeing the movie, telephone-interview (t3)).

When looking at the answers for the role the economy should play it can be seen that only small changes in the answering pattern are made: *after* seeing the movie the participants tend to see the role of the economy even greater than *before* – and vice versa when including the telephone wave.

The role of environmental NGOs is seen rather stable – especially when looking at the answers directly *before* and *after* seeing the movie. When looking at the results from the telephone wave, it seems to be the case, that with a bit time to seeing the movie the role of the environmental NGOs is seen slightly greater – and vice versa.

When looking at the results it becomes clear, that a major role is ascribed to the government/ the state. Only little changes take place from one questioning point to another. Two small tendencies can be described: people who directly *after* seeing the movie ascribe a big role to the government/ the state reduce this statement to a *medium* role in the telephone interview and vice versa. This does however not change the tendency that the government/ the state are by the participants seen in a rather prone situation.

It was expected that the responsibility for taking actions against climate change would be directed away from oneself. This tendency can be seen in all three waves. It is however interesting to see that from the first to the second questioning only rather small changes in the answering pattern took place, whereas from the second to the third wave some more changes

occur. At the time of the telephone interview fewer people agree that the individual citizen should play a big role in climate protection. The vice-versa-trend is existing but smaller.

When looking again at all points in time and at all four given groups, it can be seen, that if changes in the answering pattern are taking place, these take place into neighboring categories and are randomly big changes.

7.6 Costs and benefits of measures taken against climate change

There exists an ongoing debate about costs and benefits of measures against climate change. The participants were asked to answer a rather general statement with regard to this discussion: *There are many arguments about the costs and benefits of measures against climate change. We are interested in what you personally think about this. Effective climate change measures are ...*

- *...so expensive, that we overtax our economy.*
- *... expensive, but necessary and affordable.*
- *... not all that expensive and it could open up new economic chances and bring more quality to life.*

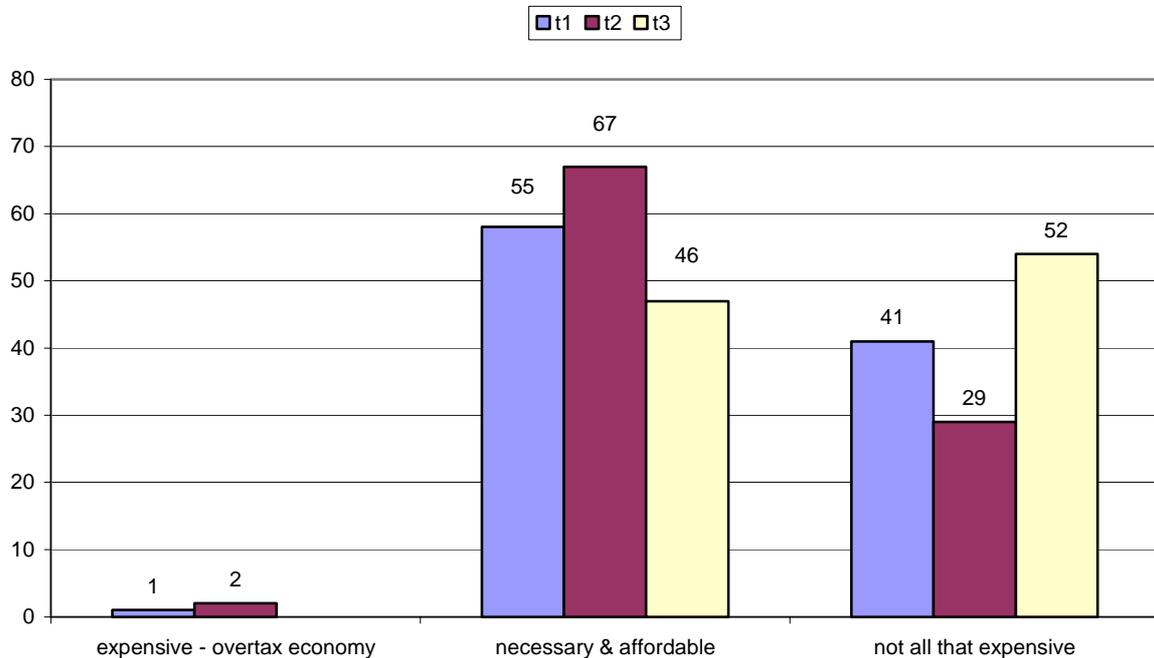


Fig. 20: Costs and benefits of climate protection before (t1) and after (t2) seeing the movie, telephone-interview (t3).

As can be seen in figure 20, the statement that measures against climate change are *so expensive that we would overtax our economy* doesn't play a role at all. Directly *before* and *after* seeing the movie the majority of this sub sample agrees that effective climate change

measures are *expensive, but necessary*. This judgment changes at the point of the telephone interview. At this point in time most of the people of this sub sample agree that effective measures against climate change are *not all that expensive*.

Table 18: Cross tabulation effective climate protection (t1, rows and t2, columns).

		t2 effective climate protection is...			Total
		expensive, overtaxes economy	necessary & affordable	not all that expensive	
t1	expensive, overtaxes economy	1	0	0	1
	necessary & affordable	1	51	3	55
	not at all that expensive	0	15	26	41
Total		2	66	29	97

Table 19: Cross tabulation effective climate protection (t2, rows and t3, columns).

		t3 effective climate protection is ...		Total
		expensive, overtaxes economy	necessary & affordable	
t2	expensive, overtaxes economy	1	1	2
	necessary & affordable	39	28	67
	not all that expensive	6	23	29
Total		46	52	98

8. Conclusions and outlook

The Day After Tomorrow wanted to entertain people and make them aware of the risks and dangers of climate change at the same time. The director outed himself to be a ‘greenish’ person, with very critical statements towards the current US government. So the film was deliberately placed in a political context. As it deals with some results of climate science it might as well be regarded as a piece of science communication, and the question is to what extent the public understanding of science has succeeded. Many climate scientists have been skeptical about the public impact of the film, being impeded with too many erroneous statements in their view. Others, such as Al Gore or many environmental activists, hoped that the film might promote the climate change and climate protection issue. In our study we compared the publics’ reaction to climate change issues before and after the film, offering a panel study with more than 1.000 interviewees. We can summarize our results as follows:

1. The film has helped to establish a new film genre—global warming films—and has at the same time created much media awareness, not only towards the film itself, but also to the climate change issue in general, which might well be regarded as a positive result.
2. *The Day After Tomorrow* has reached a German public that was already quite well aware of the issue of climate change and the risks associated with it. Despite the fact that the main dangerous impacts of climate change are perceived as hitting the 'globe' (other countries, especially in the developing world) more than Germany itself -a finding that is consistent with other studies of the German public--, most respondents are taking climate change to be a serious issue, and a significant part of the public sees clear evidence for climate change being already under way. Especially if compared to public awareness of climate change in other countries, Germans (or more precisely: our interviewees) seem to regard climate change as a major environmental issue with a high potential of symbolic representation of other environmental problems. Given these initial conditions, a very surprising result of our study is that watching *The Day After Tomorrow* seems to have weakened the subjective probability of a global climate change to happen. After having seen the film slightly more persons went from the camp of climate 'believers' to the camp of climate 'skeptics', and much more people moved from the *very probable* answer *before* to the *rather probable* answer *afterwards*, indicating an erosion of perceived probability of climate change. A recent analysis of the German climate change discourse in the media, the public and in policy (Weingart et al. 2002) summarized its findings as 'from hypothesis to catastrophe', indicating that initial scientific speculations about climate change have become dominant social convictions of a lurking disaster. The first real climate change disaster movie has in a way reversed this trend: climate change, having been a firm and eventually disastrous reality for many viewers, has left them more doubtful with regard to the probability of such a thing like climate change really to happen. How did this move from catastrophe to hypothesis come about?
3. The vast majority of the viewers did not take the film to be purely fictional, not based on sound science. Only 10% of the respondents said so, much less than the climate experts we have interviewed and who had made up their critical minds in the media around the films' issuing. The public did equally not perceive the film as a pure depiction of the state of the art of climate (change) science. Again, only about 10% thought this was the case--of course much more than the experts, who denied this

possibility totally. Therefore about 80% of the viewers' thought that the film was exaggerating here and there, but that it were based on a scientifically sound kernel of truth. Given this answer of the majority, one explanation for the above described erosion of perceived probability of climate change can be excluded: that viewers dismissed the film as purely fictional, and expressed their skeptical views about the realism of the film by 'blaming' the real object climate change. The film is perceived as more or less realistic. But what might have occurred is the following: People entered the cinemas with a more or less clear picture of what climate change was and how it would unfold. The public perception of the climate science favors slight changes in a more distant future, a more or less linear climate system with a dominant function, the link between emissions and global mean temperature, which is about to rise, and effects like the melting of polar ice caps and glaciers and a rising sea level, further leading to more droughts and weather extremes, especially in the developing world. This public image, mostly nourished by mass media reports, was more or less the master scenario people had in their minds when they entered the cinemas. The film confronted them with a very different reality: climate change is a fast thing to happen (not a slow one), it occurs in the developed world (not far away), it leads to cold waves and a new ice age (instead of a greenhouse), and it is caused and executed by a highly complex, non-linear climate system (and not a linear, simple one). Given these massive changes in the basic assumptions on climate change *The Day After Tomorrow* conveys, and given that people didn't simply dismiss the reality content of the substantially changed message they received, it seems a plausible reaction to slightly doubt the probability of 'climate change' without changing sides from climate 'believers' to 'skeptics'. People came out of the cinema with doubts and questions, as most viewers are not able to assess the scientific soundness of all of the new elements and features of climate change the film had communicated to them. This interpretation is additionally backed by the answers to the four 'myths of nature' provided by Cultural Theory, showing that the complexity and vulnerability of the climate system has been put forward by the film.

4. In line with this interpretation is the fact that *The Day After Tomorrow* has stimulated learning effects among its viewers which is rather uncommon for a disaster movie, the aim of which is more to entertain by frightening and to reassure basic social values and feelings. Emmerichs' film does so too, but mainly in its second part, where paleoclimatologist Jack Hall tries to save his son from the cold in Manhattan, and at

the same time proves to be not only a good scientist, but a good head of the family too, something he and his family were somewhat doubtful beforehand. The first half of the film, however, introduces the relatively new issue of climate change to the public, and, in addition, does so by drawing upon some more recent findings (and speculations) about paradoxical effects like the shutdown of the Thermohaline Circulation (THC), which the film exaggerates towards a new ice age across the Northern hemisphere. In closed and open questions we have asked for learning elements due to the film, and a surprising share of viewers responded positively. The main issues that have been learned (open question!) were mitigation, the role of the oceans for world climate, and the possibility of a new ice age. The film thus not only promoted the idea of a new ice age (this is its main dramaturgical effect and at the same time the most problematic one from a scientific point of view), it also raised the awareness of the role of the oceans for the global climate, the complexity of the climate system, and the vulnerability of social systems and actors as parts of it. And, surprisingly enough for a film that does not sacrifice a second of its precious time for analyzing the causes of climate change or the possibilities to mitigate against it, *The Day After Tomorrow* has triggered mitigation reactions in its public.

5. Another finding of our study supports this. Given the dramaturgical outlines of this climate change disaster movie one would have expected a rise in fatalism and fear that it would help to create in the minds of people watching it. In fact, quite the opposite reaction prevails. People are more optimistic about our ability to mitigate against climate change than before, and the film does not lead to any changes in the amount of fear people have confronted with climate change. Asked whether they thought that 'it is too late anyway, we can't do anything about climate change' or 'we should try everything we can to avoid climate change' was the main message of the film, 82% choose the latter, indicating that *The Day After Tomorrow*, despite the doubts and questions it has raised, did not discourage climate mitigation in the perception of its public.
6. When it comes to climate policy, the film has not reduced the willingness of its viewers to do something to prevent climate change, not only to adapt to its consequences, and despite eventually remaining scientific uncertainties. The film seems to have contributed to a much more positive image of science, especially in contrast to 'ignorant politicians', as many viewers have put it in their responses to an open question, very much in line with the main conflict between science and policy

depicted in the movie. Given the rather negative stereotypes scientists are confronted with in most films (dumb or dangerous), *The Day After Tomorrow* seems to have been successfully conveying a much more positive image of (climate) science, acting for the common good, serving as an early warning system for the public, and trying to get its message across in an environment mainly dominated by more or less ignorant politicians.

7. A presumably more negative side effect of this science-policy image is the fact that the film seems to have triggered public policy responses much stronger than individual responses. Governments and the business sector have been regarded as the main actors in climate policy according to the cinema visitors' beforehand, quite ahead of NGOs and individual citizens. After having seen the film even more people thought that way, indicating that their individual contribution as consumers and citizens, though not neglected right away, was further weakened after having seen the film. In line with this result is the very critical attitude our interviewees have towards the German ecotax, charging carbon fuels and designed to contribute to social welfare at the same time. We know from many other studies that a majority of Germans dislike that tax, partially because it simply impedes on gasoline prices, partially because the link to environmental benefits seems hard to conceive for many.
8. German climate policy, though, is seen more positively after the film has been viewed. Although the majority did not vote for the option 'Germany has done enough to protect the climate, it should now first wait and see what others do', rather demanded for even more (international) action of the German government, the overall assessment of Germany's climate policy performance became more positive after the film. This is not much of a surprise, given the fact that *The Day After Tomorrow* (and more so Roland Emmerich himself) heavily attacks the United States' stance to climate policy. Many viewers got the point and gave rather critical remarks towards US policies in general and climate policy in particular.
9. Asked whether climate protection was too expensive, expensive but necessary, or not expensive, but even offering new economic opportunities, the film has triggered an interesting shift: before viewing it, a significant minority of people (32,9%) voted for the latter option, indicating that they believed in double-dividend, win-win-options in climate protection. This alone is a surprising and stimulating result, especially if compared to the very low responding rate to the 'too expensive'-option. Nevertheless,

after having seen the film this climate policy assessment changes. The 'too expensive'-option is still no choice for most viewers. But many shifted from win-win to necessity, now getting 71,0% instead of 62,2%. We take this as an indication for a more 'blood, sweat and tears'-mode the film seems to stimulate. Given the vast impacts humanity has to face in the film, people seem to readjust their cost-benefit assessment, adding more costs to the policy side of the balance, but not letting them exceed the benefits expected from climate protection, i.e. avoiding damage costs.

Given all these findings, *The Day After Tomorrow* seems to have had a net positive effect on the public with regard to the self addressed goal of stimulating awareness and willingness to act. Despite slight erosion in perceived probability of climate change, mainly attributable to the significant change in the content and public image of 'climate change', it raised awareness of the problem and stimulated the willingness to act, or at least to support government action. At the same time, the film has had a remarkable effect seen as a piece of public understanding of science, having stimulated a more complex and enriched view of the Earth system in general and the climate system in particular. At the same time it left the public somewhat doubtful and with a lot of questions with regard to the exact kernel of truth behind the new features of climate change it depicts. This is an excellent window of opportunity for climate science, taken in the broader, transdisciplinary character of the word, including the necessity for the social sciences to be included in the study and communication of the 'hybrid object' climate change.

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