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Introduction: Ambiguous Progress

Advisory and Regulatory Science between Uncertainty, Normative Disagreement and Policy-Making

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1 Scientific expertise and policy-making: a liaison dangereuse?

In an impressive and unprecedented manner, the emergence and establishment of global climate change politics in recent years highlights the practical relevance and political impact of science, but, at the same time, raises new and difficult problems of justifying scientific knowledge and legitimising the political role of science.[1] These problems mainly result from the fact that science-based expertise has increasingly become the fundament of world-wide political action in relevant technological and political areas (beside climate politics for instance agri-biotechnology, nanotechnology, or nuclear fusion energy) – irrespective of all its endemic uncertainties, ambiguities and knowledge gaps. This political and practical role of science and professional expertise is all the more surprising as in recent years it has become manifest in a number of social and political conflicts (on nuclear energy, agri-biotechnology, and the like) that in contexts of practical application science usually is unable to offer reliable and consensual knowledge to guide political action in an unambiguous manner: Institutionalised expertise regularly is contested by counter-experts, the uncertainties and ignorance embedded in scientific knowledge are addressed and politicised by social movements, the media, or different epistemic cultures within the sciences (cf. Knorr-Cetina 1999; Jasanoff 2005; Hulme 2009; Böschen et al. 2010; Kaiser et al. 2010).

Thus, the growing public awareness of scientific uncertainties and "science-based ignorance" (Ravetz 1990) as well as the involvement of a plurality of contrasting epistemic cultures in social conflicts about technological risks result in a paradigm shift with regard to the perception of science (and technology) in contemporary societies: Science is no longer exclusively seen as an endeavor that produces and accumulates knowledge while at the same time repelling ignorance, but instead as an activity that *simultaneously* increases knowledge and ignorance (Ravetz 1986: 423). Given this background, the question arises how scientific expertise nevertheless can be constituted in a way that it becomes the decisive resource of policy-making

[1] In what follows we use the term „science" in a more encompassing sense (like the German "Wissenschaft"), thus including not only natural and engineering sciences but also social sciences and humanities (such as ethics).

in many fields of action: How can, in spite of knowledge gaps and irreducible uncertainties, an at least provisional consent be achieved and justified which is both robust and specific enough to form the basis of coherent political programs and economic innovation strategies? Which conflicts are addressed and which ones are ignored? And what forms of "boundary work" can be observed?

As it is well known, in the case of climate research and politics a novel transnational institution, the Intergovernmental Panel on Climate Change (IPCC), has been established in order to deal with the tensions between scientific uncertainty on the one hand and the (presumed) urgency of globally coordinated political action on the other hand (cf. Beck 2009). While the IPCC is, of course, not denying uncertainty and ignorance, its main task can be seen in manufacturing zones of consent and certainty in order to substantiate the need as well as to specify the overall goals of urgent political action. Therefore the IPCC's recent crisis of credibility triggered by mistakes in the Fourth Assessment Report is doubtless the most striking example of the epistemic and legitimatory risks inherent in strategies aiming at increasing the political impact of science by performing a more or less active management of consent which is necessarily accompanied by the marginalisation and exclusion of dissenters, the so called "climate sceptics". Nevertheless, one should not overhastily dismiss such forms of boundary work given the fact that in a number of important issues, most prominently the correlation of smoking and cancer as well as global warming, the conscious fuelling of doubt about almost indisputable scientific evidence has convincingly been criticised as a questionable, interest-driven strategy employed by certain actors (above all the tobacco industry and mineral oil firms) in order to avoid targeted political regulation (see Proctor 1995; Proctor 2008; Oreskes/Conway 2010).

Surprisingly, however, both camps, the "manufacturers of consent" as well as the "merchants of doubt" (Oreskes/Conway 2010), equally continue to stick to the claim that policy-making should be based on complete, incontestable and unambiguous scientific knowledge. Obviously, this is a classical modernist and rationalist claim, drawing on Max Weber's idea of "domination by virtue of knowledge" (*Herrschaft kraft Wissen*). While there is no doubt that this idea up to now is still highly influential,[2] one should also expect that in contemporary societies (which might be qualified as "reflexive modern") there exist different strategies to solve the epistemic and legitimatory problems which confront advisory and regulatory science. Indeed, when we look at other areas of technology and innovation politics it seems that the (obviously risky) manufacturing of consent is not always the "magic formula" for science and professional expertise to gain legitimacy and political influence. Another strategy has emerged primarily around the establishment of ethics councils designed to deal with the implications and possible consequences of new biomedical technologies such as stem cell research, predictive genetic testing or preimplantation genetic diagnosis (PGD). While in this case, too, professional expertise seems to influence political decision-making, the impact on politics of ethical expert knowledge appears to be more complex and contingent: as it seems with regard to ethically contested issues, it is *dissent* rather than consent that provides both expertise and policy-making with legitimacy and support by the public (Bogner/Menz 2010). To put it more precisely, what generates social and political legitimacy is not dissent as such but a sort of "regulated" dissent

[2] A case in point is the appeal to „sound science" in the debates on the risks of genetically modified organisms (GMOs). "Sound science" is expected to provide indubitable knowledge of whether or not GMOs pose any ecological or health risks.

which reduces the vast variety of ethical and political views on biopolitical issues to a limited number of contrasting, yet equally "acceptable" ethical argumentations while excluding more "radical" positions (see Braun et al. 2010; Hedgecoe 2010). However, apart from the fact that this outcome of expert advice might foster a questionable political decionism that uses diverging expert views as a rationale for one-sided, interest-based decision-making, there is little doubt that disagreement as the result of scientific advice is not always instrumental in policy-making and will of course not always be accepted by political actors and/or the public.

Recently, Roger Pielke jr. (2007; 2010) has developed an inspiring framework for analysing the different roles of scientific experts in decision-making. He identifies four such roles: First, the "Pure Scientist" seeks to focus exclusively on what is supposed to be "facts" and has no interaction with decision-makers. Second, the "Science Arbiter" only answers to narrow factual questions asked by decision-makers. Thirdly, the "Issue Advocate" promotes a specified view on a certain issue and thus seeks to reduce the scope of choices available to the decision-maker. Fourthly, the "Honest Broker of Policy Options" strives to expand the scope of choices available to the decision-maker and to clarify the possible consequences of each option (Pielke 2010: 171). This differentiation appears to be heuristically helpful also with regard to the question of how advisory and regulatory sciences deal with the epistemic and legitimatory problems resulting from the tensions between uncertainty, normative ambiguity and the need for targeted political activity. Apparently, the strategy of manufacturing scientific consent as employed by the IPCC and other advisory or regulatory bodies is quite close to what Pielke terms "issue advocacy", with all the risks inherent in this type of expert advice (see Pielke 2010: 179-82). By contrast, the preference for dissent might at first sight resemble the figure of the "honest broker", since disagreement between experts seems to expand, or at least not to reduce, the scope of choice available to policy-makers. However, merely stating dissent is not necessarily tantamount to honest brokering since the latter, according to Pielke (2010: 182), "must focus not simply on creating relevant knowledge (a product), but also on making knowledge relevant (a process)". Yet in this way, the honest broker, too, is engaged in elaborating policy options, and, although presenting several alternative options might foster democratic deliberation,[3] it still assigns a prominent (and problematic) political role to scientists (see Brown 2008: 488). Therefore the honest broker is not simply exempt from those questions of legitimacy and representativeness which Pielke seems to pose to the issue advocates only: "Whose values do they represent? What is the basis for the authority granted to experts?" (Pielke 2010: 182) And, as we would like to add: How does the honest broker deal with scientific uncertainty and ignorance?

Thus, while Pielke seems to be sympathetic, tacitly at least, to the ideal-type of the honest broker we would suggest not to judge the respective roles of scientific experts *a priori* in normative terms but use them instead as heuristic tools for taking a closer look at the specific empirical contexts in which practically and politically relevant science operates. This is exactly what the papers in this thematic issue[4] do with regard to some of the most contested (both scientifically and politically) are-

[3] Yet it might also result in the blockade of political decision-making by powerful interest groups who can take advantage of what they strive to label scientific dissent or indecisiveness.

[4] The majority of the papers in this issue were first presented at a meeting of the Section "Science and Technology Studies" of the German Sociological Association (DGS) held at the University of Augsburg in June 2008.

nas of technological innovation and policy-making: global warming and climate politics, the regulation of genetically modified organisms (GMOs), risk communication regarding food supplements, and bioethical expert advice institutionalised in national ethics councils: How is scientific knowledge constructed in these contexts, how is expertise organised, how are the problems of legitimacy addressed and resolved (or not), how do the experts deal with uncertainty, ignorance, ambiguity and dissent, how (if at all) is expert knowledge integrated in political decision-making, what relations of science to politics as well as to society emerge in the abovementioned arenas of social conflict?

2 The contributions to this issue

With respect to the different types of scientific expertise and their political influence, Franz Seifert discusses in his paper "Back to politics at last" the transatlantic conflict over agro-biotechnology and the consequences for the EU politics about GMO. The central issue of his argumentation is the structure of conflicts that emerge when a specific form of risk assessment is set up as an implicitly normative standard to which the other ways of stating risks are compared. In this case, the "orthodox" standard is provided by the risk regulation procedures in the U.S. which are built on an ostensibly clear-cut separation of an "objective" and unambiguous scientific risk assessment on the one hand and political strategies of risk management on the other. Opposing to European restrictions to the importation of GMOs, the U.S. filed an ultimately successful lawsuit at the World Trade Organisation (WTO) against the EU position that had evolved against the background of the BSE crisis towards a generalisation of precautionary procedures. In the lawsuit at the WTO the EU commission was accused of a violation of international trade law, because the precautionary procedures to deal with uncertainties and ambiguities were interpreted as undue barriers of trade. Notwithstanding the fact that small EU countries like Austria continue to maintain a ban on the cultivation of GMOs, Seifert regards the outcome of the WTO dispute as indicative of the unbroken power of what he terms the "othodox view" of the role of science in risk regulation.

In this case, science apparently is reduced, willingly or not, by political actors to the role of the "science arbiter" whose answers are held to be objective truths. If the sciences are seriously willing to escape such an instumentalisation and help regain an open space for *political* deliberation and decision, they would have to consciously highlight the inherent uncertainties and "blind spots" of their knowledge – a self-reflective move that is not necessarily identical to "honest brokering".

Seifert traces back the power of the orthodox view to it's intimate connection to international free trade legislation and therefore is highly sceptical of the prospects of an "unorthodox" view which accounts for the cultural relativity and intrinsic uncertainty of scientific knowledge.

Opposing to a view of transnational regimes as emerging around shared factual knowledge, Willy Viehöver argues in his paper "Governing the planetary greenhouse in spite of scientific uncertainty" that the global climate regime was established even without scientific consensus. Therefore, we need to understand how and why certain ideas (in this case the idea of human-induced global warming) acquire credibility and are institutionalised. Viehöver's argument follows the idea that the relatively successful institutionalisation of a global climate regime has been made possible through the evolution of a "narrative grammar of confidence" and corresponding "rituals of evidence". To underpin this idea he first conceives of the global warming story as a narrative in Paul Ricœur's sense and emphasises that such narratives constitute

societies' sociopolitical imaginaries including their horizons of expectations. Second, he analyses the building of a transnational climate regime as a process of ritual in the argumentative line of Victor Turner. Against this background, Viehöver offers a new perspective on the evolution of the global climate regime in three phases: a) a phase of separation (starting from the early 1970s) of human and "natural" influences on the global climate (agenda building 1970-90); b) a liminal phase (from 1990 until today) where the state of the ritual subject is highly ambiguous due to refiguring the familiar belief systems; and c) a post-liminal phase of re-aggregation (from now on). This reconceptualization allows us not only to detect how a new logic of institutional appropriateness has been configured and subsequently stabilised, but also to search for signals of the post-liminal stage and to address the question of which path of evolution and order for world-risk-societies (Beck 2010) will be chosen., Viehöver assumes the IPCC. to be the accredited guardian of climate related "truth games" since this institution has successfully installed a "grammar of confidence" – despite all "climategates" (cf. Reusswig/Lass this issue).

Fritz Reusswig and Wiebke Lass also focus on global climate politics. The main argument in their paper "Post-Carbon Ambivalences" is that there is a major shift from an "old" to a "new" climate change discourse, the latter starting with IPCC's Fourth Assessment Report. According to the authors, this fundamental discursive change can be deduced from a range of indicators. There is a change of the master frame – from earth system analysis to earth system management –, a change of the leading sciences – from natural sciences to economics and social sciences –, a change of the dominant risk perspective – from climate risks to socio-climatic risks – and other changes detailed in the paper. Now, the leading perspective is how to deal with the 'hybrid object' climate and how to manage the above mentioned changes carefully. Since the human fingerprint seems to be indisputable, the structure of uncertainty is transformed. In the old climate change discourse uncertainty was produced by the contrasting views of natural scientists, in the new one uncertainty is mainly generated by problems of decision-making. Summarising this transformation, the new climate discourse is characterized by a situation of diverging discourse coalitions which try to define the relevant policy-aspects in their respective ways. This dynamics of different discourse coalitions fuels vivid climate debates and seems to support the narrowing of problem-solving activities to technological solutions. In combination with the IPCC crisis in 2009/2010 this specific situation leads to a broad debate about the organisational structure of the IPCC – and the necessities and opportunities of an institutional reform. Nevertheless, it remains a contested issue how to institutionalise adequate procedures to answer the scientific and political questions which are seamlessly intertwined in the climate debate.

In his paper "Let's disagree!", Alexander Bogner questions the still widespread assumption that only consent among experts affords legitimacy to both scientific expertise and policy-making. As he argues, this holds true only for those conflicts over science and technology that are understood as problems of *risk*. By contrast, in those conflicts that are framed in terms of *ethics* – mainly conflicts in the field of biomedicine and biotechnologies – dissent among the experts even becomes an indicator of quality as well as a source of legitimacy of the advisory process. Insofar as questions of value are addressed in debates on biomedical technologies such as stem cell research or genetic testing, irresolvable disagreement apparently is considered legitimate by the majority of social and political actors. According to Bogner, the increasing "ethicisation" of controversial issues has re-

markable and far-reaching implications for the role of expert-knowledge in political decision-making as well as for the governance of technologies in contemporary societies. As he illustrates using the example of debates over biomedical technologies and ethical advice in Germany, disagreement among experts does not determine political decision-making, but, on the other hand, it is precisely this dissent which first and foremost legitimises the political sphere's claim to autonomously decide. Thus, disagreement among ethical experts is far from being useless or dysfunctional for policy-making. The interesting question, then, remains according to which normative criteria and based on which scientific assumptions, political decisions on "ethicised" issues are actually taken.

Against the background of the theory of "reflexive modernization", Gerald Beck and Cordula Kropp ("Is science-based consumer advice prepared to deal with uncertainties in Second Modernity?") observe an important transformation of risk communication in contemporary societies. Due to the fact that expert advice is getting more and more disputed, there are also increasing difficulties to adequately inform consumers by means of risk communication. To address the challenges resulting from this situation, the authors identify different interface-roles of science which it is prompted to fulfil in boundary situations of risk management and risk communication. With respect to their basic assumption of a fundamental change in risk communication, Beck and Kropp argue that the "classical modern style" of communicating risks in science-based consumer advice is supplemented by a more "reflexive style". While the classical style is based on a paternalistic model of authoritatively instructing the consumers about what the best options and decisions are, the reflexive style is characterized by the goal of enabling citizens to draw their own decisions under conditions of uncertainty and ambiguity. To empirically underline their argument, the authors discuss different offers of risk communication in the field of Dietary Supplement Safety. The effort of an interactive expertise-building which is offered by the tool of "risk cartography" illustrates the new direction of designing risk communication as a "two-line" process.

3 An ambiguous progress

The five papers collected in this thematic issue not only illuminate the variety and heterogeneity of constellations in which scientific expertise becomes politically and socially relevant, but also the diversity of fruitful social science approaches to these issues. In our view, they make clear that there is no "one best way" to deal with the epistemological and legitimatory problems arising from the increasingly close interactions of science with politics and policy-making. What is more important than to focus on one putatively preferable role model of scientific advice, is that policy-relevant science strives to continuously reflect upon and question its own impact on society and politics as well as the resulting repercussions for science itself. The manufacturing of consent, for instance, can become counterproductive, both for politics and science, when it fosters mistrust in scientific knowledge and thus unwillingly serves to undermine widely accepted political goals such as the protection of the global climate. The presentation of dissent in ethical advice tends to be problematic when it becomes an end in itself, or even a ritual, and comes along with the abstinence from serious argumentative dispute thus tacitly affirming the liberal assumption that biopolitical decision-making is merely a matter of *private* preferences and choice. Passing scientific uncertainty and ignorance on to the public may at first sight foster transparency and undermine paternalism and technocracy; yet, on the other hand, it might soon result in overstraining individual actors by confronting them with the task of balancing

one scientific statement against the other which might be entirely contradicting the former.

Only modernist views might still tend to conceive of the growing political relevance of scientific knowledge and expertise as a substantial progress towards more rational decision-making. By closer inspection, this progress turns out to be a highly ambiguous one. It is not simply the solution to the problems of uncertainty, ignorance and disagreement, but raises new and difficult problems of legitimacy and "truth" not only for society and democratic politics but also for science itself. Here, two implications for further research are particularly important: First, the specific dynamics of globalisation results in various encounters of different epistemic cultures as well as institutional cultures of risk and non-knowledge. Such encounters can support the emergence of new kinds of "truth games" and therefore open up opportunities of cultural and institutional innovation. This applies, partly at least, in the case of the IPCC and the institutionalised processes of learning within this framework of building up expertise for political decision-making. Simultaneously, however, such truth games tend to be selective with respect to specific forms of constructing and evaluating scientific knowledge (and non-knowledge). In the multilevel constellation of the WTO dispute over GMOs, for instance, the dominant concentration on the "orthodox view" of risk assessment could prevail over the legitimacy of the precautionary principle because the latter was held to result in "barriers of trade".

Against this background, second, it seems to be obvious that not only the institutionalised architectures of decision-making have to be analysed with regard to their inherent and often implicit selectivity of utilising specific knowledge resources. In addition, the cultural and, in particular, institutional shaping of scientific knowledge itself has to be carefully observed. This allows to get insights regarding the question of how the respective phenomena are modelled and the different forms of knowledge and non-knowledge are constructed and evaluated within different institutional contexts such as the IPCC, the WTO Dispute Jury, national ethics councils and so on. These two analytical perspectives might help to promote and inform further research into the intricate problems, both epistemological and legitimatory, of policy-relevant science which are addressed by the contributions to this thematic issue.

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Back to Politics at Last

Orthodox Inertia in the Transatlantic Conflict over Agro-Biotechnology[*]

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Abstract

This study suggests that, despite the decisive function of scientific risk assessment in the regulation of potentially hazardous technologies, conventional political decision-making prevails if in protracted risk controversies scientific consensus cannot be achieved. An examination of Austria's policy on agricultural biotechnology is presented to illustrate this point: For a number of years Austria has been upholding national bans on various Genetically Modified Organisms (GMOs) even though these bans were deemed illegal by the European Commission as well as a WTO Dispute Settlement Jury. Since European and international regulations require restrictions on biotech-products to be based on scientific evidence, for the longest time the dispute between Austria and the European Commission, seeking to lift the Austrian ban, consisted in the exchange of scientific opinions. When international pressure against the Austrian ban rose after a WTO judgment censuring the Austrian measure, only a political solution could bring about a (still provisional) settlement. The process is discussed against the backdrop of sociological debates questioning the pivotal status of science in government.

[*] This article significantly benefited from comments received at the conference "Zwiespältiger Fortschritt", organized by the Section Sociology of Science and Technology of the German Sociological Association, 26 to 27 June 2008, in Augsburg, Germany, from two detailed anonymous reviews, and comments from the editors. The Austrian Science Fund (FWF) provided the research grant P 21812-G1.

1 Introduction

A major part of the critical literature on the relationship between science and politics (otherwise known as science and technology studies or STS) takes issue with what can be called the "orthodox view" of science in political decision-making.[2] According to this view, science, even when intimately involved in policy and regulation, acts as a disinterested provider of objective knowledge, distinct and distinguishable from politics. Particularly in the case of risk assessment, which is the prerequisite for the approval of potentially harmful products, science provides the basis for a "factually grounded, objective, and value-free, analytic exercise" (Busch et al. 2004: 4) capable of properly identifying and assessing possible harm to humans and the environment.

For more than three decades STS have challenged this view as simplistic and misleading: Because science in government serves practical needs arising from regulatory requirements and political problems, it mostly operates in areas of ineradicable uncertainty and social contention, where consensus proves difficult to achieve, much more maintain (e.g. Funtowicz/Ravetz 1992). But even though numerous studies on science-policy interaction testify to the social malleability of scientific truth, how selective it can be or how bound up with tacit social considerations, authorities and legislations adhere to the orthodox view. There are three reasons for this.

In the first place, there is an unquestionable normative function of science in pragmatic matters of product safety and environmental protection: Even should uncertainty and disagreement remain, it will matter that standards or regulatory decisions have been based on scientific expertise (rather than, say, on opinion polls, exegesis, or horoscopes). Whether the issue is flu jabs or mobile phones, it is simply essential to know whether certain products are dangerous, or more or less dangerous than others. Furthermore, expert disagreement and scientific uncertainty vary from case to case. In a great range of technologies disagreement and uncertainty might be subliminal or even non-existent, so that most risks entailed by everyday life in Western society – e.g. traffic – can be defined and delimited technically without stirring up much controversy.[3]

In the second place, from a governance perspective, keeping science distinct from politics serves to maintain the legitimacy of political decisions. Regarding the handling of technical and environmental hazards the orthodox view's authority to generate legitimacy is exemplified by the distinction that is made between *risk assessment* and *risk management* in regulatory practice in the U.S. and the EU. The conceptual duality was introduced by a U.S. study in 1983 known as the "Red Book" (NRC 1983). Risk assessment refers to the exclusively *scientific* identification, explanation and evaluation of risks, and delivers objective, independent advice for the perfectly separate, *political* risk management

[2] I borrow this term from Millstone and Zwanenberg (2003).

[3] In cases where science working under value-neutral or „technical" conditions of undisputed knowledge, Funtowicz and Ravetz (1992) have proposed the terms "normal science" in basic research and "consultancy science" for established knowledge applied to defined problems, which they contrast with the "post-normal science" (a term initially introduced by Thomas Kuhn) that operates in politicised contexts of ineradicable uncertainty, most often in the context of applied, policy-relevant research. While in the emerging type of post-normal science traditional methodologies and practices of closure are deemed ineffective, "normal/consultancy" science gets along with conventional approaches. It should be noted, however, that STS authors leaning to a more constructivist view deny the viability of conventional or normal science altogether (e.g. Nowotny et al. 2001).

process whereby risks and benefits are traded off against one another, socio-economic consequences are envisioned and various interests are taken into account. Since the "Red Book", the guiding principle of U.S. environmental and product regulation has been to keep science separate from politics in public discourse, procedure and in institutions. In recent years, the principle has increasingly gained ground in the EU as well, in both supranational and national regulation. This is most conspicuous in the regulation of food safety, where, in the course of the past decade, a number of independent food safety agencies have emerged. Significantly, the differentiation between risk assessment and management initially came about as a response to a crisis of confidence: In the early eighties, U.S. environmental and job safety regulators had to cope with a loss of credibility due to concentrated industry litigation and various public and political pressures. In the EU major regulatory restructurings in the late nineties resulted from the BSE crisis (Lofstedt 2003). The dominant strategy to restore legitimacy on both sides of the Atlantic was to establish a clear-cut separation between values/interests and facts, and between politics and science.

The third reason for the predominance of the orthodox view, one which is often overlooked but which is, arguably, the most powerful one, has to do with the internationalization of regulation: In almost all fields where there is standard-setting and product regulation, states are required to comply with supranational or international regulations and standards. This is obvious for EU members, but it also holds for any member of an international standard-setting organisation or party to an environmental or trade agreement. International trade agreements based on the legal dispute settlement mechanism of the World Trade Organization (WTO) are particularly influential, as the power to impose trade sanctions acts as a strong incentive for compliance. Liberal trade rules, in turn, exclude barriers to trade other than such warranted by scientifically substantiated physical hazards. Supranational regulations and international environmental and trade agreements confer a pivotal role upon science by stipulating that product standards and product approvals be based on the best available knowledge and on scientific risk assessment. This implies that states, even if they prefer to base their decisions on alternative criteria, are required to defend their measures by means of scientific argument alone.

This lends a new, international dimension to the problem of achieving consensus. National measures based on national experts' evaluations and meeting with popular approval might be at odds with other, equally scientifically sound positions that other states or supranational institutions have adopted. In the case where there stand to be real, tangible implications, as, for example, in the case of trade disputes, conflict resolution is shaped by supranational regulations and international agreements which require decisions to be based on scientific expertise. The resulting international expert dispute is no more likely to be resolved through consensus than at national level. The legitimacy problems arising in these international techno-scientific disputes are even aggravated: Whereas common democratic understanding would suggest that where a population simply does not want to accept certain products and technologies they should not be upon them, states can now be compelled by international bodies to consent to products and technologies that have been cleared through scientific risk assessment.

The following study examines just such a new type of "nested" dispute which involves one state pit against other states as well as against supranational and international authorities within a legal framework that requires decisions to be based on science, to

wit the case of Austria's bans on genetically modified organisms (GMOs) in agriculture. For more than a decade Austria has been upholding such bans in defiance of the European Commission, which, having rejected the scientific basis for such measures, unsuccessfully has called for their abolition. The conflict acquired an international dimension when the U.S., along with Canada and Argentina, filed a lawsuit with the WTO against the EU's biotechnology policy, which the complainants considered to be in violation of international trade law. The principal targets of the lawsuit were the EU's "political moratorium" on GMO authorizations, in effect from 1999 to 2004, and a series of national bans on GMOs that had been approved for marketing in the EU beforehand. Austria was only one among various countries upholding such bans, but, for contingent reasons, it was the only country for which the conflict ever came to a head with the European Commission, after a verdict of the WTO Dispute Jury declared the national bans unlawful. Although the subsequent resolution of the conflict can be considered to have been political, the orthodox view remained unquestioned. This finding leads one to make the major claim of this article: in a protracted techno-scientific controversy where scientific consensus turns out to be unattainable, a political solution will be found in the end. That solution, in turn, will reinforce the orthodox view rather than challenge it. This observation becomes relevant when seen against the backdrop of current sociological critique of the orthodox view. It is not this study's concern to add to the already solid sociological argument proving the orthodox view wrong by highlighting persistent uncertainty and value enmeshment of science in government; nor does this study contest this view, which has been confirmed by many empirical accounts. Rather, this case stresses the unbroken power of the orthodox view, which it traces mainly to the web of supranational regulations and international agreements endorsing it and the compliance of affected states.

The following account of the international conflict over Austria's bans on agricultural GMOs examines the interplay of three modes of conflict resolution: scientific, legal, and political. While the types of disagreement they handle may be different, in the sociopolitical process under study they are nevertheless inseparably interwoven, or "closely coupled" (Weingart 1999: 157). The science mode of conflict resolution is used to settle differences about the nature of reality; in this instance the possibility or likeliness of adverse effects of biotechnology on health and the environment. Typically, this would entail scientific formats of communication and validity claims, such as empirical data, methodological designs, heuristics, hypotheses and theories. By comparison, the political mode uses political means – both formal (elections, votes, or other procedures) and informal (threat, persuasion, negotiation, diplomacy, etc.) – with the objective to arrive at authoritatively binding decisions. The legal mode of conflict resolution is operational in the routine case of procedurally organising the interplay of political and science mode of conflict resolution and where disputes need to be settled according to binding legal norms. The latter provide the framework for the arguments and procedures to be marshalled in legal mode conflict resolution.

For the purpose of this paper and the present, empirical exposition, the distinction of the three modes is an operational one. One is not seeking here to unveil the political conditioning, social bias, hidden assumptions, or blind spots etc. that are part of the conventional understanding of the relationship between science and politics. This has been convincingly done by a significant strand of STS. In particular, STS have expounded the problematic character of the science-

politics divide, which has been shown to be socially constructed in the pursuit of scientists' interests (Gieryn 1983), and to undergo reformulation and shift (Jasanoff 1987; Levidow et al. 2007).[4] Evidently, the distinction between independent scientific, legal and political modes of conflict resolution, as it is proposed here, goes along with the notion of state legitimacy based on a constitutional division of powers and, more specifically, with the orthodox view that there is a clear cut science/politics divide. Against the backdrop of decades of critical STS research, this might appear as a "naïve, pre-STS" understanding of science, law and politics. For the purpose of this article, however, these distinctions are made only in a provisional and non-normative sense in order to understand the consequences they have in a real world process.[5]

The paper is organized into eight parts, which loosely follow the chronological sequence of events. Following this introduction, section two will examine the regulatory internationalization of agricultural biotechnology and highlight the particular part the international regulatory framework attributes to scientific risk assessment. The third section outlines the course of the transatlantic biotech dispute and is followed by an account of the EU's response to its juridical outcome. The fifth part takes a closer look at Austria's recalcitrant biotechnology policy, which has important implications in both the EU and the international arena. The sixth chapter gives an account of the way in which Austria – and thus the EU – was (largely) brought back into compliance with WTO rules. The conclusion summarizes the course and outcome of the process against the background of current sociological critique of the orthodox view.

2 International Regulation of Biotechnology and Science-based Decision-making

International regulation of agro-biotechnology combines features of harmonisation and fragmentation. Harmonisation is the object behind major international agreements – most importantly the Cartagena Protocol on Biosafety (hereafter the Biosafety Protocol) and the Agreement on Sanitary and Phytosanitary Measures (hereafter the SPS Agreement). Both agreements have major implications for trade in GMOs and genetically modified (GM) products. The Biosafety Protocol, adopted in 2000 as an annex to the Convention on Biological Diversity, sets up a legally binding framework to enable member states to make informed decisions on the import of such organisms and products. The SPS Agreement, negotiated in the GATT Uruguay Round, aims to minimize trade barriers that had arisen as a result of national standards having been introduced to protect human, plant, and animal health. It commits members to annulling domestic regulations

[4] This is not to say that STS authors share a common view of the relation between science and politics. What most STS authors have in common, indeed, is a critical approach to way science has traditionally been seen to fit into politics, but disagreement prevails as to whether the ever more intricate interaction of science and politics – its "close coupling" (Weingart) – leads to a "blurring" of boundaries (e.g. Nowotny et al. 2001) or, whether alternatively, the functional differentiation of the two systems is maintained (Weingart 1999: 157; Weingart 2008: 139). In STS, unsurprisingly, the very definition of politics is also a matter of dispute (De Vries 2007).

[5] The distinction of scientific, legal and political modes of discourse is also consistent with the communicational output of social sub-systems in a Luhmannian system theory approach according to which science ultimately produces truth, whereas political decisions allocate power (Luhmann 1990, also compare: Weingart 2008: 139). While it is not this essay's specific purpose to follow the lines of this approach, this is not say that the same empirical account could not – in a separate analysis – be made a case for systems theory.

that could result in arbitrary discrimination.

The fragmentation of international regulation follows two fault lines: the first, between Biosafety Protocol and the SPS Agreement; the second, between the U.S. and the EU's regulatory systems. As to the first dividing line, tensions have arisen over the precise jurisdiction and scope of application of the Biosafety Protocol and of the SPS Agreement respectively: Whereas the Biosafety Protocol watches over ecological diversity and human health, the SPS Agreement is designed to minimize obstacles to trade. Furthermore, the Biosafety Protocol is based on a process-oriented, precautionary approach, whereas the SPS Agreement is product-oriented and requires trade restrictions to be based on scientific evidence of environmental and health hazards. That does not allow for restrictions to be introduced as a result of socio-economic, value-based considerations. Finally, in contrast to the Biosafety Protocol, the enforcement mechanism for which is still under discussion, the SPS Agreement is based on the powerful WTO dispute settlement mechanism. In the event of a legal clash it is obvious that the SPS-Agreement with its superior WTO enforcement powers would take precedence.

Another fission line is the regulatory gulf between the U.S. and the EU. The product-based U.S. biotechnology regulations do not presume the existence of any intrinsic risks, because no such risk has been demonstrated scientifically. The European regulations, by contrast, are precautionary in that risks are considered possible in the absence of scientific proof, and they support consumer choice. The two diverging regulatory trajectories are what have led to tensions in international regulation: the U.S. has clearly favoured regulation along WTO principles and has refused to become a party to the Biosafety Protocol, whereas the EU had become its champion in already back in the late 1990s (Falkner 2007).

The decisive role of science in international biotechnology regulation is a consequence of the normative function of risk assessment. In both the Biosafety and the WTO regulatory regime risk assessment provides the basis for decision-making (see also: Millstone/Zwanenberg 2003: 657). Risk assessment circumscribes the scope of scientific enquiry which ought to target physical risk, i.e. threats to human health and the environment. In theory, alternative criteria for restricting trade in GMOs are conceivable, e.g. in the form of ethical or socio-economic considerations, but these criteria are consistently kept outside the decision-making process. The focus on physical risk is obvious in the SPS Agreement with its free trade orientation, yet the same can be said of the Biosafety Protocol, where the precautionary approach only rearranges the relationship between policy discretion and scientific uncertainty but hardly addresses realms beyond physical risk. Thus, both approaches conform to the orthodox view (Seifert 2005).

In the orthodox view, the internationalization of procedures and standards using scientific risk assessment based on value-neutral, universally valid scientific expertise, ensures the international convergence in product approvals and prevents or resolves trade disputes. In actual fact, however, risk assessments conducted by national authorities often arrive at different conclusions. The transatlantic trade dispute on biotech products, which came to a head with Austria's ban on GMOs, is one paradigm of a trade dispute, which could not be pre-empted or resolved by science. The next section explores the detail.

3 The European GM Controversy: Science and Political Modes Fail

The ground for the trade dispute over biotech products was laid in the late

1990s when a number of European countries underwent public controversy over agro-biotechnology that ultimately forced the closure of the European market for GM products. From 1996 to 1999, particularly heated debate broke out in Austria, Greece, Ireland, Denmark, Italy, France, the UK, and Italy (Seifert 2006a). Public pressure caused most of these governments to tighten their national GMO policies even as scientific opinion on GMO risks increasingly varied. The ensuing controversy provides us with a demonstration of the "the interplay of science, law and politics" (Christoforou 2004) in practice.

In 1996, deliberations in member states' expert committees assigned with GMO risk assessment failed to produce a common or a clear majority position regarding the GM maize variety Bt176; the decision-procedure therefore switched from the scientific to the political mode. According to the "Comitology" of the EC Directive on Deliberate Releases (DRD), which prescribes the various interlinking of mandatory technical and political procedures, decision-making authority shifted to the Council of Ministers. The Council's vote on June 25th 1996 marked the start of the crisis of legitimacy which, ever since, has beset the EU's biotechnology policy: twelve member states voted against the proposal, two countries abstained, and only France, which had originally submitted the application, voted in favour. However, because a rejection required unanimity, decision-making authority reverted to the European Commission. The Commission consulted three of its scientific committees, all of which gave favourable opinions, and then proceeded to approve the GM maize for cultivation, notwithstanding the Council vote's narrow margin. From about that time on, national policies dogged EU harmonization goals. From 1997 to 2001, seven governments – those of Austria, France, Germany, Greece, Italy, Luxembourg, and the United Kingdom – issued bans on GM varieties that had been approved earlier for marketing in the EU. Beginning in early 1997, Austria and Luxembourg were the first countries to issue such a ban by prohibiting Bt176. In 1998, Austria banned another maize variety, and a third ban followed in 2000.

Article 16 of the DRD, the so-called "safeguard clause", provided the legal basis for the national measures.[6] Its provisions shift conflict resolution into the science mode, as they only permit unilateral bans to be imposed in the – supposedly – exceptional case of new scientific evidence having emerged that would demonstrate hitherto unknown risks. Member states are required to submit this evidence for evaluation to EU committees composed of member state representatives. Should this attempt at a scientific approach fail, which would be the case if the arguments presented by the member state enacting the ban were not in accordance with the opinion of the committee, the Commission would be required to submit to the Council a proposal to sanction the mandatory lifting of the ban by a qualified majority vote. (Thus, a return to the political mode.)

However, the policy process took a different and much more protracted course. In early 1997, after having enacted the ban, Austria (acting in the

[6] In the revised regulatory framework (compare Christoforou 2004), national safeguard bans for which there had been notification under Article 16 of DRD 90/220/EEC have to be dealt with under the safeguard clause provision in Article 23 of the amended directive 2001/18/EEC. Italy referred to Article 12 in the Novel Food Directive 258/97 to justify its bans. The text is modelled after the principle enshrined in the Treaties allowing for national product bans, in the event of a perceived threat to human health and the environment for which there had been no knowledge before approval. The orthodox view prevails, as the claim must be argued based on new scientific findings.

science mode) made the scientific case before the relevant EU scientific committees.[7] The committees concluded that the arguments did not constitute significant new evidence and that, therefore, the previous risk assessment should remain unchanged. Yet, when Austria, despite having had its plea neglected, still refused to lift its ban, the Commission hesitated over initiating Council procedure to demand Austria lift the ban. Arguably, the reason – a political consideration – was that opposition to biotechnology was meanwhile on the rise all over Europe. Most importantly, in 1998, France and Greece were putting in place safeguard bans; and in subsequent years, Austria was to decree two more bans, with Germany and the United Kingdom following later.[8] In each case, the science mode process was repeated: the scientific committees deemed that there was no new evidence to justify a reversal of the original authorisation. In each case – the only exception being the United Kingdom – member states ignored demands by the Commission to lift their bans, yet the Commission refrained from taking matters further, as the Council procedure would dictate. The situation, which neither science nor politics were capable to resolve, remained in limbo. Finally, in the summer 1999, the approval procedure came to a "political" end when, in the Council of Ministers, France, Greece, Denmark, Italy and Luxembourg declared they would block any future approval.[9] The move had a two-fold objective: first, it eased pressure on national governments reluctant to justify further market approvals before an unenthusiastic public; and, second, it aimed at putting pressure on the Commission with the ongoing reform of the Community's biotechnology regulation. The blockade, clearly and overtly, was a political act. It, therefore, came to be dubbed "political moratorium".[10]

Over the period from 1999 to 2003 and the completion of the revised regulatory framework (Christoforou 2004), member states were pressurizing the Commission to adopt ever tighter regulations in the form of cumbersome risk assessment and approval procedures, the internationally contested precautionary principle, and comprehensive traceability and labelling provisions which would make the introduction of GMOs into the European food chain a burdensome and – for applicants – risky business. In certain respects, however, the new regulatory framework was also to centralize and thus facilitate the approval procedure: in response to the crisis of confidence triggered by the BSE and other European food crises, the institutional distinction made between risk assessment and risk management (i.e. the science-politics divide) for food-product approval procedures was strengthened. A case in point was the creation of the European Food Safety Authority (EFSA) under the 2002 Food Law as an independent body conducting science-based risk assessments for the food approval process. For the authorization of genetically modified food the EFSA was assigned the key

[7] Austria cited possible effects of the Bt-toxin produced by the Bt176 on non-target organisms, the development of resistance to toxins by target organisms, and the risks associated with an ampicillin antibiotic resistance marker gene.

[8] In total, between 1997 and 2001, national safeguard bans had been decreed on 13 occasions by: Austria (3), France (2), Germany (1), Italy (4), Luxembourg (1), Greece (1) and the United Kingdom (1) (which was the only country to later withdraw its ban).

[9] At the expert level, the authorization process had come to a halt already in 1998. Later, in 2000 and 2001 respectively, Austria and Belgium joined the blockade group.

[10] In an account of the Council decision Morris and Adley quote a British official as having said: "The French Minister made it clear there was no legal basis for a blanket moratorium. What they were putting forward was a political declaration." (Morris/Adley 2000: 325)

responsibility of conducting the risk assessment, thus replacing national expert agencies. The EFSA also became the agency to turn to and, ultimately, the arbiter, when disagreements with member states over agro-food biotech's physical risks.

In April 2004, the moratorium ended with the Commission's eventual authorization of the first GM crop for six years. Previous to that time the moratorium had put the Commission in an awkward position. Commissioner Wallström, for example, had frequently stressed its illegality and appeals to reinstate authorizations remained unheard. Agro-exporting countries faced mounting obstacles as they sought to enter the EU market. From the late nineties onward the U.S. government was warning the EU to take legal action against the moratorium within the WTO. At the same time a number of transatlantic diplomatic (i.e. political) initiatives were launched to come to terms with the U.S. (Murphy/Levidow 2006: 46-97). In 1998, for instance, the Transatlantic Consumer Dialogue was created, a network of U.S. and EU consumer groups working together on the GMO issue with a consumer rights agenda. In 2000, the EU-US Consultative Forum on Biotechnology brought together a group of experts discussing strategies to avoid a transatlantic trade conflict. These efforts did not suffice. On May 13, 2003, the U.S., along with Canada and Argentina, filed a lawsuit in the WTO against the EU's "political moratorium" on GMOs. Thus, the conflict, which till then had been internal one between member states and the Commission, became transatlantic in scope. It was fought out in the legal mode.

4 The WTO Biotech Dispute: Legal Mode Conflict Resolution

The dispute settlement process turned out to be highly controversial, reflecting the high stakes involved. There was a great deal of speculation about punitive tariff duties to be imposed on the EU forfeited for lost sales in GM products in case of a WTO decision in the plaintiffs' favour (Gow 2006). The question arose as to whether such a case would call into question the entire EU regulatory system's compatibility with WTO free trade rules. The process was keenly observed throughout the world. Governments and regulators in developing countries regarded it as a precedent for eventual GM trade conflicts involving developing countries. Critical civil society organisations repeatedly highlighted the WTO's legitimacy problems throughout the process and "condemned its implicit aims: to force agbiotech products on an unwilling world, and 'to frighten off other nations' from developing their own safety regulations, especially precautionary ones." (Murphy/Levidow 2006: 168)[11]

High stakes, public salience and the complexity of the issue made for a protracted procedure. Only after lengthy debate among involved parties was a dispute settlement of three professional staff members set up in March 2004 to adjudicate the dispute. A request by the EU to have called in scientific experts, and several submissions during the proceedings by both parties led to further delays. While a WTO Dispute Panel normally takes a year to hand down its final verdict, in this case it took until February 2006 before the eagerly awaited interim report was produced, and another eight months for the final version to come out.

The advocacy strategies on the part of complainants and defendants differed in particular with respect to science. While the U.S. insisted on a narrow, legalistic interpretation of what they

[11] The bite-back campaign kicked off by the environmental NGO Friends of the Earth International, for example, resulted in a protest signed by 135.000 people and over 740 organisations claiming to represent 60 million people (FoEE 2005).

denounced as unscientific, protectionist barriers to trade, the EU's defence focused on scientific uncertainty and ambiguity (ibid: 161-173). The U.S. denied that the WTO Dispute Jury needed to look into the scientific aspects of the case, because the fact that the EU was reluctant to recognize the findings of her own scientific committees constituted an apparent procedural failure, causing "undue delay" in product approvals and, therefore, was in violation of international trade law. The EU, by contrast, sought to present its handling of the issue as in accordance with the precautionary principle and put to the panel the matter of scientific uncertainty. The EU's expert consultations, for example, helped to point up the scientific disagreement over GMO risks. The EU also attempted to broaden the ruling's legal basis to extend beyond the SPS Agreement and to consider other agreements such as the Biosafety Protocol and relevant Codex standards.

In November 2006, the Panel issued its final report. Significantly, it stressed that it did not examine scientific issues such as the safety of biotech products or their "likeness" (the technical term for equivalence in terms of toxicological and nutritional properties) to their conventional counterparts. Nor did it insist on a standardized procedure for risk assessment or that risk assessment was to be based on mainstream scientific opinion. The reasoning remained within a purely juridical reference system. The Panel also stressed that it was not ruling on WTO-compliance for the EU biotech regulations in their entirety. Essentially, what the report did do was prove the complainants right, finding that, with the blockade on GMO authorizations and the persistence of national safeguard bans, the EU was violating the "undue delay" provisions of the SPS Agreement. Approval procedures and scientific risk assessment featured prominently in the ruling. In its defence the EU had denied the existence of a moratorium, as there was no official document instituting a Community ban and authorization was being granted again by 2004. The ruling, nevertheless, stated that the EU had indeed applied a general ban in such a way that product authorizations were not being issued "without undue delay", and therefore the SPS Agreement was being violated. As to national safeguard bans, the EU sought to justify them as precautionary measures permitted under an SPS Agreement that grants members the right to adopt measures provisionally in the absence of sufficient evidence for a risk assessment to be conducted.[12] The ruling, however, said that available scientific evidence was actually sufficient. It is important to note that the Panel did not justify this verdict by invoking the science, which would have meant departing from the path of legal reasoning, but rather by citing the EU's failure to apply its own procedures properly (thus following the line of argument presented by the U.S.). The ruling argued that the EU's scientific committee had already assessed the potential risks posed by biotech products yet judged the products to be safe, thereby demonstrating that a risk assessment could be carried out. Hence, the cases presented by member states, none of which convinced the EU's scientific committees to reverse their positive risk assessment, did not amount to proper risk assessments as defined by the SPS Agreement. The panel did not make recommendations regarding the EU's general moratorium, because that had already come to an end in 2004,

[12] Article 5.7 of the SPS Agreement entitles members to take provisional SPS measures "in cases where relevant scientific evidence is insufficient." This right is circumscribed by a number of provisions: the measure is thought to be provisional and has to be reviewed within a reasonable period of time; it must be adopted on the basis of available pertinent information; and members are obliged to obtain additional scientific information for a more objective risk assessment.

shortly after the establishment of the panel. As to the national safeguard bans which remained in force after 2006, the ruling demanded that the measures be brought into conformity with WTO law, by being revoked or by having a valid risk assessment provided.

In critical respects, the EU got off lightly with the WTO ruling. Most importantly, the ruling did not affect the new regulatory framework, which had been forged through a long, contentious process (Spongenberg 2006). Furthermore, as the moratorium had been effectively ended in 2004, claims for compensation were unlikely. Yet it was clear that the ruling would have an impact on member states with safeguard bans in place. In November 2006 the European Commission decided not to appeal the ruling, and in December it was announced that recommendations would be implemented in a manner consistent with WTO obligations (WTO 2008). Observers speculated that the Commission wanted to avoid a less favourable verdict on appeal and that it actually welcomed a ruling that strengthened its position advocating against national safeguard bans (GeneWatch 2006).

5 Impact on EU Biotech Policy: Back into Political Mode

Due to the "complexity and sensitivity" of the issue, the EU asked for "a reasonable period of time for implementation," and parties in the dispute agreed on a period of twelve months from the date of the adoption of the panel report (WTO 2008). The Commission made use of this time by engaging in political mode conflict resolution in two ways. On the one hand, the victors in the biotech dispute had to be accommodated; on the other hand, member states had to be urged to lift safeguard bans and, thus, to undo the last aspect of the EU's regulatory system that failed to comply with the WTO Panel's ruling. In the international political arena the complainant parties maintained their threat potential by reserving their right to impose trade sanctions or to launch another dispute to challenge the EU's regulatory system. The U.S., in particular, urged the Commission to advance trade in agricultural biotechnology products by fast tracking approvals for GMOs with commercial significance for the US, and to regularize the EU approval system by lifting the national safeguard bans that had been condemned by the WTO ruling (FoEE 2007).

Satisfying the challengers' demands by restoring the domestic order, however, would turn out to be difficult. The Commission had been able to deflect the charge against the EU moratorium by reinstating the GMO approval process by April 2004. But this hardly mitigated tensions with resistant member states. What was symptomatic of the policy's delicacy: all approvals granted from July 2004 until end 2009 would apply only to the importation and consumption of products as food or feed, but not to their cultivation. While accommodating importers' demands for market access, the Commission thus avoided the most controversial issue: GM crop cultivation.[13] Another symptom of strained Commission-member state relations was that none of the approvals since 2004 was based on a majority decision by member states through qualified majority votes in Council; rather, the Commission passed them through a legal default

[13] Between May 2004 and March 2010, 23 authorizations for GM were issued, 15 of which were to cover various strains of the economically significant GM maize, three of which were for GM rapeseed, two for soy bean, one for GM sugar-beet, cotton and potato respectively. The GM potato Amflora developed by BASF Plant Science, authorized on March 2nd 2010, is the first and – thus far – only GMO to be granted EU approval for cultivation. All other approvals hold for the importation of the GMOs and their uses for food, feed and industrial processing. (GMO compass)

procedure. This implies that each approval was issued against the will of a considerable portion of member countries. Yet the lifting of the moratorium and the reinvigoration of GMO authorizations went some way towards satisfying the complainants' grievances.

The thorniest part was to be the abolishment of national safeguard bans. For a long time national bans remained the butt of U.S. criticism. The threat of U.S. trade sanctions did nothing to enhance the Commission's legitimacy in its attempts to have national measures lifted. On the contrary, some member states imposed new bans. The Mon810 maize variety – the only GM crop cultivated in the EU after having been authorized in 1998 – was banned by Hungary in 2005, by France in early 2008 and by Germany in the following year. The U.S. fiercely denounced these new measures but, since they had not been at issue in the WTO case, the Commission was more concerned to meet the formal requirements of the WTO-ruling by having the bans issued before 2003 removed. These attempts repeatedly failed. In the summer of 2005, still some time before the ruling, the Commission suffered a first defeat when the Environmental Council foiled its attempt to initiate legal action against Austria, France, Germany, Greece and Luxembourg for having maintained their bans in disregard for the opinion of the EFSA which had since become the chief European body conducting and evaluating GMO risk assessments.

A second attempt at political conflict resolution failed in late 2006, which was even more surprising, as by then, there remained but one country to be brought into line: Austria. In 2006, Austria was the only country with GMO bans on products that had been the subject of the WTO complaint and still actively being marketed. In other cases the companies manufacturing GM crops targeted by safeguard bans had withdrawn them from the market (Reuters 2006).[14] When Austria handed over the rotating, six-month EU presidency to Finland in July 2006 the Commission became free to try again to get the Austrian bans lifted. On 18 December 2006, however, the Council not only proved reluctant to support the Commission's proposal to have Austria lift the two bans (with only the UK, the Netherlands, the Czech Republic and Sweden backing the move) but voted by a weighted majority against it. The outcome demonstrated the wide support for the recalcitrant member country and forced the Commission to withdraw the proposal and reconsider its strategy. While it was clear that Austria would have to drop the bans sooner or later, because they violating WTO rules thus straining transatlantic relations, simply reissuing the same demand over and over was not going to work either. Austria had become the country to tip the scale in the transatlantic biotechnology dispute. Yet before turning to the further protracted attempts to resolve the European GMO dispute, that grew into transatlantic one, let us take a closer look at the Austrian story within the larger European picture to ask three questions: What are the reasons for Austria's obstinate rejection of GMOs? How did Austria defend this position? Why has it been it successful for so long?

6 Austrian Recalcitrance

Austria stands out among the EU countries opposed to biotechnology. Austria was the first country to go through an intense political debate over GMOs; it was (together with Luxembourg) the first to challenge the EU authorization process by issuing a ban; and it has issued more bans than any

[14] The two GMO maize varieties at issue were: MON 810, marketed by the U.S. company Monsanto and banned by Austria in 1999; and T25, marketed by the German group Bayer and banned in 2000. The first GM maize variety prohibited by Austria, Bt 176, was no longer a problem as it had been withdrawn from the market.

other country; Austria had three bans on GM maize varieties before the Dispute Panel ever commenced operations, and after 2006, Austria banned two varieties of GM rapeseed and another GM maize variety.[15] What was Austria's so obstinate GMO rejection about?

In 1997, after a heated public controversy, a popular initiative demanding the prohibition of agro-biotechnology overwhelmingly succeeded. The first safeguard bans were decreed around this time and, from 2000 on, Austria supported the European moratorium. In subsequent years Austrian agricultural policy took on a prohibitionist slant in an attempt both to protect the high proportion of organic farmers and reap the more general benefits of a national GM-free marketing niche strategy. Today Austria is pursuing a policy of zero-tolerance to GMOs in food and agriculture, which, after more than ten years of policy evolution, is consensus among stakeholders and political parties. In short, there is a very strong political will to keep the country "GM free".

How does Austria defend its stance? While remaining within the orthodox perspective, we distinguish between political and scientific tactics, and detect a clear predilection for the latter: Time and again, Austria has sought to influence EU decision making processes through political channels, and yet scientific argument has comprised the major focus of Austria's anti-GMO policy in the EU context. Politically, Austria has acted in various ways: e.g. by lobbying member state governments prior to Council decisions, by allying, however hesitantly, with the group of governments behind the political moratorium, or by kicking off critical debates on agro-biotechnology in the EU. For example, Austria attempted to win over Council decisions at the Council's vote on Bt176 in June 1996 (Seifert 2002: 220-1). As to the promotion of critical debate throughout the EU, the Austrian government declared biotechnology a major focus of its EU presidency, which ran through half of 2006 (Pröll 2006). Austria launched a debate on the EU approval process at the Council of Environmental Ministers in March 2006, targeting the EFSA's risk assessment practices in particular.[16] During its term in office Austria also hosted two major EU conferences on the precautionary principle and on the possible coexistence of GM- and non-GM agriculture.

As these examples suggest, even pursued in a political manner, Austria's struggle very much centred on scientific aspects of the EU approval procedure, such as the EFSA's risk assessment practices or the precautionary principle as a concept of regulatory science. However, the actual scientific dispute between Austrian experts and the EU's scientific committees (or after 2004 the EFSA) over biotechnology's risks dominated Austria's defence of its anti-GMO policy. The reason has been outlined already: EU regulations exclude but these arguments from entering the debate. It took a while for Austrian authorities to learn to play by these rules. For example, in the public furore, which preceded the popular initiative people were very quick to seize upon the idea of completely banning GMO releases but they were countered by government leaders who argued that such a ban would violate EU regulations and therefore be untenable (Seifert 2002: 169). The beleaguered Ministry of Health – the authority responsible in this case – decided to issue a ban nevertheless, invoking the DRD safeguard clause, which de-

[15] These more recent bans apply to the GT73 and Ms8xRf3 rapeseed varieties (April 2006 and July 2008 respectively) as well as the MON863 maize strain (July 2008).

[16] Ever since the approval process started up again in 2004, the EFSA has consistently attested to the safety of GMOs and rejected member states' risk claims as scientifically unfounded.

manded that new scientific evidence of harm be presented to justify the ban. Although EU scientific committees subsequently termed the Austrian case insufficient, Austria maintained the ban. Table 1 illustrates the course of the scientific dispute between the Austrian the EU experts taking the example of the GM maize variety T 25, one of the two GM maize varieties that had been at issue at the Council in December 2006.

Table 1: The scientific dispute over the GM maize T 25 between Austrian experts and the EU´s scientific committees

22 April 1998	The Commission authorizes marketing of T 25.
8 May 2000	Austria declares its provisional ban on T 25 and submits scientific reasons for the decision.
20 July 2001	The Scientific Committee on Plants refutes the reasons given by Austria, yet Austria maintains the ban.
January-February 2004	Austria submits additional information to the Commission in support of its ban.
8 July 2004	The EFSA rejects the reasons given by Austria, yet Austria maintains the ban.
26 April 2005	The Commission proposes the Council ask five member states to lift their bans, Austria among them.
24 June 2005	The Council rejects the Commission proposal by a qualified majority. The Commission is asked "to gather further evidence on the GMO in question."
November 2005	The Commission consults the EFSA again.
29 March 2006	Again, the EFSA fails to find reasons to revoke the original decision.
10 October 2006	The Commission proposes the Council ask Austria to lift its bans.
18 December 2006	The Council rejects the Commission proposal by a qualified majority.

Even though, in the mid 1990s, empirial research on GMO safety was virtually nonexistent in Austria, sociological research has shown that Austria was well equipped to put forward scientific argument in support of its bans. Even before public pressure had built up in the mid -1990s, the Austrian Federal Environment Agency (UBA), which was responsible for providing the scientific expertise to assess GMO risk, had established its own rigorous "Austrian standard", which acknowledged the limits of contemporary methods of contemporary risk assessment, or, more to the point, the uncertainty over long-term effects on ecosystems (Torgersen/Seifert 2000). Accordingly, rather than seeking to convince by providing new scientific evidence of environmental risk, the Austrian approach stressed the inherent "unknowns" in the original assessments and questioned their scientific basis (Ely 2005).[17] Over the years the Austrian government expanded its ranks of experts and broadened the scope of potential risk and uncertainty

[17] While this type of argument, focusing on unknowns, methodological flaws, and uncertainty instead of "new evidence", never convinced the EU scientific committees or the EFSA or the Dispute Panel, both regulatory reform in the EU and, ironically, the EU's line of defence in the WTO followed these same lines. Austria, for example, advocated environmental monitoring, questioned assumptions as to the comparability of GMOs with their unmodified counterparts, and insisted on freedom of consumer choice through the labelling of GM products before any of these principles became guiding principles in the EU's regulatory reform (Ely 2005).

to be examined, commissioning numerous studies on, for example, the allergic reactions to or toxicology of GM food, the co-existence of GM and GM-free crops, or specific GM crops to be banned. Table 2. illustrates the evolution of Austrian expertise and related scientific debate on regulatory aspects of agro-biotechnology through scientific studies commissioned over the years by the Austrian Ministry of Health.

Table 2 highlights both the diversity of subject areas related to agro-biotechnology and the permanent interest authorities take in GMO risk assessment. We find a relatively high number of studies on the linked issues of organic farming, co-existence, and GM-free regions (nine out of 39 studies), while the highest proportion of studies (22 out of 39) deal with various aspects of GMO risk assessment. Without further detailing the scientific arguments chosen by Austria to defend its policy, this picture attests to the priority Austrian authorities accord to science in determining what to ban and, more particularly, in the dispute about GMO risk assessment.

The strength of the Austrian scientific case was what enabled them to keep their bans in place for such a long time, as that would imply that the EU

Table 2: Evolution of Austrian expertise on GMOs 1996-2007. Source: http://www.bmgfj.gv.at/

Year	Number of Studies	Topics
1996	1	Provision on social compatibility in the Austrian Genetic Engineering Act (1);
1997	1	Risk assessment in GMO field releases (1);
1998	4	Environmental risk assessment (1); GMO safety research (1); herbicide resistance in GMOs (1); GM herbicide resistance and organic farming (1);
1999	3	GM food risks (2); GM free regions in Austria (1);
2000	3	Risk assessment of GM rape seed (1); amendment of the EU DRD (1); GM-free crops as part of Austrian organic farming (1);
2001	1	GM-free regions in Austria (1);
2002	3	GM-free regions in Austria (1); evaluating substantial equivalence (1); risk assessment of GMO field releases (1);
2003	5	Legal implications of Austria's GMO ban (1); assessment of GM allergies and toxicology (2); environmental monitoring of GMO releases (1); co-existence of GM and GM-free agriculture (1);
2004	4	Risk assessment of GMO Products in the EU (1); agroecology of GM rice and GM cotton (1); assessment of human health effects of GMOs (1); monitoring of "GMO-contaminated" maize fields (1);
2005	4	Co-existence of GM and GM-free agriculture (1); GM food labelling (1); Biodiversity in GMO risk assessment und monitoring (1); ecological effects of GMOs (1);
2006	5	Risk assessment of antibiotic-resistance marker genes in GMOs (1); GM-free rape seed (1); risk assessment of GM rape seed (1); the role of precaution in GMO policy (1); GM corn (1);
2007	4	Risk assessment with regard to Austrian bans and WTO-Panel conclusions (2); GMO risk assessment (2);
Total	**39**	

scientific committees and the EFSA had accepted the Austrian arguments. They never did (Table 1). The key is rather to be found in the political context: no pressure was brought to bear on Austria during the moratorium, and even afterwards the Commission's attempts to force Austria to lift the bans foundered because of the lack of cooperation from member states with their own anti-GMO agenda or with a general reluctance to see a small country overruled by the Commission.

7 Back to Politics at Last: The – Partial – Lifting of the Austrian Bans

Past failures notwithstanding, in February 2007, the Commission renewed its campaign to restore WTO compliance, this time asking the Council to require Hungary to end its ban on the MON810 GM maize. Yet again, member states rejected the proposal by a qualified majority. Even three defeats in a row, however, could not sway the Commission in its normalization policy. While Hungary's ban, which had been in force since 2005, was not subject of the WTO lawsuit, the Austrian bans remained the major obstacle to formal WTO compliance. Since the Commission's hands were tied to repeat its bid for a complete abolition as a consequence of the Council's rebuff in December 2006, a new strategy had to be found to overcome the last, Austrian, impediment to compliance.

Conflict resolution along political lines resumed in both transatlantic and internal EU-relations. The US kept pushing for improved market access, the Commission went on pushing through GM product authorizations, albeit with difficulty. While market access remained the complainants' major concern, the Commission did emphasize that Austria's safeguard bans, would have to be repealed since, however economically insignificant, they constituted the last remaining formal obstacle to WTO-compliance. The Commission submitted a revised proposal on Austria's ban to the Council in October 2007. This time, the proposal was to remove Austria's bans on the import and processing of the two GM maize strains alone, but not on cultivation. This modification combined three political considerations: firstly, the Commission would have to submit a revised proposal, as their two previous proposals for the complete rescinding of national bans had been rejected beforehand. It was unthinkable that the same procedure could ever achieve the desired result; secondly, as there was scant interest in cultivating GM crops in a small country like Austria, the opening up of Austria's markets for GM materials intended for GM food and feed would meet importers key demands; thirdly, as Austria's anti-GMO policy is primarily designed to prevent GMO field releases, even though tolerating, for instance, GM feed is allowed to be imported, the proposal would accommodate Austrian exigencies and would therefore be apt to gain acceptance.

Although the proposed Council decision of October 2007 failed again to muster a qualified majority in support, it was not opposed by a qualified majority either. Formally, this entitled the Commission to request the lifting of Austria's bans, yet also imposed the obligation to re-examine the issue. The vote's narrow margin and the sensitivity of the issue called for skillful handling. Austrian consent was crucial if a final showdown before the European Court of Justice, something which would only further strain the Commission's domestic legitimacy, were to be avoided. Diplomacy resumed both internally and in the transatlantic arena. When the time limit for restoring WTO compliance expired in November 2007, the complainants agreed on an extension until January 2008. Again, the EU missed the deadline, thus entitling the complainants to impose sanctions and, again, the US held off with punitive measures in order to pursue talks even

as they continued to criticize the still slow pace of authorizations and reserved the right to reopen the suspended arbitration process in the event talks not produce results (Bridges 2008).[18] Meanwhile, besides the differences among member states, increasing fault lines within the Commission were becoming a major obstacle to normalization. In 2007, Environment Commissioner Dimas declared approval for certain GM maize varieties would be blocked despite EFSA assessments that found GMOs to be safe (Mason 2007). Trade Commissioner Mandelson, by contrast, called on EU decision-makers to respect the EFSA's scientific judgement in order to avoid further international litigation (Reuters 2007). By early 2008, commentators were describing the Commission as having entered "uncharted legal territory" and being "at a complete loss" as to how to settle internal disagreements (Moravec 2008).

There were two questions on the agenda at the meeting on biotechnology policy in May 2008: the Austrian bans and the decision on three GM crops, which had been returned to the Commission after an inconclusive Council vote – like on every previous occasion since 2004.[19] While the deadlock persisted on the three controversial GMOs and the Commission postponed the decision, the executive body did manage to agree to demand Austria lift its bans on the cultivation of the two GM maize crops. By then, the Austrian ban, if of any relevance at all, was only a minor issue in transatlantic talks, as its economic significance was virtually nil. Rather, the complainants were pushing for a speeding up of the still slow approval process and were particularly angry over the recent French ban on GM maize. For the Commission, however, the removal of the last obstacle to formal WTO compliance was a significant step forward.

Austria agreed to a partial lifting of the bans it had maintained throughout a decade. In principle, the country could have ignored the decision and run the risk of litigation for non-compliance but, notwithstanding some criticism by Austrian anti-GM activists, the government chose not even to consider that option (Ruzicka 2008). Instead, it was stressed that the ban on GM crops remained in force, and that Austria would achieve its ultimate goal to prevent any GMO cultivation. This would be even the case in the event there should cease to be a ban on GM farming, inasmuch as a variety of domestic legal provisions and policy measures would have made Austria a most unwelcoming place for GMO cultivation in the future; e.g., in particular, strict national rules on the co-existence of GM and GM-free agriculture, and a voluntary GM-free policy of Austrian retailers (Seifert 2006b). Until now (early 2010) this "solution" of the problem of biotechnology recalcitrance proved viable, even though the Commission's obstinately refused to soften its legalistic-scientific position: To the surprise of most observers, in early 2009 the Commission started her, so far, last attempt to overthrow the remaining Austrian ban on cultivation. When the Commission asked member states' ministers at the Environmental Council in March 2009 to order Austria and Hungary to lift their bans, a qualified majority refused the motion. It was the third time that the Commission had failed to get Austria's bans lifted and the second for Hungary.

[18] In January 2008, Canada, Argentina and the EU first agreed to extend the "reasonable period of time" to February 2008. In February 2008, they agreed to a further extension until June 2008. In June 2008, the deadline was pushed back to December 2008 (WTO 2008).

[19] The two GM maize varieties 1507 and Bt11 and the GM potato Amflora. The Commission approved these varieties not earlier than March 2010.

8 Discussion: Inertia by Compliance

To date Austria and the European Commission seem to have come to an uneasy compromise, which, although the Commission has not given up its position, carries features that serve both sides interests. In Austria, the partial lifting of the ban is likely to meet with public approval, as it does not threaten the country's zero-tolerance policy; the Commission is happy, because the measure – however irrelevant economically, and however much overshadowed by a number of subsequent bans introduced since 2004, – does usher in a return to formal WTO compliance. The key point to be made here is that this arrangement was arrived at by pursuing both a legalistic and a politically sensitive track for conflict resolution, i.e. adjudicating, voting, lobbying, diplomacy, negotiation, rather than scientific deliberation. (Nonetheless science and the law still remain the Commission's principal sources of legitimacy. We also recall that the use of the threefold distinction between law/politics/science made in this contribution is not apt to an essentialist or prescriptive reading, neither it is thought as an opinion in the intrinsic STS debate about the very nature of science in politics. Rather, this essay has adopted a "naïve" notion of law, politics, and science to be used provisional manner in order to make sense of a real world process.) This finding supports the more general argument that if, in the context of a liberal framework, decisions are required to be based on science yet consensus on technological hazards proves beyond reach, a political solution will be found. Its substance, we might add, will crucially depend on the set of formal and informal rules that apply and the distribution of power in a given situation. In this way the issue is kept in check and any crisis of legitimacy is thus adverted, while the framework and the central role it assigns to science remain unaffected. In other words, liberal risk governance relying on scientific consensus ultimately withstands the challenge of persistent lack of scientific consensus. This may seem a truism, but it is nevertheless worthy of note in the context of prominent STS criticism challenging the orthodox view.

A letter to the WTO Dispute Jury Panel from a group of academics of considerable renown in the social studies of science and technology provides a model of such criticism (Busch et al. 2004).[20] Stressing the high stakes of the transatlantic dispute for "the global development of agricultural biotechnology, the democratic governance of risks in world trade, and, not least, the legitimacy of the WTO as an institution of global governance" (ibid: 7), the scholars warned that a ruling that was solely based on the criterion of scientific risk assessment would both misinterpret the mandate of the WTO agreements and imperil the WTO's democratic legitimacy. It was therefore imperative to go beyond a purely technical notion of risk to embrace "a more complex understanding of risk assessment as practiced in real-world conditions." (ibid.) According to the authors, sociological research had called into question the orthodox understanding of risk assessment as a "factually grounded, objective, and value-free, analytic exercise." (supra) Conventional accounts of risk assessment were problematic because of several omissions: firstly, there is the

[20] The letter came about through the formal mechanism of the "*amicus curiae* brief", a provision in the dispute settlement procedure by virtue of which civil society actors have a possibility to make their opinion heard in WTO dispute resolution. In the case at hand this involved a concurrent view on the part of five highly influential experts whose "scholarly expertise is in the areas of risk and regulation, with individual competences in environmental law, international trade law, scientific advice, comparative studies of risk assessment and management, public understanding of science and technology, and food and agricultural policy (Busch et al. 2004: 8).

disregard for problems arising out of scientific ignorance; secondly, there is disregard for how national contexts and scientific and cultural contingencies influence risk assessment practices; and thirdly, there is disregard for "background assumptions and value commitments that are unavoidably embedded within scientific knowledge generated for policy applications." (ibid: 5) The authors therefore pleaded that the WTO Dispute Jury: 1) begin by expanding the range of scholarship considered relevant in decisions related to aspects of risk assessment, especially by including the social sciences; 2) go on to acknowledge that practices of risk assessment vary according to the national and institutional context and are therefore limited and partial; 3) allow public deliberation and review to be part of risk assessment; 4) understand the EU's slow-down in GMO approval rates as the consequence of such an expanded notion of risk assessment under conditions of uncertainty and public contention, rather than as "undue delay" in trade-relevant decision making; and 5) refrain from any judgement over the substantive merits of the parties' risk assessments (ibid: 6).

The point here is not whether this academic intervention had any direct effect on the case's outcome;[21] rather, the statement summarizes an important sociological critique of the orthodox view and applies this critique to the conflict at hand. (It should be stressed that this critique must not be misinterpreted as calling for the abolition of science in political decision-making; rather, based on thirty years of social research into the value-laden character of science in politics, it is to be understood as a plea to admit that non-scientific factors unavoidably operate in risk assessment; to abandon the belief that science speaks universal and objective truth; and to give up the fiction that science and politics are perfectly separable – to the service of technocratic decision making and global market integration, we might add.) In a sense, the critique is confirmed by the course the process took. The same process, however, also attests to its practical futility. Thus, the fact that ten years of regulatory dysfunction, at times paralysis, had to pass before a political settlement was found, if only provisionally, because over the whole period consensus over GMO risks proved unattainable, only confirms the critics' chief argument, according to which risk assessment practices are constrained by political context, background assumptions, and value judgements. For these reasons there never was any rapprochement between Austria (or the other recalcitrant states upholding bans) and the EU's scientific committees or the EFSA (Table 1). It has been argued that the inclusion of scientific committees into wider policy networks involved in supranational political decision-making is an effective method of promoting policy deliberation (e.g. Joerges/Neyer 1997). Yet, to the extent policy deliberation means to generate consensus, thus workable solutions, in the case of agro-food biotechnology this interpretation does not hold. This is readily understandable since what is at stake in the scientific dispute over GMO authorizations is a yes-no decision: a positive risk assessment means approval, a negative risk assessment rejection of a given GM product. Hence, for either side, acknowledgement of the opponent's arguments implies policy failure. For the Commission in par-

[21] At least according to the Dispute Jury no such effect occurred. The only mention the jury made of this and two other *amicus* briefs in the over 1000-page report was: "We note that a panel has the discretionary authority either to accept and consider or to reject any information submitted to it, whether requested by a panel or not, or to make some other appropriate disposition thereof. In this case, we accepted the information submitted by the *amici curiae* into the record. However, in rendering our decision, we did not find it necessary to take the *amicus curiae* briefs into account." (WTO 2006: 285)

ticular, acknowledging Austria's arguments would have meant accepting there could be possible physical hazards and, thus, that Community authorizations would need to be withdrawn.[22] In sum, deep-rooted politicisation, profound scientific uncertainty (at least in the eyes of the technology's critics), and the ultimately binary logic of expert deliberations involved in product authorizations seem to preclude consensus which might be possible under different circumstances.

However, what the episode illustrates is not the political relativity (or malleability) of science in government alone. It also demonstrates the inertia surrounding the orthodox view when challenged and thus the unlikelihood of reform along the lines of "a more complex understanding of risk assessment as practiced in real-world conditions." (supra) With the sole exception of the last recommendation that one withhold judgement on risk assessment practices, the Dispute Jury's decision ran counter to all claims made in the intervention. The EU, actually, was found guilty of "undue delay" for formal reasons, and the ruling contained no advice for risk assessment practices along the lines proposed. Why has the orthodox view continued to hold sway?

As has been pointed out, the major strength of the orthodox view is that it has been enshrined in international free trade legislation, notably in the SPS agreement. Most importantly, the Dispute Panel's statutory reading of this agreement reaffirmed the orthodox view. In theory, there was scope for alternative readings.[23] The above-cited intervention, which allowed for cultural relativity, intrinsic uncertainty and the potentially democratic quality of risk assessment represents such an alternative. Yet, the authors were well aware of the difficulty in incorporating such reasoning in the Dispute Jury's judgment:

"WTO validation of multiple approaches to the assessment of particular products could, at best, cause delay for the larger project of regulatory standardization; at worst, it could open new avenues for protectionism masquerading as risk-based technology policy. A subtler version of this critique is that increasing the evidentiary burden necessary to establish a violation of the science-based provisions, or widening the scope of affirmative defenses, might decrease the sharpness of the SPS Agreement's anti-protectionist tools." (Winickoff et al. 2005: 121)

To dismiss the orthodox view clearly would run counter to the anti-protectionist mission of international free trade legislation. Adoption of the proposal must have appeared unlikely from the outset. That the authors did make the attempt nonetheless to convince the Dispute Panel was mainly because a radically different approach was needed to restore the WTO's tarnished political legitimacy. But political legitimacy, or the lack thereof, is a concept that is hard to pin down. In general, the "grounds for accepting or complying, consenting or agreeing to something" vary widely, ranging from coercion or apathy to pragmatic acquiescence and instrumental acceptance to factual or ideal normative agreement (Held 1996: 195). Leaving aside the theoretical assessment of the le-

[22] This explains the ironic fact that the EU defended its stance in the WTO suit by resorting to arguments similar to those of Austria, stressing uncertainty and the precautionary principle, yet, rejected the Austrian arguments in the internal dispute over safeguard bans.

[23] Foster, for example, suggests that a member should be able to defend SPS measures on the basis that its population simply does not want to run a given risk. In support of this view, she demonstrates that the SPS agreement, indeed, gives considerable scope for greater recognition of factors such as public opinion in decision-making about risks to human health and the environment (Foster 2008).

gitimacy of the WTO dispute settlement mechanism and its reliance on science, and turning instead to consider observable forms of compliance, we find the political legitimacy of the WTO ruling far from having been undermined.

To be sure, countless surveys and even a number of plebiscitary procedures have confirmed that most Europeans refuse to accept GMOs in agriculture and food and, as can be surmised, are particularly outraged if these products are forced on their plates through the WTO mechanism. This concern, however, has been fairly alleviated, given that strict EU labelling rules (unquestioned by the WTO) and European food industries' reticence towards GM-food keep the EU market virtually GM-free.[24] As far as agricultural biotechnology is concerned, GM crop cultivation is also negligible, and in part because of the same reasons, in part for the Commission's reluctance to authorize GMO cultivation.

Another way to gauge the legitimacy of the WTO ruling is to look into the conduct of state or supra-state actors subject to it. What became evident in the transatlantic conflict including the Austrian case-in-point, was the defendants' readiness to comply with both the ruling and the principles on which the ruling was founded. It is patently obvious that the Commission complied by accepting the WTO ruling, thus abandoning the arguments that had been used as a defence. As mentioned, the decision was not surprising, since the EU got off lightly with the ruling. In particular, the EU's major objective remained safe, i.e. the amended biotechnology framework. Consequently, the Commission did comply in that it sought to bring the EU's internal situation in line with WTO prescriptions. In a certain way the Commission also complied by adopting a defence strategy that focused on the scientific aspects of risk assessment (e.g. scientific uncertainty, differences of opinion among experts, the provisional nature of scientific knowledge, the precautionary principle) while sidestepping the dilemmas arising out of the socio-political context of risk assessment. In the EU's case such unresolved dilemmas led to regulatory paralysis as national experts and supranational scientific committees had become entrenched in their positions. In its defence before the WTO the European Commission reinterpreted this as precautionary policy.

In a similar manner Austria displayed compliance – a seeming paradox – as a means of defending a basically recalcitrant policy. This is reflected in the strategies Austria adopted to defend its safeguard bans, since, more consistently than in its political engagement, Austria chiefly pursued a scientific or regulatory defence. Earlier, regulatory experts had established an "Austrian standard", stressing the limits of risk assessment. Over the years the authorities commissioned a special body to provide precautionary expertise on strategic subjects (Table 2). Naturally, the defence kept silent about the "real" motives behind the country's zero-tolerance policy, such as, for example, the technology's extreme unpopularity, attested to by the popular initiative, or the clash with agro-political priorities. Superordinate EU regulations restrict the debate to these arguments alone. In sum, defendants did not question the legitimacy of the WTO, nor did they question the orthodox view underlying international risk regulation. The political solution that ultimately came to be applied to the amalgam of EU domestic and transatlantic tensions was designed to forestall further escalation of the dispute, one which truly had the potential to undermine WTO legitimacy. Thus, rather than subvert the

[24] By contrast, protein-rich GM soy-based animal feed is marketed in the EU on a large scale. As meat from animals fed on these products does not need to be labelled, this has not provoked any consumer backlash.

orthodox view, the (still provisional) political settlement, by striking a subtle balance between interests, actually helped to prolong orthodox inertia.

This study may provoke several questions. Although they reach beyond its scope, three of them should be addressed in order to stimulate further discussion and research. Let's begin with the crucial question: Is orthodox inertia unbreakable? Is the belief that risk assessment is a merely technical exercise, scientific expertise is objective and universal, and science can be perfectly separated from politics unalterable? Secondly, what lesson can STS draw from this episode? Thirdly, is there any evidence for policies, procedures, or institutions based on an "unorthodox view"?

As to the first question: Nobody knows. The future holds many surprises. Yet, it would be a true surprise if tangible decisional procedures based on "unorthodox" thinking would gain ground. The reasons have been given: firstly, the orthodox view of risk governance is functional and "works" in uncontested technological decision-making;[25] secondly, the separation of science and politics actually is a quite robust political legitimation-strategy. We might quote the common saying "politicians use science like drunkards use lampposts: not for illumination, but for support."[26] To present decisional procedures entailing science as based on politics alone, would do justice to sociological enlightenment but it also would deprive politics of a very helpful lamppost; thirdly and perhaps most importantly, the orthodox view is a key element of international free-trade legislation at both global and European levels. Even a deep crisis of legitimacy, such as the one on agro-food biotechnology, and a serious trade conflict between the major economic powers has so far not shattered orthodoxy. In fact, the orthodox view provided the common ground on which to play through the transatlantic dispute and prevented it from escalating into an even more damaging, or costly, confrontation. The expectation therefore: the orthodox view is here to stay.

Second: Which are the lessons for STS? For many years STS scholars and policy observers have been calling for a less rigid, more reflexive handling of the scientific advisory process, its democratisation and embracing of wider social demands (For a recent contribution see: Expert Group on Science and Governance 2007). Concepts abound and debate thrives both within academia and beyond.[27] The discourse of science reform clearly resonates with policy making: ELSA (Ethical Legal and Social Aspects) programmes, round tables, consensus conferences, ethics-committees etc. are well on their way to become regular features of emergent technology governance. This in turn raises a number of questions. For example, to what extent are these initiatives capable of substantially influencing policy trajectories driven by global state and industry competition? What is their normative basis? Can the social (disputed) function of science be maintained in cases where non-scientific or non-certified expertise is allowed to permeate expert-advice? The issue highlighted by the present

[25] The Expert Group on Science and Governance (2007) stresses that only certain technologies in rather exceptional cases provoke social controversy: "(…) *We do not share the view that public mistrust is pervasive, indiscriminate and dominant. The much more typical examples of everyday public trust in science are almost unseen because they are so taken-for-granted, leaving high-profile exceptions like the GMOs or* MMR (Measles, Mumps and Rubella, added by author) *issues to misleadingly define the whole terrain."* (81, fn 35)

[26] The original aphorism, attributed to Swiss chemist Hans Kuhn, did not refer to science but to statistics.

[27] Note, for example, the normative debate on the call to give a voice to uncertified expertise in policy-relevant science (e.g. Collins/Evans 2002).

case presents yet another problem for the reform of science in policy that should, in my view, be addressed more clearly. It deals with scale: as the orthodox view is a key feature of international free-trade legislation, it is a major pillar of an international order operating on liberal principles and, thus, a manifestation of a global power structure. It is this that primarily explains orthodox inertia in the face of massive public and academic critique. To dilute orthodoxy would run counter to most powerful corporate and national interests. One conclusion for STS should therefore be to bring into view more clearly the macro-structures of international relations. Combining macro- (international), meso- (national), and micro- (risk expertise in social context) perspectives could bring a better grasp of the operation of the orthodox view.[28] It could also help to gauge more clearly the relationships – mutually restrictive or reinforcing – of reform initiatives at macro-, meso- and micro-levels (Compare: Dahl 1994).

As to the educational mission of STS shared by many influential scholars in the field (e.g. Jasanoff 1996), it is probably wise not to overburden interventions such as the one presented with unrealistic expectations. To be sure, under certain circumstances reforms aimed at improving accountability and transparency in policy-relevant science can be realized, typically in an effort to cope with a crisis of legitimacy amidst social controversy. We have seen, for example, how the demarcation of risk assessment and risk management has been adopted in an attempt to cope with a crisis of trust, first in the U.S. and later in the EU. For reform-oriented commentators such situations of crisis are opportunities to promote their alternative agendas (e.g. Expert Group on Science and Governance 2007).[29] Yet, it appears unlikely that reform projects will triumph over the constraints created by a global power structure.

Finally: is there, nonetheless, any evidence of an "unorthodox view" materializing? Perhaps. While it is too early to say whether the latest, still ongoing twist in the never-ending story of agro-biotechnology heralds a deviation from orthodoxy, it is certainly worth looking at it: At the Environment Council in December 2008 member states expressed their dissatisfaction with the regulatory impasse[30] and asked the Commission to revise the authorization procedure so as to directly involve member states in the risk assessment process which the current framework delegates to the EFSA and the single member state proceeding the application. The Commission was also requested to take specific national or regional characteristics in precautionary decision-making into consideration. Furthermore, in the Agricultural Council on March 2009, the Netherlands urged the Commission to develop proposals for taking socio-

[28] Levidow et al. (2007) give a convincing example of how macro-, micro-, and nano-perspective can be united by combining concepts from the fields of STS and international governance.

[29] The conflict over agro-food biotechnology, certainly the most dramatic technological controversy in the past two decades, created such an opportunity. The Expert Group on Science and Governance (2007), for instance, quotes the GM controversy more frequently than any other "problematic" technology to make its case for a *general* rethinking of science and technology governance in the EU. Twelve times throughout the report the controversy is quoted as an example for a crisis of legitimacy and the fallibility of conventional approaches to risk assessment (Pp. 15, 33, 55, 57, 65: fn 31, 67, 68, 79, 81: fn 35, 82, 83, 85).

[30] Since the lifting of the moratorium, not a single GM product was authorized by the Council. Authorizations were always given by way of Commission decision, even when a majority had voted against them. Member states, in turn, had frustrated all Commission attempts to lift national bans. Furthermore, in April 2009, Germany became the sixth country to issue a safeguard ban on a commercial GM maize variety.

economic dimensions into account. In March 2010, the Commission announced to come forward by summer with proposals to combine the science-based approval system with member states' rights to decide whether or not they wish to cultivate GM crops on their territory. To devolve decision-making power back to member states could alleviate frictions between them and the Commission and send cracks into the orthodox framework: if national experts were more strongly involved in EU risk assessment procedures, a greater variety of perspectives could be taken into account; the consideration of regional aspects might generate a much more nuanced risk map and rectify the belief in universal valid science; if socio-economic considerations were admitted into the list of restrictive criteria, this might open the door for (explicit) value judgements within assessment procedures. Certainly, the expectation from this analysis is that orthodoxy will prevail. Let's wait and see.

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Governing the Planetary Greenhouse in Spite of Scientific Uncertainty

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Abstract

Climate discourses during the past decades are characterized by scientific uncertainties and related conflicts of interpretation. Times of conflict are times of *social drama,* as the anthropologist Victor Turner called ritual activities enacted in public ritual spaces. In this respect the paper suggests that an appropriate sociological interpretive analysis of current global climate change discourse requires a *ritual* as well as a *narrative* approach to climate change. The paper outlines three basic arguments: According to the *first* argument the making of the international climate regime has to be conceptualized as a *rite of passage.* Following the second argument, we entered the *liminal stage* of the passage ritual of climate action in the 1990s which empowered climate scientists to construct an anti-structural order in terms of an imagined global world risk community of climate change believers. This ritual stage is extremely delicate with reference to the public communication of uncertainties. With regard to uncertainties the third argument emphasizes that the IPCC, despite of scientific uncertainties, succeeded in preserving the institutionalized climate regime´s core identity based on the idea of a global "communitas" of climate change believers by installing rituals of evidence as well as by developing and refining a narrative grammar of confidence.

1 Introduction[1]

The environmental discourses of the 1970s and 1980s revealed not only that the current "nature" crisis is caused by unintended side-effects of human practices (Beck 1986). More importantly, they provided us with a new symbolic order by turning *nature out there*[2] (as opposed to human societies) into a *historical product* (Beck 1986: 107-108; Viehöver 2008). The anthropogenic greenhouse effect seems a case in point showing that *nature* at present, even on a global scale, is definitely under *human* design (Schneider 1989; Viehöver 1997). Global climate change made it apparent that mankind is now living in a *world risk society* (Beck 2007) in which, in spite of all scientific uncertainties (IPCC 2007), we need to think about what kinds of "society" and "nature" future generations *might* or *should* live in.[3] The question "*How to create a Green Modernity*?" has been raised on a global level (Beck 2010). However, the related scientific, public, and political debates on factual knowledge as well as on normative questions concerning climate change and the corresponding societal responses have been highly controversial (Viehöver 1997; 2003b; Miller 2001; Hulme 2009). Debates are characterized by a strong *conflict of interpretations* (Ricœur 2005: 32, 2010) on how to understand, evaluate and respond to the challenges of the (predicted) climatic changes. To analyze *how* societies create new knowledge orders is the task of interpretive social sciences as Sheila Jasanoff (1996; 2010) claimed. Yet, to be able to do so, one has to develop a valid theoretical frame of reference which goes beyond a linear model of scientific expertise (Beck 2010). Social and political sciences so far explain the making of the international climate regime out of the "spirit of politics" (Beck 2009: 94ff.), as a result of ongoing international and transnational negotiations (Miller 2001; Beck 2009: 127ff.) or related consent making activities (Adler/Haas 1992; Haas 1992; Oberthür/Ott 2000). But as Beck (2009; 2010), Hulme (2009; 2010a) and Jasanoff (2010) have indicated, the climate change debate so far falls short of taking *society*, rather than merely politics, appropriately into account. Hulme (2009) is right stating that climate change is a phenomenon which is reshaping the way societies think about humanity's place on Earth; the point however is to show how the process of refiguring climate change works if not simply by means of arguing and bargaining at the crossroads of science and policy.

Therefore, in the following paper I suggest that an appropriate sociological interpretive analysis of current global climate change discourse requires a *ritual* as well as a *narrative* approach to climate change. Climate discourses during the past decades argue that we are living in a state of transition (Gupta 2010). Since the blueprints of a future "Green Modernity" (Beck 2010) as well as factual knowledge on climate change are both highly controversial, a focus on *ritual* is a good starting point for a sociological perspective on climate action and the making of the international climate regime. Times of conflict are times of *social drama,* as the anthropologist Victor Turner (1969) once coined ritual activities. And social dramas are, as Durkheim has already told us, enacted in public ritual spaces. According to Whitehead (2004: 8), Turner believes that even modern societies refer to ritual processes "through which disputes develop and progress to some kind of resolution." Taking this stance I propose to go one step beyond the analysis of climate

[1] I am grateful to Stefan Boeschen, Peter Wehling, Ingo Schulz-Schaeffer and two anonymous STI reviewers for helpful comments on an earlier version of this paper as well as to Sarah Kolvenbach for correcting the final draft.

[2] For the modern concepts of nature see Groh/Groh (1991) and Collingwood (2005).

[3] See the contributions in the Theory, Culture and Society Special Issue on Climate Change introduced by Szerszynski/Urry (2010) as well as Hulme (2009; 2010a; 2010b).

negotiation processes. I suggest viewing regime making activities, the truth games of the Intergovernmental Panel on Climate Change (IPCC), and related narrative discourses, as an ongoing creative and dynamic ritual process.

This ritual process is fundamentally based on the anthropogenic global warming story. It forms the core identity of the regime of climate change believers. Keeping this in mind, and if we are inclined to follow the IPCC climatologist's discourse, the *anthropogenic greenhouse story* does not only offer *hard cognitive facts, facts* which demonstrate that global climate change has already or will have future serious un-intended impacts on environment, human beings and society (IPCC 2007a; 2007b; 2007c; 2007d). More importantly, the global warming story is to be seen as a "way of world making" (Goodman 1978) which provides societies with a powerful narrative on global change. A narrative, as the result of collective sense-making-activities, configures a meaningful "composition"[4] of events, causes, consequences, geopolitical spaces, time scales, attributions of responsibilities as well as an emerging environmental ethos (Ricœur 2007). Based on the global warming story during the past decades the boundaries between *nature* and *society, science* and *society* have shifted, and the self-understanding of modern (pluralist) societies and their interrelations have been reconfigured (Viehöver 2003a). In short, the global warming narrative not only opened up new *fields of experience,* but it provided – in terms of scenarios and related actions – also new *horizons of expectancies*.[5] The bearer of these framing activities and respective truth games has been an active scientific epistemic community, and above all the IPCC.

However, politicizing a global environmental crisis by means of narrative in terms of a coming climate *catastrophe* and re-framing the earth climate as a global *common good* (Heritier 2002) to be protected by concerted global climate action (Viehöver 1997; 2003b) is only the first step in the ritual process as a sense making activity. It does not show how the "*possible worlds*" (Ricoeur) narrated by climate scientists could become transformative for human behavior and attitudes, given the fact that we "disagree about climate change" (Hulme 2009). Exploring the question of *how* to govern the global common good climate adequately, by establishing a climate regime under conditions of uncertainty is an even more puzzling question.

To answer this latter issue in a sociological perspective, the following paper outlines three basic arguments: My *first* argument conceptualizes the making of the international climate regime as a *ritual process. Second*, I will show that in the 1990s we entered a new stage of climate action, which is probably the most interesting, because it allowed climate scientists to construct an anti-structure in terms of an imagined global world risk community of climate change believers. *Third*, it will be emphasized that the success of the international climate regime's anti-structure is achieved by installing *rituals of evidence* as well as by developing and refining a *narrative grammar of confidence*.

The following chapter 2 briefly outlines a narrative and ritual approach to regime building under conditions of uncertainty. Chapter 3 raises some hypothesis concerning ritualized truth games enacted in the emerging global public space. Subsequently the paper shows how the social and environmental drama of global climate change has institutionalized a core identity of the climate regime by means of a narrative on anthropogenic global warming (chapter 4). As chapter 5 shows,

[4] See Ricœur (1991a: 463ff.; 2007) for the concepts of narrative, narrativization and the act of plotting. For an application to the problem of climate change see Viehöver (1997; 2003a; 2003b).

[5] Concerning the status of these two historical meta-categories, see Koselleck (1996: 349-375).

over the course of its 20 years history, the climate regime's IPCC has developed some important institutional skills and strategies, that have enabled it to a.) render complex, ambiguous and uncertain knowledge communicable towards a large audience of laypeople and professional policymakers, b.) to cope proactively with the problems of scientific uncertainties, ignorance and unintended consequences of climate action c) and last but not least to keep its core narrative on anthropogenic global warming alive by ritualizing a new global symbolic order and its "communitas" of global warming believers.

2 A theoretical frame of reference: ritual processes and narrative refigurations of climate change

The IPCC, although being constantly under massive attack by climate skeptics (McCright/Dunlap 2000; 2003; 2010), is undoubtedly the legitimate institutional body governing society's experience of climate change and related risks perception. Up to these days the IPCC is the janitor of climate related truth games. According to it's self-perception, the IPCC speaks truth to political power by means of regular assessment reports. In this respect, the IPCC recently has been criticized for still promoting an outdated policy concept based on a linear model of expertise (Beck 2009; 2010). Climate sciences have even been blamed to detach factual knowledge from social meaning (Jasanoff 2010: 233ff.). This raises the question how the IPCC at the core of the transnational climate regime matters if not by way of a linear expertise. Clark A. Miller (2001; see also Jasanoff 2001) focuses on the coevolution of ideas and institutional order. He criticizes the assumption prevalent in political science and political sociology regarding the relation between knowledge and political institutions. He argues against the theoretical narrative according to which institutions, policy networks and transnational regimes emerge around shared factual knowledge. According to this concept of cognitive convergence, the constitution of consensus precedes the institutionalization of transnational or international regimes in the environmental policy domain (Haas 1992). Miller's (2001) own pragmatist view on the other hand points to the social interactions and related practices that allow for community building, the adoption of shared causal models as well as the social constitution of new moral orders. In this regard he emphasizes that we need to ask how and why certain ideas gain credibility (Miller 2001: 149). Miller stresses the fact that knowledge, the social norms, concepts of global society need to be constantly "renegotiated in specific institutional contexts" (Miller 2001: 249-259). I think, Miller (2001) is entirely right, stating that the emerging climate regime has become operative even without scientific consensus. Moreover, it has even been debated what consensus means (Edwards/Schneider 2001). In fact, it is the ongoing discursive deconstructions and constructions of certainty which makes the IPCC an interesting object of social scientific analysis. It is not by chance that the communication of certainty became a focal point of the 4th assessment report (IPCC 2007a; 2007b; 2007c). Although I fully agree with Miller's critique on the consensus model of policy advice, Miller's own negotiation model has left some puzzling questions to be unraveled.

First, how can the negotiation model appropriately address the logic of discourse? While it seems to be based on a concept of intentional speech act, it tends to underestimate the fact that complex discursive acts are *structuring* as well as *structured* events which are never fully reflected by negotiating agents.

Second, given that negotiation processes never take place in a discursive vacuum, but are always embedded in given and often competing (scientific) cultures, it hence needs to be shown,

how and when a (scientific) narrative is able to transform taken-for-granted knowledge (e.g. about the Earth's atmospheric system). The pragmatist approach hardly specifies the creative processes required for transforming a given symbolic order within negotiating processes nor does it indicate the cultural barriers to achieve a corresponding shift in symbolic orders (see Viehöver 2003a).

2.1 A narrative approach to regime building under conditions of uncertainty

My paper applies a narrative approach to the problem of institutional constitution and legitimation under uncertainty. I argue that (bio-physical) occurrences are related to synthesizing discursive acts of narrating, I follow Ricœur (1991b: 463ff.), who emphasizes that societies possess (fluid) symbolic codes, whose structures are best understood in terms of narrative (opus operatum) and narrativization (modus operandi) as principal human "ways of world making" (Goodman 1978). A narrative composition by making use of the inventive power of language, helps us for example to configure new modes of plotting, deconstructing taken-for-granted world views as well as creating (new) possible worlds and related horizons of expectancies (Ricœur 1991b; for an application see Viehöver 1997). In the light of a narrative approach, climate scenarios can be seen as concepts of possible worlds, worlds we want to live in or future generations might be forced to live in (e.g. the green house warming scenarios). These worlds might be utopian (greenhouse paradise story) as well as dystopian constructions (the runaway greenhouse scenario for example). Hence climate narratives recounted by (IPCC's) scientists provide us with climate related cognitive concepts: They teach us what climate is and how it "works". However, the (climate) narratives cannot be reduced to mere cognitive social order. A narrative order comprises socio-cognitive concepts as well as an ethical and moral framework, but it even goes beyond, in as much as narratives constitute the societies' socio-political imaginaries including its horizons of expectations (Ricœur 1991b: 475ff.). They translate single occurrences into a complex story; they provide a dramatic plot and organize forms of human *time* and *space* (see Ricœur 2007). The global warming story is such a consequential institutional narrative, retelling the (natural) history of our planet earth, based on a dramatic narrative plot (Viehöver 2003b). By telling the anthropogenic global warming story, the increasing epistemic community of "global warming believers" during the past 20 years of institutional history has opened up new horizons of possible worlds to come (vgl. Rahmstorf/Schellnhuber 2006: 46ff.). Changes in the conception of global climate change as well as the emerging climate regime's institutional moral order thus have to do with the narrative act of plotting (Viehöver 2003b). The results of the discursive acts of refiguring the planet's climate in the past decades became manifest in the different assessment reports. Moreover, in a condensed form the core beliefs on climate change have been institutionalized in the 1992 United Nations Framework Convention of Climate Change (UN FCCC) and the Kyoto protocol. The narrative act of plotting is a synthesis in at least three major respects (Ricœur 1991c: 426ff.):

First, the plotting activity *synthesizes the multitude of incidents or occurrences into a story*. Thus every incident selected by the narrative discourse, be it the outburst of a volcano, changes in solar activities, an extreme weather event or political events, contributes to the progress of the (climate change) story.

Second, the *act of plotting provides a temporal [and spatial order; W.V.] order*. The narrative plot transforms mere temporal succession into a configured human time, which gives a story its specific sense by integration,

culmination etc. (see also Jasanoff 2010).

Third, *the plot provides a matrix* (actants, modes of action, relations, conflicts, composes causalities etc.) for the story by unifying "components as widely divergent as circumstances encountered while unsought agents of action and those who passively undergo them, accidental confrontations or expected ones, interactions which place the actors in relation ranging from conflict to cooperation, means that are well-attuned to end or less so, and, finally, results that were not willed." (Ricœur 1991c: 426) As I am going to point out in chapter 5, the matrix also includes "narratives grammars" which structure the communication with lay people. What I shall call a *narrative grammar of confidence* is one such grammatical tool, which allows for a better communication of experts' knowledge to non-expert audience. Climate change narratives and the institutional success of the global warming story is only one element of the climate regime's success story. To understand how the climate regime coped with scientific uncertainty a change of perspective is demanded. Usually the making of the climate regime is explained out of the spirit of politics and related negotiated orders. I propose a new *sociological* vantage point conceiving the regime and the IPCC's truth games in terms of a ritual process. The climate regime represents a rite of passage, a ritual process which on the one hand governs societies in transition and on the other hand constitutes a medium for carrying out conflicts.

2.2 Ritual processes in societies in transition

Rituals are frequently considered to be the social glue of societies, performed to maintain a pre-existing social order. In this respect rituals and related symbols, myths or narratives appear to be mere representations of a given social structure. Several authors stress, however, that rituals are *processes* rather than being states. In the Durkheimian vein rituals are the medium to endow a sense of community. Rituals among participants generate affective commitment among societies' members, by making reference to sacred objects, collective symbols and myth (see for example Krieger/Belliger 1998). Rituals moreover confirm the boundaries of an existing community of believers and thus reproduce common categories as pillars of social order. Even Mary Douglas' (1970) writings on "natural symbols" and "purity and danger" focus on such integrative rituals in different social contexts. Different from the British structuralism, which underlines the integrative function of ritual processes, French structuralism treats rituals as *ritual speech*. In this sense rituals, if conceived as repeated speech acts, become narrative orders. According to Lévi-Strauss a ritual is composed of gestures, uttered words and performed objects, whereby gestures and objects are substitutes for words or complex narratives. Narratives and ritual texts are considered as expression of minds. Related analyses hence focus on the binary classificatory systems present in ritual expressions and respective narratives (mythologies). Thus divisions like nature/society, north/south, present/future, global/local as elements of the global warming story (see for example Viehöver 2003; Hulme 2010a) would be such binary oppositions of major interest for ritual analysis. Among others, they form categorical pillars for concepts like time, space, polity and community.[6]

[6] Although Jasanoff (2010: 233ff.) stresses the importance of those categories for current climate debate she underestimates the importance of science based climate change narratives, by claiming that scientific assessments have "detached knowledge from meaning". On the contrary it was climate science (and not social sciences) that provided a meaningful refiguration of sublunar space, framed the time spans for a coming dangerous anthropogenic warming effect, called for urgent international climate policy and the need for a new world order based on the (presumably idealistic) concept of a global community.

The different symbols and binary oppositions of ritual speeches according to French structuralism can only be fully comprehended if put in relation to another. In other words, one has to reconstruct the narrative in order to appropriately locate its underlying structure of binary opposition (Ricœur 2007; Viehöver 2003a; 2003b). The French Post-Durkheimian approach, however, remains too narrow because it is basically a cognitive approach. It insinuates that narratives and symbols in narrative contexts are 'good to think', to paraphrase Lévi-Strauss.

Whereas French structuralism treats rituals as symbolic speech and sheds light on textual classification systems and their binary oppositions, Victor Turner was interested in *what* the ritual dramas really do and *how* actors handle symbols during ritual processes. Thereby Turner emphasizes a strong relationship between symbols – narratives as I would prefer to say – and the ritual process (Turner 1969). Turner points out that symbols are not simply words, gestures and symbolic objects which are good to think, such as is the CO_2-Molecule as a sacrum of the climate discourse. Rather rituals bear also qualities of efficacy. Mathieu Deflem (1991) summarizes Turner's concept as follows:

> "Symbols are 'good to manipulate' and the handling of symbols 'works', because they are not just reflections of cognitive classifications, but also 'a set of evocative devices for rousing, channeling, and domesticating powerful emotions' (Turner 1969)."

Hence Turner's perspective is interesting for our analytical purposes in various respects: *First* it allows to combine the different strands of ritual analysis, keeping in mind that rituals are neither limited to 'cold societies' (i.e. societies without history), as Lévy-Strauss believed, nor are they static. Rituals are *processes*! *Second*, ritual processes are *performances* of cognitive as well as moral orders. A ritual involves, on the one hand a cognitive statement verbally uttered, on the other hand they develop a behavioral ethos. *Third*, ritual performances imply also elements of *affective commitment*, as the classic Durkheimian view assumes. Finally, Turner focuses not only on the symbolic interrelations within ritual texts, but on the *efficacy* of ritual symbols and performances.

What makes Turner's ritual analysis exceptional is the fact that he depicts them as *rites of passage*. He looks at them not as representations of a given social structure order but as eminent events in societies of transition. Rituals are means to broach the issue of climate change, to perform and mitigate or even resolve conflicts. Moreover, one could emphasize that rites of passage are the medium by which societies perform periods of transition, by developing three distinct stages of transition (separation, liminal stage, aggregation). The most important stage within the ritual process is the liminal phase, because within this period an anti-structural order is performed as well as a sense of *communitas* created. This is the point, I think, which makes ritual analysis a very interesting perspective on the international climate regime and the IPCC's truth games.

3 Coping with scientific uncertainties and ambiguities: the role of rituals and narratives – some hypotheses

How does the transnational climate regime cope with scientific uncertainties and ambiguities? New institutional theories generally view institutions as means for reducing uncertainties (March/Olsen 1989; Powell/DiMaggio 1991). The climate regime, however, concerning this matter remains a puzzling case. First, the making of the international climate regime can neither be explained by a given preference structure nor by existing systems of appropriate governance. Rather it needs to be shown, how a new logic of institutional appropriateness has been configured and subsequently stabilized despite of ongoing debates on scientific uncertainties. Second, the case of

the climate regime reveals the limits of the linear model of scientific expertise. However, although the IPCC is the core organization for collecting, assessing and advocating scientific advice within the climate regime, it has not been the harmonizing force it was expected to be (Miller 2001; Hulme 2009). Rather scientific uncertainties remained to be a major topic of public and political debate up to the present. Third, although one could consider the establishment of the climate regime as well as the subsequent negotiation of the Kyoto-protocol as a successful institutionalization of environmental policy (Oberthür/Ott 2000), it seems to be crisis ridden since the beginning of the 1990s. How then were the IPCC's scientific representations of the climate systems able to gain amazing persuasive power and stability? I think that the societal role of IPCC could be better comprehended, if we take it not so much as a hybrid organization acting at the crossroads of science and society (Beck 2009) but as a ritual body processing expertise in front of an emerging global public space. The paper hence provides a new vantage point for deliberating on the legitimacy of the climate regime, showing how *legitimation* under conditions of continuous scientific uncertainty works in terms of a ritual drama. A drama, within which the emerging world risk society resituates given concepts of nature and culture. With respect to this I want to develop three arguments.

(1) My *first* argument suggests to conceptualize the constitution of the international climate regime as a *ritual process*, a process which can be described as a central part of a still ongoing *rite of passage* (van Gennep 1960; Turner 1969). Rites of passage are processes of symbolic action which can be divided into three main stages: first a phase of *separation*, second the *liminal* phase where the state of the ritual subject is highly ambiguous and a third post-liminal stage of *re-aggregation* (i.e. a new stable state of social order). Ritual orders are tightly related to narrative orders. In this respect the making and the public diffusion of the *global warming story* until the late 1980s has been the major ritual effort during the phase of separation (1970-1990). The narrative on a coming anthropogenic climate change has been the symbolic vehicle to put into question industrial societies' goals and values as well as their dominant *concept of nature*. Trace gases, above all the CO_2 molecule became the core symbolic objects not only to reflect on the dominant *nature/society* dualism, to deliberate on climate pasts/futures or on global/local climate spaces and time spans (Beck 2007; Viehöver 2008; Hulme 2010a). Integrated into the plot of the global warming story, they have also been the ritual tool of scientific epistemic communities to mobilize climate action (Viehöver 1997; 2003b; Weart 2008). Thus global climate change narratives and their main symbolic objects (e.g. trace gases) are not only good to provide a new cognitive and moral order, but an evocative device for "rousing, channeling, and domesticating powerful emotions" in order to mobilize collective action (Deflem 1991: 11). Stories can create solidarities!

(2) In the 1990s we entered a new stage of climate action, which could be described as the *liminal stage* of a passage ritual. What I want to show, is that during this liminal stage, which currently might still be going on, *societies*, their *individuals* as well as *nature* got an ambivalent and inter-structural status; they became betwixt and between (Turner 1964). The focus of interest in this stage shifts from merely politicizing nature's crisis to problems of how to appropriately *govern* the emerging global community and the newborn global common good "climate". This ritual stage is *first* characterized by high degrees of scientific uncertainty and ambiguity concerning the status of *nature*. The regime tries to cope with uncertainty by means of the IPCC's assessment reports and the annual Conference of the Parties

(COP). *Second*, the phase is also characterized by the collective activities of deconstructing and *refiguring the familiar belief systems* – based on the idea of a sustainable development – and related classificatory categories (culture/society; past/present/future; global/local; science/public). In order to create the outline of a new moral world order, the climate regime needed to institutionalize its basic creed, i.e. the belief in an anthropogenic global climate change (UN FCCC 1992) as well as a program for common climate action (Kyoto Protocol 1997). In this respect one could say that the making of the global climate regime has contributed to the emergence of an anti-structural ethos for sustainable development (UN FCCC 1992) which has become a keystone in transnational environmental policy making (Breitmeier 1996; Oberthür/Ott 2000).

There is, however, another important characteristic of the climate regime and its activities and this is the point where the notion of *society* comes into the ritual play. Through the lens of Turner's theory of ritual processes, the social drama creates a *space* of a social "world in becoming" (Turner 1974: 24).[7] In this respect the climate regime has to been seen as a ritual effort to create a new global "community" or better, as Turner calls it: *communitas*.[8] *Communitas* denotes a kind of emergent comradeship among the liminal personae – be it individuals, organizations or nation states. The creation of a global *communitas* as opposed to the challenged order of (egoistic) nation states is, however, the very problem of this ritual stage. It has to relate the new *cognitive beliefs* (i.e. the human fingerprint) and the new *ethos* of the world risk society (sustainable development) to the idea of an imagined world community. This has turned out to be a difficult task, and this brings me to my third and last argument.

(3) The climate regime, since the early 1990s, besides internal institutional self-critique, continuously has to cope with public discourses on scientific uncertainties and ambiguities related to global climate change (see, among many others SV GUA 2003; McCright/Dunlap 2000; 2003; 2010). As a consequence it has been permanently afflicted by institutional crises, without, however, harming its institutional core belief on anthropogenic global warming. On the one hand the climate regime currently recollects its institutional memory as a success story (Pachauri 2009a). On the other hand, while negotiating the Kyoto protocol pursuant in the run-up to the Copenhagen Conference, it was again forced to call for further urgent action, because the institutional goals of the UN FCCC (1992) still cannot be appropriately achieved in following current climate policies (Pachauri 2009b). Hence, the puzzling question to be examined is: How are these two opposite and apparently contradictory assessments, "success" and "failure", mediated or reconciled by ritual climate action in front of a global public space? Even though the scientific basis of the climate regime has been continuously challenged by climate skeptics the IPCC remained the main ritual watchdog of this ritual stage. This begs the question on why the IPCC remained the legitimate authority to represent the object climate, notwithstanding the IPCC had serious problems to render truth claims communicable to public and policy makers (Bray/von Storch 1999; Weingart 2001). In this regard my *third* argument emphasizes that the climate regime succeeds preserving its institutionalized

[7] Beck (2010) and Hulme (2010a) seem to see the emerging world community gulf in the realization of a new cosmopolitan idea.

[8] It is hardly enough to speak about a coming cosmopolitan world order as do Beck (2007; 2010) and Hulme (2010a). From a sociological point of analysis it rather is to show *how* such a world community could come about. The ritual approach is to explain the making of a global *communitas* as a precondition for a possible cosmopolitan word order based on principles of a sustainable development.

core identity based on the idea of global "communitas" by installing *rituals of evidence* and by developing and continuously refining a *narrative grammar of confidence*. Organizing *rituals of evidence* means to ritualize truth games in the public space. Whether these developments are sufficient to keep alive the imagined community of climate change believers in the future remains an open empirical question.

4 Refiguring and ritualizing the symbolic order of global climate change

4.1 The global warming narrative and the configuration of new boundaries between Nature and Society

To look at climate action in a ritual perspective first requires depicting the three stages of a passage rite. To put it in a nutshell, the period of agenda building from the 1970s to 1990s can be characterized as the ritual stage of separation. Since the constitution of the IPCC and the subsequent making of the climate regime FCCC the ritual process has entered the *liminal* stage, "when the state of the ritual subject is ambiguous" (Deflem 1991: 8). I think we have not yet fully entered the post-liminal period within which societies acquired a new stable state; but I will briefly take up this argument in the concluding remarks. The following section thus mainly focuses on the middle liminal phase of the rite of passage, which is, as some scholars seem to believe, accompanying national societies on their way to a cosmopolitical order of a greening world risk society (Beck 2007). Rites of passage start with the preliminal stage of separation. Thus we need to identify an exegetical ritual actor who is able to herald a state of "crisis", which denotes a breach within the normal process of societal reproduction. I maintain that this has been done by means of the global warming narrative, keeping in mind that the narrativization of (natural) events on the one hand constitutes a new cognitive, moral and symbolic order. Telling a story is a sense making activity a way of world making. On the other hand the act of telling a story on global climate change is itself a complex speech act directed to a public audience (Ricœur 2004: 209). In this pragmatic sense, narrating is inviting public as well as policy makers to act. Hence storytelling rather than negotiating has been the beginning of the regime building process. The narrative evokes a coming climate catastrophe caused by anthropogenic action and the lifestyle of Western cultures (Viehöver 2003b). This narrative configures the climate catastrophe on a discursive level as a possible turning point in (Western) industrial societies. Trace gases, above all the CO_2 molecules became the sacra of the global warming story and in this sense they were good to think.

The global warming story has been the result of collective sense making activities of a growing discourse coalition of global climate change believers (Viehöver 1997). The global warming story presents not only a sharp critique of western lifestyles and points to the increasing scarcity of natural resources. Moreover the science based collective narrative on a coming climate catastrophe institutionalized in the FCCC in the early 1990s also developed a new sense of institutional appropriateness for governing environmental problems as well as it proposes a concept of an emerging world community. A new sense of community, however, cannot be provided by an overarching global warming narrative alone. What is needed is a ritual drama in order to create a new anti-structural order.

As I have outlined elsewhere (Viehöver 1997), one can in fact identify a growing epistemic community of global warming believers, which in the 1970s and 1980s developed a powerful narrative on anthropogenic global climate change. The climate change narrative provides with a new conception of the planet Earth. It developed models of

climate systems and climatic change. Furthermore it began historicizing the concept of climate and climate change. And finally it identified *mankind* as the new driving force of global climate change and its unintended side effects. It furthermore accented societies with new concepts of time and space and it blamed mankind for being the cause of a coming environmental *and* societal crisis. One has to underscore that the stage of separation has to be seen largely as a ritual play which took place in an emerging global public space. The global warming story thus has to be seen as the founding narrative of what U. Beck has called the world risk society. One could say that with the constitution of the climate regime the new and politicized symbolic, cognitive and moral conception of the atmospheric spaces and related climate systems became institutionalized.

With the foundation of the IPCC (in 1988) and the making of the climate regime we entered the liminal stage of the ritual process. It has to be accentuated that this anti-structural order has not been a commonly shared knowledge order concerning the causes and effects on global temperature rise. On the contrary, not only the global warming epistemic community itself conceded in its intermedium report, the first assessment and the 1992 supplementary report major scientific uncertainties and disagreements. Moreover, especially in the US, we find a rather strong oppositional epistemic community based on a media and science fiction narrative, which during the 1990s had been highly successful in deconstructing major claims of the global warming discourse coalition (McCright/Dunlap 2000; 2003). Consensus thus has not been a precondition for regime building, if at all it has been manufactured within this process (Miller 2001). Thus constructing and deconstructing certainties has been a central part of the discursive struggles between opposing epistemic communities. The debate on uncertainties has been heavily amplified by the mass media (Edwards/Schneider 2001). The communication of and the treatment of uncertainties in front of a growing public and public audience has been a major task of the IPCC at the core of the transnational climate regime since its constitutive period. Staging truth games in front of an emerging public space cannot be done by mere factual knowledge coined in scientific language games. This made the ritual process of climate related truth games an even more complex task: *First* scientific knowledge had to be translated for non-expert readers. *Second* because the IPCC's expertise has been permanently put into question by climate skeptics, communicating uncertainties became a focal point of the IPCC's activities. I maintain that by means of the global warming narrative the emerging climate regime has been able to cope with uncertainties and categorical ambiguities, or to put it in Ricœur's words, to compose and recompose dissonant events to a consonant, comprehensible and credible narrative. How does this work?

Turner's concept of liminality contains three components of communication: first the communication of sacra, second the deconstruction or refiguration of familiar beliefs and cultural configurations, third the simplification of the social structure, i.e. order is substituted by the concept of *communitas*.

Concerning the communication of sacra trace gases as symbols of evil have gained the status of sacred objects of communicating global risks. Another sacrum woven into the global warming story is the identification of the *human fingerprint*. In this respect the most outstanding step in this still ongoing process of narrativizing climate change has been the institutionalization of the climate change story in the United Nations Framework Convention on Climate Change (UN FCCC 1992) stating that the parties to the convention *acknowledge*:

"that the change in the Earth's climate and its adverse effects are a common concern

of humankind, *Concerned* that human activities have been substantially increasing the atmospheric concentrations of greenhouse gases, that these increases enhance the natural greenhouse effect, and that this will result on average in an additional warming of the Earth's surface and atmosphere and may adversely affect natural ecosystems and humankind, *Noting* that the largest share of historical and current global emissions of greenhouse gases has originated in developed countries, that per capita emissions in developing countries are still relatively low and that the share of global emissions originating in developing countries will grow to meet their social and development needs of greenhouse gases" (UN FCCC 1992: 1).

The UN FCCC in this context not only makes allusions to an imagined global community (humankind) to which climate change is a common concern, it also provides cognitive attributions of the causes of the assessed global warming process (UN FCCC 1992: 1; see also Art 1 Definition 2.). It attributes them to anthropogenic activities such as burning of fossil fuels, agriculture and deforestation. What the UN FCCC climate change narrative fundamentally does is testifying and acknowledging that the boundaries between nature and societies have been blurred by human activities. By recomposing the symbolic code of globalizing societies, the institutional climate change narrative underlines that the Earth's climate could no longer be seen as just something out there. Rather it confirms that Descartes' world is fallen. We need to conceive *nature* and the climatic system in specific as part of our own social history (see also Hulme 2009). The atmospheric processes, if we follow the IPCC's assessment reports I. (1990), II. (1996), III. (2001) and IV. (2007) became a historical product.

The global warming story is also a reconfiguration and interpretation of the changing biophysical world, which neither makes reference to transcended beings that punished sinful human behavior, nor to nature which endangers societal progress. On the contrary it is mankind that unintentionally has turned nature into a historical product, a 'historical fact' which now "may adversely affect natural ecosystems and humankind" (UN FCCC 1992: 1). Although the framework convention's text makes already clear statements and attributions concerning the directions and causes of and additional global climatic change, on the other hand it also frankly acknowledges that there remain many uncertainties.

"Noting that there are many uncertainties in predictions of climate change, particularly with regard to timing, magnitude and regional patterns thereof, Acknowledging that the global nature of climate change calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, in accordance with their common but differentiated responsibilities and respective capabilities and their social and economic conditions" (UN FCCC 1992: 1).

In this respect the climate change narrative of the UN FCCC underlines the continuous needs for reevaluations and it hence empowers the IPCC's role of scientific, technical and economic advice. Uncertainties are hence built into the UN FCCC as the core of the regime's institutional narrative.

"*Conscious* of the valuable analytical work being conducted by many States on climate change and of the important contributions of the World Meteorological Organization, the United Nations Environment Programme and other organs, organizations and bodies of the United Nations system, as well as other international and intergovernmental bodies, to the exchange of results of scientific research and the coordination of research, Recognizing that steps required to understand and address climate change will be environmentally, socially and economically most effective if they are based on relevant scientific, technical and economic considerations and continually re-evaluated in the light of new findings." (UN FCCC 1992: 2)

The text of the UN FCCC quoted above is interesting insofar as it calls for what I would like to call the ritualization of evidence. The subsequent installation of the Conference of the Parties can be seen as such an indicator for the ritualization of evidence. The regular publication of assessment reports and the meetings of the different IPCC working groups can be taken as

further support to this argument. One should add, that the attribution of climate change made in the text, the parties agreed upon in June 1992, was even more decisive than the first scientific assessment report the convention rests upon (The Convention was ratified and set into force in May 21. 1994). The summary of the Working Group I report confirmed as "certain" that greenhouse gas emission, resulting from human activities, are increasing the trace gas concentrations in the Earth's atmosphere and it stressed that the global mean temperature increased by 0.3 – 0.6 degrees during the past century (i.e. 1890-1990). The story introduces new concepts of time (past/future), for example it underlined that an unequivocal detection of the anthropogenic global warming effect was supposed to be not likely for a decade or more. The 1992 supplementary report did not yet change this assumption. Thus even after agreeing on the framework convention, cognitive uncertainties and boundary ambiguities remained a major concern for scientific, public and political debates and therefore an urging question for the legitimacy of the climate regime itself. The first clear IPCC attribution of anthropogenic causes of the contemporary climate change has been published only in the second Assessment report in 1996.

> "Our ability to quantify the human influence on global climate is currently limited because the expected signal is still emerging from the noise of natural variability, and because there are uncertainties in key factors. These include the magnitude and patterns of long-term natural variability and the time-evolving pattern of forcing by, and response to, changes in concentrations of greenhouse gases and aerosols, and land surface changes. Nevertheless, the balance of evidence suggests a discernible human influence on global climate." (Houghton 1996: 5)

Although the IPCC report – besides confirming further increasing trace gas concentration, progresses in distinguishing natural and anthropogenic causes of global warming, as well as improvements in modeling future climates (scenarios) – still admits uncertainties, e.g. concerning a quantification of anthropogenic influence on global climate, it emphasizes the existence of an discernible human influence for the first time. This statement again triggered a larger debate on the trustworthiness of climate science and the reliability of the IPCC peer review processes (Edwards/Schneider 2001). This debate in contrast did not prevent most of the member states of the FCCC to agree on a first binding agreement in order to meet the central objectives of the framework convention on the third conference of the parties in 1998.

The 2001 third assessment report (SAR), according to the IPCC scientists brought further and stronger evidence for the human fingerprint in global climate change and it added new related space and time scales to the IPCC's global warming narrative. But the ongoing debate forced the IPCC to make uncertainties a focal point of the 4th assessment report. The further debate concentrated not only on statements concerning the estimates and ranges of past climate warming, but on ranges of future average surface temperature increases (1.4-5.8 Celsius degrees over the period 1990-2100) or projected sea level rises (0.1-0.9 meters in the 1990-2100 period) due to anthropogenic CO_2 emissions. scenarios – reaching from a pessimistic "business as usual" scenario to rather optimistic blueprints, which imply drastic reduction in trace gas emissions – and related models moved to the center of the critical debate (possible world scenarios; see for example IPCC 2007a: 18).

With the introduction of the different scenarios, the story of a global greenhouse in the IPCC's third (and fourth) assessment reports turned out to be what Ricœur (1991b) called a „bearer of possible worlds". The global warming narrative got even more complex because it reconfigures now assumptions concerning occurrences in a climate past, assessments on the actual climates and its driving forces, and projections on future climates caused

by past, present and future human (and natural) activities. These plural *horizons of expectation* became relevant for actual policy choices and of course for further debates on uncertainty and ambiguity concerning the boundary situations described by the IPCC. On the one hand scenarios of the possible planetary decay have been introduced, on the other hand the scenarios are designed to model possible paths out of the impasse. Between the third and the fourth assessment report uncertainties became a cross cutting theme for the IPCC review and assessment process as well as the public communication with potential users on the assessment's results. One could say that uncertainty itself became a sacrum of the climate change stories.

Manning/Petit (2003) proposed a classification of uncertainties concerning: 1. incomplete and imperfect observations (scarcity of data, systematic or calibrating errors); 2. incomplete conceptual framework (e.g. models which do not include all relevant processes); 3. inaccurate prescriptions of known processes (requiring intermodal comparisons); 4. uncertainty due to properties of the concerned system (chaos is related to processes where future states of a system might be extremely sensitive to small changes in the initial conditions of a system or a given system's equilibrium); and 5. lack of predictability (e.g. concerning rates of climate related technological inventions and innovations.

Most of those questions of uncertainty and ambiguity have been addressed and further developed by the synthesis and evaluations of the IPCC's 4th assessment report and its summaries for policy makers. This recognition and discussion of uncertainties point to the fact that climate related knowledge has to undergo complex *processing of uncertainty, ignorance and ambiguity* (Wehling/Viehöver/Keller 2005: 149ff.). The physical basis of the changing understanding of the global climate change has been repetitively described in the publications of the Working Group I of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change published in 1990 (FAR), 1996 (SAR), 2001 (TAR), 2007 (4AR), this again shows that evidence is ritualized by the IPCC. But, as stated above, the global warming narrative offers more than a new cognitive order to gain credibility.

4.2 A new moral of global affairs: the climate regime's creed

The second component of liminality according to Turner is the deconstruction and reconfiguration of familiar cultural belief. In this respect the global warming story recounted by IPCC's scientists and institutionalized in terms of the UN FCCC is much more than a simple cognitive reinvention of the sublunar space (Viehöver 1997). It reflects the given basic values and suggests a new anti-structural order in terms of the idea of a sustainable development. Beginning in the early 1990s, the emerging climate regime succeeded in establishing a specific creed, i.e. that man is responsible in triggering off a process of global warming with negative impacts on nature as well as on societies, individuals. But the "ultimate objective" of the Framework Convention on Climate Change (Art. 2) is the „stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the Climate" (UN FCCC 9.5.1992). Thus the climate regime has been designed to establish a new ethos of global affairs (see also Miller 2001: 247ff.) in order to prevent dangerous interferences between human practices and the climate system and related biota (UN FCCC 1992: 4 Article 2 Objective). Moreover, it moved towards the establishment of legally binding agreements on how the international community could and should meet the Conventions objectives.

"The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the

atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner." (UN FCCC 1992: 4 Article 2; Objective)

The definition of what the prevention of dangerous anthropogenic interferences means, makes clear attributions with regard to the meaning of adverse effects and the causes of the global climate change.

"(1)'Adverse effects of climate change' means changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition resilience or productivity of natural and managed ecosystems or on the operation of socio-economic systems or on human health and welfare. (2) 'Climate Change' means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." (UN FCCC 1992: 3 Article 1; Definitions)

The adoption of the rather hybrid concept of a sustainable development is what could be called the core ethical creed of the Convention's ethos. In this sense the UN FCCC (1992: Art. 3) institutionalizes a new anti-structural order, the idea of a sustainable development.

"(4.) The Parties have the right to, and should, promote sustainable development. Policies and measures to protect the climate system against human-induced change should be appropriate for the specific conditions of each Party and should be integrated with national development programs, taking into account that economic development is essential for adopting measures to address climate change." (UN FCCC 1992: 5, article 3; principles)

The planet's atmospheric system, as another ritual sacrum, was now considered a global common good to be protected by the conditioned, coordinated and cooperative actions of the parties. The conception of the climate system as a common good to be protected can be seen as a sacrum of the anti-structural normative order. This brings us to a third component of liminality, the simplification of social structure within the ritual stage of liminality. Turner claims that within ritual processes a sense of *communitas* is invented. The idea of *communitas* is opposed to the real complex social structure (i.e. anarchic world order of nation states). Communitas is designed to create a feeling of "comradeship among the liminal personae" (Deflem 1991: 14). One could say that in the beginning of the ritual process the scientific narrators of the global warming community constituted a spontaneous sense of communitas. The global warming story formed the generic bond among this generic group of believers. With the institutionalization of the global warming story in the framework of the UN FCCC this sense of communitas became normative, it musters the members states under the idea of sustainable development. To be clear, *communitas* is not a real community it rather is an imagined community of climate change believers, temporally united to safeguard the planet's climate system.

"The parties should protect the climate system for the benefit of future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly the developed country Parties should take the lead in combating climate change and the adverse effects thereof." (UN FCCC 1992: 3 Article 1; Principles)

One could furthermore show that the distinction of developed and developing countries is another ritual simplification made in the liminal stage of the climate ritual. The convention attributes major responsibilities to the (most) developed countries (Annex I states) and it concedes specific needs to the most vulnerable ones (e.g. AOSIS states), as well as a series of specific rights to developing countries. The regular meeting of the Conference of the parties, the constitution of further subsidiary bodies and the negotiation of the so called Kyoto Protocol can be seen as the first successful

steps to concretize the anti-structural order and to give it a legally binding fundament, the so-called Kyoto-Protocol (accepted in December 1997 on the third Conference of the parties) encompasses the legally binding goal to reduce anthropogenic greenhouse gas emissions. Accordingly industrialized countries are obliged to reduce the amount of six trace gases at least by 5.2 %. Reduction goals should be met in the period 2008-2012. The enactment of the UN FCCC and the Kyoto-Protocol did not bring an end to the problem of uncertainty of scientific knowledge. Still some put into question the institutional legitimacy of the IPCC by putting into question the very existence of anthropogenic warming, or by doubting its negative impact on humans, societies and ecosystems. The major debate has now shifted to the inadequacy and insufficiencies of the protocol itself. In the next section I would like to reflect on two skills by means of which the IPCC tried to cope with the problem of communicating uncertainties.

5 Climate truth games on the public stage

Apart from the recent crisis of the IPCC's credibility ("Climategate"; see Beck 2010), there have been several examples in the climate regime's twenty years history, showing that a fundamental institutional crisis, was always virulent. Especially the US-American position in the negotiation processes has been supported by a strong epistemic community of climate skeptics who pushed questions of uncertainty into the foreground. McCright/Dunlap (2000; 2003; 2010) have shown how American think tanks challenged the very existence of the global warming effect, or its urgency as a social problem. Some even re-narrated the green house story as a greenhouse paradise narrative emphasizing the possible benefits of future global warming. Another critical event has been the release of the second IPCC's assessment report because it also triggered a wide public debate which touched the very core of the climate regime as well as the trustworthiness of the IPCC (Edwards/Schneider 2001). What was at stake here is in fact its institutional identity (Somers 1994). I would like the reader not to take the term identity as something entirely unchangeable. Rather it is to be grasped in more dialectical terms (Ricœur 2005). On the one hand as something which requires the maintenance of the institutional character and related values (i.e. sustainable development, the detection of a human fingerprint) and on the other hand as something that needs continuous imagination in order to provide further institutional credibility. Concerning institutional fidelity major efforts in the IPCC's Assessment Reports have been made to provide further credibility to the assessments of evidence of the human fingerprint in climate change (see also Rahmstorf/Schnellnhuber 2006). The question was how to respond to skeptics without giving in on the institutional core objective. As the discussion after publishing the second assessment report indicates, the IPCC was able to cope even with harsh criticism which puts into question the core assumptions according to which human activities are responsible for the ongoing global warming process and its expected negative impacts (Edwards/Schneider 2001).

This raises questions of how the climate regime was able to gain credibility by coping with conditions of continuous ambiguity and uncertainty. The existence of hybrid organizations like the IPCC (or the subsidiary Body for scientific and Technological Advice (SBST; since 1995) alone was not enough. Even the climate regime's constitution (i.e. the UN FCCC) and its leading principles, norms and rules did not guarantee credibility and legitimation. I think that the first institutional answer given by the climate regime is what I called the installation of *rituals of evidence*.

The imagined global community – communitas in Turner's sense – needs science based rituals which keep alive the constitutive narrative of the climate regime, the anthropogenic global warming story. I see rituals of evidence at work at various levels of the climate regime. First I would point to the Conference of the Parties (COP) which usually takes place on a regular yearly base. Second I think the publication of assessment reports is to be seen as an element of such rituals of evidence. Third, the different meetings of the working groups as well as other expert meetings (e.g. IPCC meetings on the detection and attribution related to anthropogenic climate change) have to be conceived as rituals of evidence. There is however another ritual skill the IPCC has used to cope with uncertainties. This has to do with the fact that states of scientific uncertainty require *explicative discourses* that mediate between climate experts and their diverse public audiences. To become more comprehensible and credible the IPCC has provided a so-called "rolling assessment" process (Edwards/Schneider 2001). Within this process the IPCC developed a dispositive which I would like to call a *narrative grammar of confidence*.

5.1 The imagined community of climate change believers and the need for rituals of evidence

It is Rajendra K. Pachauri, at present IPCC Chairman, who addresses the problem of unintended consequences of institutional success of the climate regime, with the IPCC at its scientific core, in his opening speech at the 30th Session of the Intergovernmental Panel on Climate Change in Antalya (Turkey) on 21st April 2009. He stresses:

> "Our work emphasizes the policy relevance of the assessments we produce, and if this is going to remain the hallmark of our work we must understand the shifting landscape on which our work must be based. And in understanding this aspect we would also have to grasp the rising expectations of our audience which is now better informed, much more seized of the urgency of new policies and actions in the field of climate change, and, therefore, more impatient in seeking new findings of the IPCC. To a large extent, we are now facing the consequences of the success achieved by the Panel, credit for which must go collectively to all the distinguished delegates present in this room and the thousands of scientists who have toiled hard over the years." (Pachauri 2009a: 1)

Thus on the one hand we find important ritual manifestations of IPCC's institutional history including its increasing policy relevance, such as emphasized by the IPCC chairman Pachauri.

> "This meeting represents an important milestone in the history of the IPCC (…). The IPCC in its twenty plus years of history has established an outstanding record of assessing all aspects of climate change, of which all of us are proud. The award of the 2007 Nobel Peace Prize was the crowning moment in the distinguished record of scientific endeavor that governments of the world from north and south, east and west have fostered and built over the past two decades, and which has been the result of remarkable teamwork on the part of the international scientific community." (Pachauri 2009a: 1)

On the other hand we face alarming news such as the warning released by the German insurance company "Münchener Rück" which insinuates that one of the major side effects of the current global economic crisis might be a further loss of interest in environmental issues related to global climatic change (SZ Tuesday 17. February 2009, Economy, No. 39, p. 19). In the same vein, the United Nations negotiations on a future Kyoto pursuant protocol, held in Bonn (April 2009) have been widely criticized as being without any remarkable results; the same holds true for the Copenhagen Conference held in December 2009 (Grubb 2010). Other critics maintain that the Assessments of the Third and Fourth IPCC's Assessment Reports are already outdated and thus not representing actual states of atmospheric changes (e.g. carbon equity report on arctic summer 2007). What are the lessons to be drawn from these rather ambivalent estimations? If the IPCC has a key role as a guardian of credibility put into

charge to safeguard the regime's core identity, how it is possible for the IPCC agents to contribute to the maintenance of institutional legitimacy, while the regime seems to constantly be under attack? As Miller (2001) has pointed out, to understand the ambivalent status of the climate regime, we need to readdress the following question: What kind of institution is the transnational regime?

As stressed above, we can hardly conceptualize the climate regime as a problem solving institution which simply has to translate a consensual taken-for-granted sound expert knowledge into concrete mitigation policies (see Edwards/Schneider 2001; Miller 2001; Jasanoff 2001). The commitments made by the members of the Annex I and Annex II states to the UN FCCC (1992) in order to protect the global common good atmosphere have been made despite of continuing scientific uncertainties (Miller 2001; Edwards/Schneider 2001). As Miller has emphasized against the cognitive convergence approaches we need to explore how ideas and related knowledge can acquire credibility among the diverse public audiences. I take his point, but as I have stressed above the climate regime is not a simple negotiated order, as Miller seems to believe. Even if we agree with his assumption that shared ideas and organizational structure co-evolve (COP; UN FCCC; Kyoto Protocol etc.) in ongoing negotiation processes (Miller 2001: 248ff.), we need something that has motivated a critical mass to move and which has finally mobilized passive public or political audiences (e.g. national governments or NGOs) to start, and get actively involved in negotiation processes. Additionally, one needs to identify the entities that structure the communication once negotiations had begun. As shown above, I think the global warming narrative by framing climate change as a coming catastrophe provided with the appropriate "vocabulary of motives" (C.W. Mills) which was able to mobilize political negotiations and mark a turning point in the process of modernization by defining the planet's climate system as a global common good to be protected (Viehöver 2003a). This narrative has itself been transformed and refined by the growing epistemic community of global climate change believers by adopting and disseminating the idea of a global community cooperating in order to maintain the common good atmosphere. This is what I have called the creation of a sense of global "communitas" (Turner 1969), i.e. imagining a global collective in a liminal state, characterized by ambiguity and potentiality as well. This was to say that the IPCC is not a simple truth machine. Rather it is an institution that tries to transpose new, but highly ambiguous experiences (causes and effects of the warming planet) and horizons of expectancies (scenarios) into a sense of an imagined global communitas. *Communitas* is not yet a real community I would emphasize again, but an idea. If it could become more is an open question. It could be an interesting starting point for further deliberation on this point, as Sheila Jasanoff (2001: 312ff.) has proposed, to have a second look at Benedict Anderson's (1983) concept of "imagined political communities". The environmental cosmopolitan idea, around which the climate regime emerged, tends to challenge, if not erase given institutional boundaries in terms of the global warming story. This holds true not only for the taken-for-granted boundaries between nature and society, but also for those of "national" nation state based policies. We can see that the transnational climate regime is something which is currently challenging the idea of nationhood by means of the old Durkheim (1994) notion of increasing interdependencies. Moreover, the emerging global "communitas" imagined by the climate change believers neither has *clear boundaries*, nor is it *sovereign*.[9] Thus three of the

[9] Benedict Anderson stressed four features of nationhood: a nation is imagined; a

four criteria Anderson used to define imagined communities of nationhood would not fit the cosmopolitical narrative of the transnational climate regime. We hence have to push Anderson's idea of imagined communities a little further. I would propose to take *ambiguity* as a starting point to characterize the climate regime. If it is true that the knowledge on global climate change is still characterized by uncertainties, categorical ambiguities and even by ignorance and unpredictability, we best conceive the climate regime and the IPCC as its guardian of truth itself as a *liminal institution,* or to put it in terms of Victor Turner (1989), as an anti-structural order. The leading principles, norms, rules and procedures – used to characterize international regimes in regime theory (Keohane/Haas/Levy 1993) are hence – the "for-the-time-being – outcome of an ongoing ritual process not its prerequisite. Factually the global climate regime is a liminal institution designed to govern a world in transition. I have described the first two stages of this transition in terms of a ritual order, consisting of three major ritual sequences: a.) separation (indicated by the narration of a coming climate catastrophe), b.) liminality which becomes manifest in the formulation of an anti-structural order (e.g. UN FCCC; Kyoto Protocol), c.) restructuring or transformation (i.e. the still utopian concept of sustainability).

One could say that the global warming story has been the main vehicle since the early 1970s used in order to dramatize the non-intended consequences of modern industrial risk societies (Beck 1986; 2007). It rewrites our planetary cosmos by refiguring the biophysical world as well as human relation to biosphere and it sparks a new sense of *communitas*, which is of course still far from being a real community. The global warming story has thus been framed to mark a turning point needed in global environmental policy as well as international relations. At present the main institutional task of the IPCC within the climate regime still is to keep alive the idea that emerging world risk societies are self-endangering their societal as well as the planet's natural reproduction. This is mainly done by the assessment report of Working group I and II of the IPCC.

As Edwards/Schneider (2001; Schneider 1993; 1994) have stressed the scientific observation of the changing atmosphere needs constant reassessment. The same is required for the public communication on the narrated risks of climate changes in the ongoing policy making process. Ritualizing the state of transition can thus be seen as an answer to one of the major challenges for the climate regime, the problem of how to manage with scientific ambiguities and uncertainties. What Edwards and Schneider (2001: 245) call a "rolling reassessment" in sociological terms could be better coined as *rituals of evidence*. The scope of all these rituals of evidence is to maintain the trust in the core institutional ethos without, however, petrifying it into an inflexible dogma of environmental policy. I would say the climate regime is thus to be seen as a complex ritual order, based on a series of ritual performances taking place on various levels. The meetings of the COP, the releases of the IPCC's assessment reports, the meetings of the Subsidiary Body for Scientific and Technological Advice (SBSTA) as well as plenty of other scientific meetings of the IPCC bodies are only the most prominent ones. But the ritualisation of expertise is only one way of coping with uncertainty and ambiguity and to gain credibility in the imagined communitas of climate change believers. Because knowledge has to be communicated from climate experts to other experts and even to a worldwide lay public audience other dispositives are required to gain credibility.

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nation is limited; a nation is limited; a nation is a community.

5.2 Explicative discourses, narrative fidelity and a grammar of confidence

Maintaining the core identity of an operative regime under conditions of uncertainty and ambiguity is a very delicate enterprise which requires *continuity* and *flexibility* as well. This task is even more challenging if the regime's objectives and related policy responses are continuously criticized as being inefficient, unfair and ineffective or even a pure invention of climate scientists. Criticism confronts the climate scientists as advisers of policy making processes with serious problems of credibility. The climate discourse of the past 20 years has revealed and deconstructed at least three modern fictions which forced IPCC's climatologist to redefine and clarify their central role as guardian of truth in the climate change policy making process. The first I would call the *fiction of objectivity*; the second could be nominated the *fiction of sovereignty* and the third one could be called the *fiction of scientific consent* (for the distinction see Wehling/Viehöver/Keller 2005).

Fact is that IPCC climatologists operate beyond the boundaries of pure science, they are also acting as moral and political entrepreneurs. With regard to this, they are forced to cope with the fiction of scientific objectivity, consensus and sovereignty for several reasons. In order to take countermeasures against the discourse coalitions of contrarians (e.g. Global Climate Coalition) and to gain credibility the climate regime in the past 20 years has developed several institutional strategies and dispositives in communicating on and dealing with questions of ambiguity and uncertainty.

The first reaction was to define the IPCC as a hybrid transnational intergovernmental body which blurs clear drawn boundaries between science and (national) politics. In fact the IPCC reports undergo an extended peer review process within which government officials are involved. The second reaction responds to the problem of consent. As IPCC representatives underline, consent is not the same as truth. They emphasize that the IPCC is not a truth machine (Edwards/Schneider 2001: 245). In fact the IPCC does not carry out research, but as an intergovernmental body it collects, evaluates and disseminates advice and information concerning the risks of anthropogenic climate change to public and policy makers. One could also say that the IPCC proceduralizes the problems of consensus generation, by installing assessment reports as core elements of ongoing rituals of evidence. Furthermore it approaches the modern fiction of objectivity in a new way which clearly respects the increasing need for public communication of science. Realizing this task successfully in the IPCC's rituals of evidence (i.e. for example the assessment reports) *explicative discourses* (Habermas 1981/1: 43) gained increasing importance.

Thus the IPCC's goal is not to play the truth games in the strict scientific sense. It rather generates and improves *communicability* of scientific findings (Weiß 1981). Therefore the task of explicative discourses is to translate the arcane knowledge of climatologists and other IPCC experts into narrative discourses which are comprehensible to non climate experts or even a global public audience. Where do these explicative discourses occur if not in the national mass media? I think explicative discourses are not to be found in the so called "bricks", the IPCC's full assessment reports, but in the summaries of the synthesis reports.

One of the major problems for the IPCC in this respect is how to proactively deal with scientific uncertainties and ambiguities without being forced to recall the need for urgent climate action. What comes into play here, as a major legitimating resource, is *narrative fidelity* (Ricœur 2007). Institutions in transition gain credibility not simply by maintaining that they are providing facts or by mere uses of arguments. It rather has to do with the way the nar-

rative configuration of bio-physical events and human action is fitted into a comprehensive public narrative, thereby avoiding losses in credibility and trust. The IPCC's assessment process – which should be comprehensive, open, transparent and objective as well as neutral with respect to policy – is based mainly on published peer reviewed scientific literature. Additionally the assessment reports again undergo an extended review process (Edward/Schneider 2001) and finally the major results are summarized in the three so called summaries for policy makers. The 1996 second assessment report also included a synthesis report for policymakers to interpret the FCCC, and later reports also included a synthesis report for policy makers. Moreover, the peer review process encompasses scientific peer reviews as well as reviews by government officials. Each assessment report contains three volumes and all of them undergo a review process. Authors, contributors, reviewers as well as other experts are selected by the bureaus of the working groups after having received a list of nominations by governments and participating organizations (see IPCC http://www.ipcc.ch/organisation/organisation_procedures.htm; access 20.08.2009). Appointed lead authors have the responsibility for the various chapters in the reports. Whereas full reports are accepted in the plenary or working group sessions, the summary report need a line by line approval and must not be altered once being approved. Nonetheless, especially the second assessment report triggered a major debate on the trustworthiness and credibility of climate scientists. Probably the intense political, public and scientific debate on the SAR up to the present day could be seen as the major crisis in the climate regime's history, because the core identity of the climate regime was at stake. As a result of this crisis the rules for the IPCC's peer review process have been revised. This was only the beginning of an intense debate on how to recognize, acknowledge and communicate ambiguities and uncertainties to public and policy makers.

Communicability thus became core issue of institutional legitimacy (Weiß 1981). One of the most remarkable progresses in terms of narrative fidelity to my point of view is the introduction of what I would coin narrative grammars of confidence, i.e. skills used for example in summaries for policy makers to specify levels of confidence as well as degrees of certainty. The first formal innovation has been the appointment of "review editors" (Edwards/Schneider 2001: 228) assisting the working group bureaus in identifying reviewers. They should help to ensure that comments of scientific and government review are appropriately afforded and that controversies are adequately represented in the reports. Furthermore coordinating *Lead Authors* (two per chapter; one from developing countries) have to coordinate the contents of the different chapters they are responsible for. A further part of the grammar of confidence refers to the procedures of acceptance. The summaries for policy makers now need a line by line discussion (approval). The overview chapters of methodology reports and the synthesis report receive a section by section discussion (adoption). The report although having an intense review has no line by line or section by section approval (acceptance). After the 2001 Third Assessment Report an intense debate on the treatment and the communication of uncertainties took off with a series of working papers, workshops and conferences. The result was not only making uncertainties a key topic of the 2007 Fourth Assessment report, but also developing Guidance Notes for Lead Authors of the 4AR; guidelines which have been respected by the authors of reports and summary reports (IPCC 2005). The guidance notes further developed the grammar of confidence in various respects. The guidance notes should be used across all working groups and they allow a common approach and a comparable

language. First a typology of uncertainties has been proposed to be considered in the reports (including typical approaches), which distinguishes unpredictabilities (for example regarding the projection of human behavior), from structural uncertainties (e.g. regarding incomplete or competing models) mode and value uncertainties (e.g. regarding missing, inaccurate or non-representative data). Second the language to describe findings has been formalized, synchronized as well as simplified. Experts should be prepared "to make expert judgments and explain them by providing a traceable account of the steps used to arrive at estimates of uncertainty or confidence" (IPCC 2005), but be aware of becoming overconfident in individual or group judgments. To communicate their findings, they should qualitatively define the levels of understanding (levels of consensus or agreement; amounts of evidence), quantitatively calibrating the levels of confidence and finally use a likelihood scale. The vocabulary of the qualitative scale allows judgments on various scales ranging between high agreement/limited evidence or low agreement/limited evidence and high agreement/much evidence or low agreement/much evidence. The quantitative levels of confidence ranging from very high confidence to very low confidence are summarized in table 1 section A. The vocabulary of the likelihood scale ranging from virtually certain to exceptionally unlikely is summarized in table 1 section B below.

These elements of a grammar of confidence have been used in the 4AR for the first time. Their introduction is probably the result of one of the main learning processes the regime's principal agents have undergone, acknowledging that uncertainty, ignorance and category ambiguities could no longer be camouflaged in order to increase public credibility. Uncertainties, ambiguities and fuzzy boundaries are now actively recognized and communicated in order to stabilize or increase the *communitas* of global warming believers and to facilitate communication with non climate change experts.

Table 1: Quantitatively calibrated Levels of Confidence and Likelihood Scale (source IPCC 2005 pp. 3-4)

Section A		Section B	
Terminology	**Degree of confidence**	**Terminology**	**Likelihood of occurrence /outcome**
Very high confidence	At least 9 out of 10 chance of being correct	Virtually certain	> 99% probability of occurrence
High confidence	About 8 out of 10 chance	Very likely	> 90% probability
Medium confidence	About 5 out of 10 chance	Likely	> 66% probability
Low confidence	2 out of 10 chance	About as likely as not	33% to 66% percent probability
Very low confidence	Less than 1 out of 10 chance	Unlikely	< 33% probability
		Very unlikely	< 10% probability
		Exceptionally unlikely	< 1% probability

6 Conclusion

Institutional public climate policy is climate action in contexts of scientific

uncertainty. Therefore, legitimizing climate action in the name of the transnational climate regime requires strategies to cope with uncertainties. These strategies should be reconstructed as truth games enacted on a public stage. This pushes the IPCC into the lime light of public attention. The paper suggests a theoretical frame of reference for understanding the character of public truth games. I have proposed understanding climate action in terms of a ritual process, a ritual process which is fundamentally based on the credibility and fidelity of the global warming narrative. As shown above, the climate regime is based on institutionalized global narrative, which has provided the globalizing world with a new symbolic, cognitive and moral order as well as a new sense of community. This narrative order has been configured by a growing discourse coalition of anthropogenic global warming believers. The related epistemic community has its organizational form in the IPCC. The IPCC, despite of all "climategates" (cp. Reusswig/Lass this issue), is still the legitimate guardian of climate related truth games, truth games which always took the form of a narrative order open to integrate new experiences, events and *actants* – be they natural or human. This narrative order is extremely fragile. It has to continuously cope with uncertainty and ambiguity, with the consequence that the climate regime seems to oscillate between success and failure.

To better cope with these problems, the climate regime has developed two astonishing strategies. As I have pointed out the climate regime's IPCC made progress in dealing with uncertainties and their public communication. On the one hand it copes with continuous scientific uncertainties by establishing scientific advice as rituals of evidence. On the other hand IPCC developed a narrative grammar of confidence to facilitate communication with decision makers and the public. Making use of these skills the climate regime so far was able to reconcile sometimes fundamental critics. Even the recent case of "climategate" referring to manipulation and misinterpretation of words and data could not seriously harm the reputation of the IPCC, as the report of an urgently established independent Science Assessment Panel, published on 14th April 2010 concluded. The institutionalization of the Science Assessment Panel who saw "no evidence of any deliberate scientific malpractice in any of the work of the Climatic Research Unit"[10] supports my central hypothesis, i.e. that the role of IPCC's truth games in terms of a ritual drama is based on the continuous reconfiguration of the global warming narrative. It simply confirms the reflexivity of the scientific assessment process in the global public space. Against this background: What is the policy relevance of my theoretical perspective? Generally it is to remind that to focus merely on the policy relevance narrows the analytical perspective in a risky manner.

With regard to this general point, it is important to recognize that the IPCC's truth games are not only at the crossroads of science and politics. Rather they are enacted *in* and they are *contributing to* the emergence of a global public space. In this respect the global warming narrative is the first global narrative which makes us all reflect on the side effects of industrial and consumerist lifestyles. The global warming narrative is, however, even more: So what does the ritual enacted narrative on global warming and related truth games really transmit to the emergent global public? To proceed forward answering this question, we have to look at an argument Hulme (2010a: 267ff.) recently made: He assumes in the past decades we have seen that science and society are mutually constructing climate change as a phenomenon. This

[10] See http://en.wikipedia.org/wiki/Climatic_Research_Unit_email_controversy#Science_Assessment_Panel; last access 20.01.2011.

fact he further reasons "offers us a way of asking 'what can climate change do for us?' rather than 'what can we do for climate change?'" Hulme (2010a) taking up a cosmopolitan perspective on climate change points to the fact that climate change contributed to the dissolution of the three modern binary oppositions, nature/culture, local/global and present/future. He seems to believe that sociologists need to answer the first question posed above, which I think is a very dangerous one, because it transcends the problem and it insinuates that these two questions are separable. They are not!

Jasanoff (2010: 233) underlines that "climate change" – note that climate change here becomes an active *actant* (Greimas) in sociological narratives – "produces discordances in established ways of human place in nature, and so offers unique challenges and opportunities for the interpretive social sciences". She believes that the assessments of the IPCC helped to establish climate change as a global phenomenon, but in this process the IPCC not only "detached knowledge from meaning" but also undermined "existing social institutions and ethical commitments at four levels: communal, political, spatial and temporal" (Jasanoff 2010: 233ff.). Well, time, space, polity and related categories are important categories, but they get their meaning through social scientific concepts of ritual and narrative discourse which provides humankind a new cultural frame of reference. Thus, I would like to advocate IPCC's and scientists role in the climate discourse by taking a ritual and narrative perspective on climate change and climate action. Even scientists as humans are necessarily storytellers and by narrating their global warming story they provide the public with new concepts of time (relating present worlds to possible worlds in the future, by means of scenarios), space (by teaching us what climate is composed of, that climate variability exists and how it works) and polity (by inventing an anti-structural sense of communitas).[11] Ritual communication through narrativization of global climate change is however not only a way of world making and a sense making activity. It is, to put it in Austin's (1962) words, *to do things with words*. If repeated in ritual communication, global warming narratives and related truth games are complex speech acts addressed to public and policy makers. As such they are intended to be transformative. The success of the global warming story shows that it had already major impact on how societies perceive climate change. I would like to suggest three points to make this argument more concrete.

First, based on a narrative approach (Ricœur 1991a; 2007, Viehöver 2003b), I have argued, that one of the main tasks of the global climate regime's IPCC has been to recompose the blurring boundaries between nature and society, by attributing the global climate change to human influence. Therefore, the central institutional problem to be resolved by the IPCC's activities is whether its scientific advisers are able to identify the *human fingerprint* within the global climate change processes (Schneider 1994). As far as ritual communication is based on the identification of sacra, the attribution of trace gas emission to a human fingerprint is most important to gain trust and narrative fidelity in the ritual process of the IPCC's ongoing truth games.

Second, I have shown, that governing the new global common climate system is not only evaluating and synthesizing the cognitive understanding of climatic change, but it also requires an *ethical creed* and a practical ethos that calls public and policy makers for urgent action. In this sense the global warming narrative provides an anti-structural ethos of sustainable devel-

[11] To stress that climate scientists detached knowledge from meaning, as insinuates Jasanoff (2010), is hence mistaken.

opment, however ambiguous this concept remained so far. But the ethos of climate action oriented towards the idea of a sustainable development underlines that the IPCC's climate change narrative can no longer be reduced to the mimesis of cognitive experiences or the formulation of an ethos of mitigation or adaptation (Rahmstorf/Schellnhuber 2006: 91). Part of the ethos has also been the construction of communitas. The idea of communitas is an imagined – not a real one – world community. It is debatable whether this vague idea of a world community of equal nations could really become a model for a new and green world order. The major challenge to a successful climate regime in this respect remains that its narrative needs to be transposed into practical action. This process of transposition raises questions of feasibility, fairness (environmental justice), efficacy and efficiency. These might become subject of future rituals of evidence.

Third, the ritual communication of the IPCC has also provided the public with a grammar of confidence. As far as I can see, this is an important device to translate expert knowledge into public communication. The grammar of confidence developed by the IPCC makes truth communicable, it enhances communicability of uncertainties it does not however provide proof in a strict scientific sense.

Finally, one could raise the question whether we are heading towards the post-liminal ritual stage of the climate ritual. In this respect, one has to remind the reader that rites of passage have a temporal order. The new anti-structural order put into question the preexisting order of (capitalist) industrial societies as well as the political order of "egoistic" nation states. IPCC's climate change rituals contrast this order of things with the anti-structural order of an imagined order of a world risk community based on the idea of a sustainable development. Against the dream of a green modernity based on a global risk community (Beck 2010), one has to state that the anti-structural *communitas* could turn out to be the utopia of reflexive modernity a mere illusion enacted in a ritual game that scientists for the past decades seemed to have had under control. Copenhagen could be the beginning of the end of a huge ritual game, but in the end, it could become like carnival, normality returns after a few days of exception. This would be no good news, neither for nature nor for human societies. Probably we never became "reflexive modern" (U. Beck). And to deliberate on this possibility should be the future task for sociologists.

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Post-Carbon Ambivalences

The New Climate Change Discourse and the Risks of Climate Science

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Abstract

The publication of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) can be seen as a starting point for a new climate change discourse. The paper reconstructs the two ideal types of 'old' and 'new' climate change discourse and pays special attention to the new role of scientific expertise in it. In analyzing the recent credibility crisis of the IPCC, the paper tries to assess the choices to be made at the science-policy interface. We conclude by sketching some of the ambivalences of the possibly emerging post-carbon society, and the challenges for a non-expertocratic science.

1 Introduction

In most developed countries, climate change has evolved as the major environmental concern, and climate science has gained both public attention and policy relevance. Climate science today transcends the boundaries of a single discipline, such as meteorology, and encompasses others like atmospheric physics and chemistry, oceanography, plant biology, ecology, physical and human geography, (climate) economics, (environmental) sociology, political science, and is also supported by scientific tools such as modeling or integrated assessment. Yet, climate science is less a well-defined area of various scientific (sub-)disciplines but more an evolving field of partly heterogeneous domains of research in a highly political context. *If* the scientific evidence supports the idea that humans change the climate, and *if* society declares this a real problem, *then* the results of climate science are highly relevant for the future path of the world society.

For this very reason, climate science is a contested science. And the more aspects it does encompass, the higher the risk of dissenting voices, arguing for different interpretations or valuations of the complex universe of 'climate facts'. A major reason for this polyphonic choir lies in the fact that global warming does *not* result from some insignificant human activities that can easily be changed. Quite the contrary: The immediate causes of anthropogenic climate change are intricately linked to all kinds of important human activities (such as growing food and raising cattle, cooking meals, heating homes, driving cars, flying to other places, using the internet etc.). They are thus not only deeply rooted in everyday routines, they do also relate to all kinds of economic and political structures and related interests. Climate science, initially a rather marginal branch of meteorology, today cannot avoid being political. This is why uncertainties, ambivalences and controversies exceed the scope of merely scientific debates. They are expressions of and at the same time causal factors within the 'social fabric' that defines the future pathway of human development.

In this paper, we would like to focus on the recent evolutions of climate science, understood as a social endeavor. It will be argued that the dominant climate change discourse has changed recently, and some of the characteristics of that change will be given in section (2), where we analyze this change as a transition from analytical understanding of the climate system to a decision-oriented understanding of the Earth system, a 'hybrid object' composed of natural and social entities, mainly driven by human agency, and subject to all kinds of interventions. This change was brought about by the combined effect of the broadening of the social discourse base, the cognitive closure with respect to prior uncertainties, and the ability to influence the policy cycle. An important test case for the hypothesis of a changing climate discourse is the recent crisis of the public perception of climate science, especially the credibility of the Intergovernmental Panel on Climate Change (IPCC). Section (3) will briefly touch upon this most recent development of the climate change debate. Although it has been argued in the previous section that the public climate change discourse has reached a new quality, there is no reason to believe that the new discourse will be free of ambiguities and conflicts. On the contrary, it will be argued in section (4) that we are facing new uncertainties and conflicts, and some of them will be characterized. We will argue that these conflicts mainly arise from the ambiguities that have become explicit in the new climate change discourse, especially from the side-effects of 'climate solutions' and their evaluation. The final section (5) concludes by defining some future challenges and tasks of (climate) science as we see

them today, and it especially addresses the responsibility of the social sciences that have become much more important in the new climate change discourse. By arguing in favor of a 'reflexive interventionism', we propose that social scientists should transcend their chosen role as 'pure observers'. Only by reflexive interventionism, we argue, can the social sciences adequately perform their tasks in the new climate change discourse.

2 The Old and the New Climate Change Discourse

Climate change is a highly scientifically mediated issue. Other than, say, air or water pollution, average everyday actors can hardly detect changes in the central parameters of the Earth's climate (Yearley 1994). One of the reasons for this is the 'ontological' distinction between weather and climate: While 'weather' refers to the concrete state of a set of parameters of the lower atmosphere, such as air temperature, humidity or sunshine, 'climate' is a theoretically more ambitious construct, referring to statistically significant patterns of weather over time (about 30+ years), linked to basic mechanisms of the physical Earth system (such as the solar constant or the global carbon or water cycles). As weather encompasses many stochastic processes, it cannot be precisely predicted. Climate, on the other hand, is characterized by a high share of deterministic processes, resulting in the counterintuitive fact that we can 'predict' the climate of 2100 more precisely than the weather of next week.

This is not to say that lay persons are completely unable to notice changing climate patterns. People with high stakes in the economic use of climate sensitive natural resources, such as farmers or fishermen, have developed their own methods of monitoring weather patterns in order to cope with adverse effects, especially in developing countries (cf. Broad and Orlove 2007, Orlove 2005, Patt 2001, Semenza et al. 2008). Nevertheless, *global* climate changes can only be detected by systematic instrumental records, statistical methods, the analysis of historical data sets, and computer models (Edwards 2001; Rahmstorf and Schellnhuber 2007), which are beyond the scope of non-scientific observers. This is why the history of the climate *discourse* (see below for a definition) is for long almost exclusively – and even today to a substantial degree – a history of climate *science* (or its predecessors) (Fleming 1998; Weart 2003). Measured global warming until today adds up to no more than an increase of 0.8° C of Global Mean Temperature (GMT) since the 19th century (IPCC 2007). GMT is a statistical construct that integrates across all geographical regions, seasonal differences as well as day/night-differences – the very fabric of everyday experience. Usually perceived and relevant daily temperature changes by far exceed this figure. The scientifically mediated character of climate change especially holds when it comes to the attribution problem: who or what is responsible? Climate (other than weather) refers to long-term patterns and processes of the atmosphere as embedded into other bio-geochemical cycles, influenced by the oceans, the biosphere, human activities, and natural factors, such as volcanic eruptions or the sun's activity. Causal analysis and attribution in such complex and non-linear systems is extremely difficult – one of the reasons for various uncertainties in climate science statements, and a major driver behind the increasingly interdisciplinary character of climate science.

And it is not only interdisciplinary natural science that is needed to assess whether or not (and how strong) there is anthropogenic climate change. One also needs to know about system feedbacks and their time asymmetry in order to assess if, how and how quickly societies could 'stop' global warming. This requires a thorough

understanding of the Earth's energy and urban systems, again with inclusion of the major feedbacks of natural systems (e.g. the buffering capacities of the oceans or the fertilization effect of CO_2). Indispensible part of this understanding is an assessment of how difficult a transition of this energy system towards less carbon-intensive fuels (low-emission society) would be and how fast it could be achieved.

Sociologists and other social scientists have repeatedly and correctly pointed out how the scientifically mediated character of climate change anchors it in society and in societal debates. Climate science is part of a social discourse on climate. Human reasoning and practice is constitutively relying on discourses, i.e. on the structured flow of exchanging arguments in order to give reasons for statements and actions – not only for enabling the (public) communication of arguments, but also for the very process of generating reasons in a originally shared world of human action (Brandom 1994; McDowell 1996). Beyond this very fundamental interdependency of discourse and human reasoning, any actual social use of scientific reasoning can be reconstructed as a social discourse, and discourse analysis has developed into a powerful tool of analyzing science-society interactions. It has also been applied to climate change. [1]

A *Climate Change Discourse* (CCD) is a thematically focused and (more or less) coupled sequence of publicly visible arguments in various contexts (or framings) that different social actors are engaged in, in order to influence (1) one another, (2) specific boundary conditions of social action (such as politics), and (3) the general public so, that the resource endowments, interests and worldviews of the speaking actors have a higher chance to prevail in the social interpretation and individual or collective decision making processes. It is worth noting that this definition on the one hand draws from discourse analysis in the Foucault tradition, but combines it with sociological theories that focus on actors, action, and structures (Giddens 1984; Oswick et al. 2007). And it links power and truth, i.e. the realm of argumentative justification of (scientific) claims (Habermas 1981). Discourse analysis can be seen as a contemporary realization of a famous dictum of Max Weber's:

> "Not ideas, but material and ideal interests, directly govern men's conduct. Yet very frequently the 'world images' that have been created by 'ideas' have, like switchmen, determined the tracks along which action has been pushed by the dynamic of interest." (Weber 1946: 280)

Would one concentrate on 'ideas' exclusively, one would, for example, be able to follow the changes in narratives about carbon dioxide, but risks to ignore the economic and political interests involved (Blaikie 1996). Talking about these interests by neglecting the sphere of 'ideas' would, on the other hand, miss the interpretation (framing) of interests, and thus their relevance to social action. Discourses are the social 'locations' for creating and processing ideas and worldviews (Weber: 'world images'), as well as social spaces that are shaped by interests. 'Ideas' *and* 'interests' in their *interplay*, *not* as *isolated* from each other make up a social discourse.

The distinction between 'old' and 'new' CCD creates two ideal types,

[1] Keller (2005) offers an enlightening discussion of the sociological and philosophical backgrounds of modern discourse analysis, and gives some applications to debates about environmental risks. Ereaut and Segnit (2006) have analyzed the recent British CCD in an interesting manner, but narrowed down 'discourse' to mass media coverage. Viehöver (2003a; 2003b) has also looked at the ('old') climate discourse, but as a contested narration of reflexive modernity. Discourse analysis can highlight the embedded and contextual nature of global environmental issues, and the constitutive role of discourses in shaping identities, attitudes, and controversies (Macnaghten/Urry 1998).

thus stylizing facts in a manner that enables the generation of hypotheses and further discussion.[2] One can summarize the changing CCD with the following table:

worldwide (Besio and Pronzini 2010; Boyce and Lewis 2009; Boykoff 2007).[3] Second, in qualitative terms, the character of mass media reporting has changed, and one important indicator

Table 1: Old and New Climate Change Discourse

Analytical Dimension	Old Climate Change Discourse	New Climate Change Discourse
Master Frame	Climate System Analysis, Attribution	Earth System Management, Decision
Leading Sciences	Physics, climatology, other natural sciences (IPCC Working Group I).	Economics, engineering, other social sciences (IPCC Working Groups II & III)
Main Risks	Climate Risks	Socio-Climatic Risks
Main Uncertainties	Climate System Uncertainties	Hybrid Earth System Ambiguities
Core Questions	Is there (anthropogenic) climate change? How certain can we be about it? How and when will natural and social systems be affected?	What is dangerous climate change? How can a cost effective and fair stabilization of the climate system be achieved? What is an optimal degree of adaptation, and how can it be financed?
Main Actors	Natural sciences, environmental politics, environmental movement	Trans-disciplinary science, politics in general, business sector, environmental movement, critical consumers & citizens
Core Public Debates	Nature versus society Alarmism versus skepticism Mitigation versus adaptation	Hybrid scenario preferences Normality of climate change Optimal mix of mitigation/adaptation

Well aware of the difficulty to exactly date the beginning of the 'new' CCD, we suggest the years 2006/07 as its inception phase. There are some indicators that support this hypothesis. A first indicator is the significant increase in mass media coverage of climate change – not only in Europe, but here is that especially in the U.S. the 'balanced' view (presenting climate supporters and skeptics as two equally legitimate scientific positions, see Boykoff/Boykoff 2004) has given way to an unequivocal statement that climate change is real, that its causes are

[2] Weingart et al. (2000; 2002) and Carvalho and Burgess (2005) have proposed other, partly more fine-grained subdivisions of the CCD. None of these authors has yet looked at the most recent period which is addressed here. As we refer to ideal types in a hypothetical distinction, we usually use quotation marks when speaking of old and new CCDs.

[3] There are substantial differences in the quantitative and qualitative coverage of climate change, not only between countries (coverage is less marked in developing and transition countries, quality is lower), but also between individual media. Nevertheless, compared against their relative historical backgrounds, 2006/07 has been a historical threshold in *all* countries and *most* individual mass media.

anthropogenic, and that something should be done to prevent (further) climate change (Boykoff 2008; Cottle 2009). Several agenda-setting studies show that press coverage does influence public attention to climate change issues (Hester/Gonzenbach 1997; Trumbo 1996). And it is not only the frequency of coverage, but also the character and framing of that coverage that help to draw public attention to environmental issues, e.g. the narratives told and the storylines presented (McComas/Shannahan 1999).

Some additional stimulating events of the emerging 'new' climate discourse have to be mentioned, which helped to bring about the new master-frame of decision making:

- The publication of the 'Stern Review' (2007) in late 2006, where a number of distinguished climate economists have argued that (a) the consequences of (unmitigated) climate change would be substantial in monetary terms, and not marginal as often previously thought; and that (b) climate policies would be much less costly than often assumed (only about 1-2% of the world GDP). This helped the business community and policy makers to justify otherwise too risky investments and regulations.
- The publication of the IPCC's Fourth Assessment Report (2007), showing that climate change is happening more rapidly than previously thought, and settling the debate about whether or not human activities can be attributed as drivers. IPCC's Working Group III basically confirmed the results of the Stern Review, and underlined the urgency of action.
- The Nobel Peace Award for both the IPCC and Al Gore, who in his movie 'An Inconvenient Truth' (2006) had demonstrated the serious consequences of climate change to a wider public worldwide. Among other things, Al Gore in 2007 became portrayed together with (other) Hollywood celebrities in a 'green' cover story of Vanity Fair. Al Gore organized a worldwide series of music festivals in early 2008 in order to highlight the necessity to act against climate change. The issue thus had become part of popular culture.

The most important question for the 'old' CCD, which we would date from the founding of the IPCC in 1988 to the first years of the 21st century, was to find out if and to what degree human activities did cause observed recent climate change. In order to do so, massive climate change research programs had been launched, including data gathering, modeling work, and systematic analysis (Conrad 2008; Fleming 1998; Miller/Edwards 2001; Maslin 2004; Weart 2003). Our understanding of the climate system did grow substantially during this first phase, and it ended by more or less unequivocally answering the attribution problem: 'Yes, the climate is changing, and, yes, human activities (such as burning fossil fuels or clearing forests) are responsible for the majority of the observed changes'. The natural sciences – such as physics, meteorology, atmospheric chemistry, biology – did take the lead in that early phase, given the enormous complexity of the climate system and its links to important bio-geophysical cycles (like carbon, water or nitrogen). All kinds of uncertainties did occur and had to be tackled, not only with respect to missing data, but also with respect to imprecise or contested scientific models, and to the complexity of a mainly mechanistic, but partly stochastic and, above all, non-linear system.

In the 'new' CCD, after the closure of the attribution debate, the new master frame is Earth System Management, explicitly taking into account the human contribution to a changing atmosphere, as well as the widely recognized necessity to take decisions in view of adverse impacts of climate change, either by mitigating against its causes, or by adapting to a changing

environment. Instead of being a distinct and purely natural object, the Earth's climate is now fully recognized as being an integral part of human-nature interactions at various levels. Climate transformed from a natural to a 'hybrid object' (Latour 1993), including human activities as well as the reflexive reaction upon our knowledge about climate change.[4] The leading question now no longer is whether or not there is anthropogenic climate change, but rather what to do about it. More precisely: How can a cost effective and fair stabilization of the climate system be achieved? In this global management perspective climate risks have become dependent upon societal decisions, so that socio-climatic risks are at stake. Not only in the sense that climate change has become visible as a side-effect of intentional human action (such as heating a home or driving a car), but also in the sense that – in the face of that knowledge – we now have to confront the risks and costs of climate *inaction* with the risks and costs of climate *action*. The dominant uncertainties of our climate knowledge now mainly originate from human decision making processes, no longer from, say, the stochastic component of the climate system. The latter adds to the former, but the former defines the new quality of risk. As decisions at various levels have to be looked at in order to 'predict' the future climate, climate science is confronted with the inherently ambivalent character of human choices, bringing additional uncertainties to climate projections. A multitude of preferences and alternative choices (opportunity costs) now have to be taken into account.[5] We have to choose among different socio-climatic (thus termed hybrid) scenarios, and our choices depend not only upon our knowledge about the Earth system (including its uncertainties), but also upon our preferences and values, which are often inconsistent, conflicting, and subject to historical change. We would like to use the term ambiguity in order to characterize this type of risk coming up in the 'new' CCD.

While climate change in the old discourse was mainly debated by natural scientists, environmental NGOs (ENGOs) and environmental politics, today we observe a substantial broadening of the actor base:

- Many more sciences engage with climate research, and new subdisciplines such as 'climate economics' have emerged. Governments have launched various interdisciplinary climate research programs, and as a result new research capacities, institutions and communities have been built. They in turn generate new questions, ask for additional funds, and offer new solutions (Halfmann/Schützenmeister 2009).
- *Climate policy* during the 'old' discourse was more or less confined to the environmental ministries and their administrative extensions (like environmental protection agencies). The 'new' discourse is characterized by (a) a substantial broadening of

[4] There is a 'very old' climate discourse, dating back to the ancient Greeks, mainly stating that the Earth's various climates more or less determine—via the human body—the way people think and behave, and thus also influence culture and politics. Elements of this early form of climate determinism can also be found in later periods, such as in Montesquieu (18th century) or Huntington (20th century) (Stehr/Storch 2000). The 'old' climate discourse is inspired by a scientific hypothesis of the 19th century, that humans can in fact modify not only local climate conditions, but the climate of the whole planet.

[5] Some scholars even doubt whether it is both possible and feasible to built climate policy on the search for coherent and consistent social preferences (Jaeger/Jaeger 2010). But even if one assumes that an optimal social choice is possible, it inevitably comes with the opportunity costs of foregone options—and these are the 'stuff' that political debates are made of. Every 'optimal' social choice in point t_1 can be questioned in t_2, based on new facts, new preferences of old players, or old or new preferences of new players.

political agencies that deal with climate change, and (b) by an upgrading of climate policy in the agenda of the political system as a whole. Today, climate issues are dealt with in all branches of the administration, such as economic policy (e.g. when it comes to the subsidizing of renewable energy), education and research policies, infrastructure and traffic planning, foreign policy etc. In recent times, leading political figures such as Barack Obama (USA), Tony Blair (UK), Angela Merkel (Germany) or Manmohan Singh (India) have given climate change top priority – at least for some time. Climate change has evolved from a marginal issue to a complex political theme that might even play a role in general elections.

- The 'old' CCD saw the *business sector* mainly as opposing the claims for combating global warming. Industry was mainly perceived as 'the enemy', a view that many environmental NGOs did hold at that time. Today, a remarkable part of the industry makes money by selling 'green' products or services, such as wind or solar power plants, bio-fuels, green electricity, building insulation materials, carbon offsets etc. Millions of jobs depend upon these 'green industries' (Lehr et al. 2008). And even traditional, carbon-intensive industries, such as car manufacturing or oil production, have developed green branches or product lines, broadening both their economic portfolios as well as their political lobby interests. The recent boom of organizational changes such as the introduction of Corporate Social Responsibility (CSR) or of Sustainability Reporting has supported and reinforced this trend (Epstein 2008; Laszlo 2008; Schaltegger/Wagner 2006).
- In the 'new' CCD, critical *consumer organizations* and *concerned citizens* do play an important role. They assume responsibility for themselves, but also advocate climate friendly policies and green business models. Lifestyles of Health and Sustainability (LOHAS) are both detected and promoted, and many civil society watchdogs have taken on the issue of climate change as a good opportunity to promote their agendas. Technological changes, most importantly the rise of the internet, have substantially reinforced this more active role of the civil society in the new CCD. Web blogs for example help both to create virtual communities and to influence the mass media and political decision makers. The new CCD is a significant driver of a possibly emerging 'moral economy' (Stehr 2007), linking questions of private consumption and lifestyle choices to outcomes in terms of the carbon footprint of individuals, communities and countries (Leggewie 2010; Leggewie/Welzer 2009).

One thus can observe a *broadening* of the set of actors that participate in the social discourse on climate, which at the same time has *intensified* – measurable in terms of more mass media coverage, or more political debates and decisions related to climate. *Ceteris paribus*, that is under the conditions of the 'old' CCD, this might have led to an intensification of 'old' controversies, such as the oscillation between alarmism and skepticism. But this has not happened. Instead, climate change has become a reality, part of the normal world view, and the mass media as well as the mass media consumers take it for granted that upcoming extreme weather events are part of that normality. From 2006/07 onwards, we can observe a remarkable closure of the 'old' debate about attribution, and a significant shift of the dominant discourse frame towards decision-making problems. The *discourse closure* was mainly promoted by the scientific community (around Working Groups I and II). The *discourse shift* was mainly initiated by Working Group III scientists and a related community of climate economists.

Their argumentation to some degree resembles to what engaged scientists and environmental NGO activists had already stated in the 'old' CCD: the problem is real, and now something has to be done about it. Nevertheless, different to former times, this conclusion could now be supported by serious data analysis and computer based economic reasoning.[6]

Many NGO representatives and policy makers – not only, but foremost those who had been involved in the boundary organization IPCC and in environmental decision making – together with some business representatives basically accepted this view, trying to accommodate it to existing political programs and profiles. These agents thus added something to the climate discourse that it was lacking so far: a viable socio-economic vision of the future that at least offered the chance to find the support of social majorities, together with some degree of economic *resources* and political *power* to bring it about. The narratives of a 'Third Industrial Revolution', a 'Green New Deal', or simply the 'greening of the economy' did orchestrate this vision in different political disguises.

This discourse change can thus not be grasped by the concept of 'epistemic communities'. Haas (1992) has coined this term in order to highlight the constitutive role of scientific consensus for environmental policy making. As in the case of acid rain or ozone layer depletion, in climate science there is something like a scientific consensus about the attribution problem (with some clearly marked remaining uncertainties), which has been forcefully communicated in and around the Fourth Assessment Report by IPCC members (above termed discourse closure). However, the main drivers behind the discourse *shift* towards (economic) solutions – the climate economists and some other integrated assessment people around WG III – do not share neither a cognitive nor a normative consensus with respect to exactly *what* the solution might look like. A majority favors technological solutions, but there is a minority opinion that behavioral changes would (also) be needed. And among those who favor technological solutions, some see nuclear power as the most important wedge, while many others argue that only renewable energy sources are the way to go. Most economists favor market solutions, while others see a more prominent role for the state. And so forth. In other words: the 'new' CCD is characterized by various discourse coalitions (Hajer 1995), not only by a single one. The visible consensus did thus only cover the notion that climate change was happening, that it would become very dangerous if business as usual was to prevail, and that massive technological and other supporting measures would rather rapidly have to be taken. It did neither include the socio-technical pathway, nor did it cover the instruments and measures by which to achieve it. This remains the task and challenge of the 'new' CCD, and this is a major reason why we think that it will be characterized by vivid debates and conflicts.

However, together with the formerly mentioned discourse closure, this discourse shift did suffice to lend everyday *credibility* to the seriousness of the climate change issue, even beyond the question whether climate science is right or if media attention cycles are supporting public perception of climate issues. If, as in the case of Germany or the European Union, encom-

[6] The Stern conclusions did not pass uncontested by many 'mainstream' economists, questioning aspects like discount rates or damage figures (Tol 2006; Tol/Yohe 2009). More 'radical' critics asked for leaving behind some basic assumptions of standard neoclassical theory, doubting that cost-benefit analysis is a feasible tool for climate policy (Spash 2007). In our view it has been exactly this 'sticking to mainstream thinking' that enabled the conclusions of the Review to become so powerful in the scientific community and, especially, in policy making.

passing climate policy packages with ambitious goals (e.g. reducing GHG emissions by 40% until 2020), a variety of measures and instruments (from economic incentives to announced bans) are publicly discussed and brought on their way, the climate discourse has entered a new and advanced stage of the policy cycle (Jänicke et al. 1999). Scientific evidence usually plays a crucial role in early stages, especially in the phase of problem definition and agenda setting. In the 'new' CCD, a thematically broadened scientific discourse has managed to influence policy formulation, policy implementation, and to some degree even policy monitoring. The discourse, in other words, has managed to shape the boundary conditions for further decisions and their discursive embedding. And this also means that the public awareness of climate issues has started to become decoupled from the mass media and its attention cycles – at least with respect to climate science and (possibly) related natural disasters. Climate issues have made their way to 'normal' policy debates in various action arenas, and these are – other than scientific debates – object of constant mass media observation and attention.

These three tendencies – the *broadening* of the actor base, the *narrowing* of the argument base, and the *strengthening* of the policy relevance – taken together have helped to bring about the 'new' character of the social CCD. They are responsible for the new framing of the discourse, as well as for the shift in the core questions and the related scientific implications, e.g. new research questions that arise in climate science.

Before we expose our interpretation to a possible counter example in the next section, we would like to stress that *new* discourse formations do not preclude *old* arguments to be repeated or renewed by particular actors. We have characterized the 'new' CCD by a *broadening* of actively participating actors, *not* by a *substitution* of actor set A by actor set B. This implies that participants of the 'old' CCD are still speaking today, trying to rephrase them under the new boundary conditions, or even try to reverse the change of the master frame.

In other words, there is ample reason to assume that we will be confronted with new and even intensified conflicts in a 'new' CCD. These conflicts do not arise *in spite of* a reached consensus on the attribution problem, but *because* of it. Once the 'human' factor in climate change has been firmly established, the full complexity, including ambiguities and heterogeneous interests, of modern society has become part of the climate discourse.

3 Interpreting Calamity: The recent 'credibility crisis' of IPCC and its meaning

Discourse changes are not irreversible. The stylized distinction made in the previous section could have rolled out in the years to come, with climate change remaining an uncontested scientific issue residing at the higher ranks with the agendas of policy makers, the business sector and civil society organizations.

However, things came different. In 2009/10, climate science in general and the IPCC in particular did come under heavy attack by many critical observers, questioning not only the credibility of science, but in part also the relevance of climate change as a public issue. Whether or not this recent 'credibility crisis' will inhibit the further development of the 'new' CCD remains to be seen. Before we address this question, we would first like to face and interpret some relevant facts.

- *The Economic Crisis*. In 2008 and 2009, the global economy underwent a severe crisis, initiated by the breakdown of the U.S. real estate 'bubble'. Across the globe, the economic output of most economies

dropped, many lost their homes and savings, and many more their jobs. One climate change relevant consequence of this crisis was the drop of global CO_2 emissions of about 2.5% (GCP 2009). Another was that public concerns about climate change have been outdistanced by concerns about the economy in most countries (for the U.S. see Gallup online: www.gallup.com/poll/1615/Environment.aspx#1; for Europe see Eurobarometer 2009).

- *The Copenhagen 'Failure'.* The COP 15 meeting of UNFCCC parties in December 2009 was the largest climate policy conference ever. More than 16,000 participants, many of them from NGOs, and numerous political leaders across the globe had been attending. The media coverage was huge, and expectations high. While the conference started promising, the closer it got to decisions, the more disappointing the results turned out to be. No binding Post-Kyoto regime was established. The final document – termed 'Copenhagen Accord' – did accept the 2° C goal, but remained mute about concrete measures to reach it. Besides some financial transfers to poorer countries for adaptation, nothing tangible came out of Copenhagen, and all remaining work was passed on to future conferences. The COP 16 conference in Cancún (December 2010) could not resolve the issue, but helped to stabilize the UN climate regime.
- *'Climategate'.* Immediately before Copenhagen started, internet blogs and newspapers did report about the publishing of some 'secret' e-mails from some climate scientists at the University of East Anglia. This 'uncovering' seemed to demonstrate that climate scientists did actively manipulate their results in order to push the climate policy agenda.
- *'Glaciergate'.* At about the same time, scientists discovered an open mistake in the 2007 WG II contribution of the 4AR, maintaining the Himalayan glaciers to retreat until 2035. This statement was based on non-peer reviewed (so called 'grey') literature (in this case from a NGO report), which first was not in line with the working principles of IPCC, and second did contradict the (presumably correct) statement of glacier experts in the WG I contribution to the same report.[7]

These developments did lead the climate science community into a rather disastrous 'mood' at the beginning of 2010. All the credits of IPCC, the hallmark of a politically relevant community of excellent (peer-reviewed) scientists seemed to have been melting away like the famous ice caps and glaciers of the planet. The public perception of climate science had reached a low. U.S. respondents for example tended to believe that the media in general exaggerate the seriousness of global warming (2007: 35%, 2010: 48%). 36% believed that scientists were unsure about climate change, up from 29% in 2006. The loss of conviction that climate change is already happening was especially marked with those who felt best informed about climate change; those who do not understand much of the issue have remained uninfluenced by the recent debate (Gallup online: http://www.gallup.com/poll/1615/Environment.aspx#2).

How is this development to be interpreted? Does it not contradict the claim of a new CCD made in the previous section? Given the very recent character of these events, any interpretation seems to be preliminary. For the so-called climate 'skeptics' (otherwise also termed 'contrarians' or 'deniers'), the interpretation is rather easy: IPCC has always been an advocacy coalition rather than a thorough scientific body,

[7] Another mistake in the same document did quote misleading information about the size of the low-lying areas in The Netherlands, provided by a Dutch governmental organization.

and the recent events only reveal this to the wider public (Singer 2008; Idso/Singer 2009). Looking back to a long-standing history of quite successful work in 'debunking' climate science and lobbying against climate policy (Agrawala 1998a; 1998b; McCright and Dunlap 2003), the 'skeptics' community tries to seize the actual opportunity and 'kill' the whole issue.

But not all critics of IPCC are climate contrarians, and not all are on the payrolls of the coal, oil and gas industries. Some even have participated in IPCC reports. They still criticize the way the IPCC results have been generated and communicated. Pielke (2007) for example argues that many IPCC scientists have left behind the role of a 'solid broker', offering sound scientific evidence and the option space of possible choices to policymakers, taking on (often covertly) the role of an 'issue advocate', trying to sell preferred solutions to politicians. In reading the books of famous climate scientists (Hansen 2009; Schneider 2009), one can see how difficult to draw that line in reality is. And it is not a priori clear whether one has to blame the scientists or reality for this difficulty (Jasanoff 2008).

Against this background, a reform of the IPCC has been proposed by many observers and participants in 2010. Broadly speaking, the propositions made fall in two categories: While some argue in favor of re-assuming the role of the 'honest broker' (Pielke 2010) and of re-scientification even at the expense of its policy interface (Schellnhuber 2010), others resort to more explicitly dealing with values and the intrinsically political nature of climate science, e.g. by dissolving the three working groups (Hulme et al. 2010).

In interpreting the calamity in which IPCC seems to have come, one has to keep several points in mind:

- IPCC undoubtedly issued erroneous statements in its 2007 report – most probably also in earlier ones. Every scientist or scientific organization is bound to 'getting the facts right', otherwise its credibility suffers. However, given the huge number of scientific publications that IPCC has reviewed, as well as the large number of international reviewers, failures do and will continue to happen. The contradictions between Working Groups I and II indicate that IPCC needs closer collaboration between its Working Groups, transparent rules for dealing with 'grey' literature, and possibly an independent supervising committee to control the correct application of rules. But given the overall quality of its reports, as well as the quantitative relation between errors and non-errors, IPCC is still an outstanding scientific organization. This especially holds when one takes the treatment of uncertainties into account, which many other scientific bodies treat much less transparent than IPCC, although even there improvements are possible (Edwards 1999; Edwards/Schneider 2001; Schenk/Lensink 2007). Alarmism is the wrong way if there is no reason for concern. But if climate trends provide ample reasons for concern, scientists have to be alarming (Risbey 2008).
- Attempts to re-establish IPCC as a purely scientific body in order to regain public credibility are risky both for IPCC and the UNFCCC process, given the success story of this very specific 'boundary object' (S. Beck 2009; Conrad 2010; Skodvin 1999; 2000). Climate policy has been and in large parts still is a science-driven issue. But keeping politics out (according to the original rules of the British Royal Academy in the 17th century: 'Not Meddling with Politicks') of the formulation process of IPCC Reports would substantially reduce the political relevance and impact of IPCC, especially under conditions of the 'new' CCD. Political bureaucracies that, together with IPCC,

have developed expertise and commitment would loose interest, and IPCC would share the fate of so many scientific expert committees, that usually pay the high price of political irrelevance for their presumed scientific purity. Climate science can be regarded as an example for 'post-normal science': stakes are high, and uncertainties as well (Funtowicz/Ravetz 1993). Attempts to 're-normalize' it risk to trade less impact for more purity (Ravetz 2010).

- There is no doubt that the 'Copenhagen Accord' (http://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf) has disappointed the high expectations that many climate activists and scientists did have. No binding commitments have been achieved, and the greenhouse gas reductions offered on a voluntary basis by some governments fall short from any realistic chance to achieve the 2° C goal (Rogelj et al. 2010). Nevertheless, the Accord is the first international policy document within UNFCCC to accept this goal as a valid and binding definition of Article 2 of the Convention, stating the prevention of 'dangerous anthropogenic interference in the climate system' as policy goal. May be more flexible multilateral solutions for single aspects of the climate problem will be found. In addition, the 'failure' of Copenhagen has facilitated the importance of non-state actors in (international) climate policy, namely consumers/citizens, the business sector, and local communities, especially cities. This might also give rise to new initiatives at the international level (Ostrom 2009; Sterk 2010).
- Macroeconomic indicators as well as expectations regarding the economy point to a recovery of the world economy already in 2010, not only in India and China where two digit growth rates have come back. Parallel to this, public awareness and concern regarding climate change might also recover – in fact we have empirical evidence supporting that view (Borgstedt/Reusswig 2010). This holds especially true if one takes into account that many weather related disasters can in principle be causally linked to global warming, as the mass media have done (sometimes erroneously) during the last decade. Forest fires in Russia and floods in China and Pakistan during summer 2010 are cases in point.

The heated and controversial public debate on IPCC and climate science in general in 2009/10 can hardly be explained as a debate about scientific accuracy. Otherwise the public would have had to blame mainstream economists much more aggressively after their failure to predict the recent economic crisis. Giddens (1990) argues that trust entails a commitment to something, rather than just a cognitive understanding. The trust crisis of IPCC is thus not merely a crisis of the cognitive credibility of climate science, but also a chance to get rid of the illusion that our commitment to climate policy was only a function of scientific discoveries. Instead, we are confronted with the inevitably political character of our climate views and choices (S. Beck 2010; Jasanoff 2010). The intensity of the debate indicates how powerful climate science has become, or is perceived to be. The coincidence of 'Climategate' with the recent economic downturn indicates another element of explanation: By shifting from 'Convinced that climate change is real' to 'We are not sure about the science', the general public can dispense itself from saying 'Yes, action would be needed, but actually we have other problems'. When people are facing an economic crisis, they may be less willing to support policies that will cost them money, but at the same time feel uncomfortable about jeopardizing the planet's future simply to fatten their bank balance. Skepticism absolves them of selfishness.

Interpreted that way, it would once more be a failure to focus on the scientific credibility issue exclusively

when considering the recent twist of the Climate Change Discourse. Instead, we do better to address a much wider scope of the science-society interface in actual CCD. This ultimately leads to the ambivalences and risks associated with the possibly emerging post-carbon society. In our interpretation, the recent debate about IPCC is less a consequence of scientific uncertainties (as it would have been under the auspices of the 'old' CCD), but rather a symptom of decision ambiguities that characterize the 'new' CCD.

4 Ambivalences of a post-carbon society

Discourses, it has been mentioned, refer to speech acts, e.g. to socially relevant narratives of looming disasters and culprit agents such as CO_2 (Viehöver 2003a; 2003b; and in this volume). Discourses, as Weber reminds us, do also refer to social actors, their interests and their actions. For discourse analysis – not only in the case of climate change – it is crucial to keep the interactions between the 'material' and the 'ideal' levels in mind. Neither is it true that ideas and worldviews simply 'reflect' pre-determined interests, nor can be stated without restrictions that actors are simply governed by 'discourse' in the narrow, idealistic sense of the word. The relation between both levels is a dialectical one: the 'ideal' sphere of worldviews – expressed in speech-acts – and the 'material' sphere of interests – expressed in dispositions, preferences and actions, anchored in positions of the socio-ecological system – are opposite aspects that are mutually dependent at the same time.

Human action, far from being 'mute' behavior, is inevitably interwoven with the logic of reasoning as set out in language. Other than by *interpreting* what we do – or what we observe others doing – the very fact of *doing* is non-existing for humans. And as a private language is impossible (Wittgenstein), interpretation is a social process, taking place in a world shared by a multitude of actors.

Social change and/or scientific progress can thus alter the *meaning* of one and the same action. The climate discourse provides sufficient examples: While 'car driving' was an action (and a concept) that did relate to many discourse orders (such as the economy or law), it did not occur as a global environmental problem until the climate discourse identified CO_2 emissions from cars as a source of global warming.

The same holds for interests. One might think that having economic assets in fossil fuels inevitably binds the asset holder to particular interests and significantly limits the scope of possible actions. Although this is empirically often true, it is not necessarily true. Even in the empirically *true* cases fossil fuel asset holders still need to interpret their assets and evaluate them in the social space and its dynamic in order to detect profitable ways of utilizing the resource. But there are cases where this link does not hold true. Some fossil energy companies have started to seriously invest in renewable energy sources, broadening their economic portfolio, while others have remained reluctant, maintaining their fossil fuel path dependency. These cases are not exceptions from a rule ('actions follow interests, interests follow physical assets'), but arguments of another rule ('actions follow *interpreted* interests, interests follow *evaluated* physical assets'). The important point is that this latter rule holds for both cases – fossil path dependency and portfolio approach – alike. It is not (necessarily) a different physical asset base that drives company A to diversify, while company B stays its course. It is a different *interpretation* of that asset base in the economic and political landscape that leads one company to divert from the path taken by the other. These differences may arise due to a new assess-

ment of profit rates from renewable energy sources, or from expectations about new government regulations, or from changes in the public perception of the corporation etc.

The 'new ' CCD has revealed that both unchecked climate change and climate protection are choices we have to make, and that both of them come with 'price tags'. It thus ultimately confronts us with questions about the way of life we want to live (Leggewie 2010). As a consequence, the 'new' CCD has to face *new types of uncertainty* and is explicitly confronted with the problem of *ambivalence*, both of which have not been (that) relevant in the 'old' one. While uncertainty in the climate system can arise from lacking data or from the impossibility of predicting the future development of very complex and/or (mainly) stochastic systems, the uncertainty of human agents and social systems arises from other sources: the freedom of human agents to decide otherwise, the double contingency inherent to interaction systems, unintended side-effects of intentional action, or of emerging macro-properties of micro-systems (Mayntz 1991).

In addition, if the climate system is explicitly perceived as part of a wider Earth system that is significantly modified (if not dominated) by human action and intervention (Turner et al. 1990), the scientific understanding of this complex and hybrid object now cannot escape to deal with the fact that human actors (individuals, organizations, states) adhere to different, sometimes even conflicting values that influence their perception of what is the case (or what is relevant), and what should be done at individual or collective levels (Kahan et al. 2011). The new CCD is characterized by this double influence of *uncertainties* from the social realm that add to climate uncertainties, and from the *ambivalences* that any decision brings about due to the (contested) values involved. One thus can, taking these elements (uncertainties about human decision making, ambivalence of decisions) together, conceive the highly *ambiguous* nature of the 'new' CCD.

As has been stated before, climate change is a scientifically mediated, but by no means a science-dominated affair. It has been stated that the major question of the 'new' CCD is less about the attribution problem ('Is climate change anthropogenic in nature or not?'), but more about the management of adverse effects (adaptation) and of cost effective and fair solutions (mitigation). This might seem to imply degrees of coherence and consistency of measures, according to the motto 'We all know what needs to be done.' This is clearly *not* the case. A unanimous set of solutions, encompassing climate-friendly individual attitudes and behavior, organizational routines, new technologies and supporting political regulation has not emerged yet. Instead, the 'new' CCD is characterized by new controversies about climate friendly lifestyles, technologies, and policies (Giddens 2009). And we are confronted with the unintended consequences and ambivalences of 'climate solutions' – aspects which had been of minor importance during the 'old' CCD, when the solution space for the climate problem has been much less in the center of attention. In other words: The *sustainability* of a post-carbon society that vaguely becomes apparent in the new CCD is open to debate (and in fact has to be debated). One can easily imagine a fully-fledged post-carbon society that massively violates, say, other environmental goals (such as biodiversity conservation) or social goals (such as protecting smallholder farmers from exploitation). There are several aspects that can support this view:

- What looks like a 'solution' or 'wedge' to mitigate against the causes of climate change from a (natural) science point of view has to be regarded as a behavioral change and/or a different investment deci-

sion from the standpoint of a social actor. Both behavioral changes (such as buying a hybrid car) and investment decisions (such as setting up a wind park) have to 'make sense' for the actors involved, i.e. they have to maximize utility (or whatever rationality concept one wishes to defend), or they have to be profitable, i.e. they have to generate a financial return that exceeds costs by at least average profit rates in a given period of time. Decisions come with transaction costs, and they are located in a world of limited (social) resources. This will inevitably lead to conflicts, competition, trade-offs, strategic use of (scientific) knowledge etc., especially in global capitalist market societies (Deutschmann 2008).

- Given the long lasting path-dependencies of the 'modern' energy system and infrastructures (Arthur 1989; Unruh 2000), the de-carbonizing of modern society will be a long-lasting and difficult process. As in every other historical case of major socio-technical transitions (Geels 2005), the transition towards a post-carbon society will bring about structural disruptions. There will be winners and losers of climate change and climate policy (DB Research 2007; Meadowcroft 2009). Potential losers will most probably oppose the transition, e.g. by doubting the credibility and impartiality of its scientific underpinning. They will highjack some arguments, piggyback on others, or re-interpret them in 'creative' ways – just in order to utilize social trends for particular interests. Losers are usually much clearer about their losses than potential winners about potential gains, resulting in an asymmetry of their respective voices. Post-carbon ambiguities result from the creative ability of social actors to re-interpret both their interests and hegemonic ideas that might threaten them.
- Given the complexity of the hybrid Earth system, which is heavily influenced by human action without being completely determined by it, many interventions are possible, but remain risky at the same time. Global mean temperature, the central 'driver' for all kinds of climate change impacts, cannot, as a statistical property of the system, directly be influenced by human action. Only anthropogenic emissions can, but the translation of emissions (via greenhouse gas concentrations) into temperature remains a scientific challenge. In addition, many 'variables' of the Earth system intervene in not-easy to understand ways: the oceans, terrestrial and marine biomass, global biogeochemical cycles other than the carbon cycle (e.g. water or nitrogen), the albedo of different land covers, dust in the atmosphere etc. (Rahmstorf/Schellnhuber 2007; Walker/King 2008). If, for example, the iron fertilization of the world's oceans could substantially increase their carbon uptake, costly emission reductions 'on land' are rendered unnecessary. Such 'geo-engineering' options have been arising rapidly in recent years, trying to intentionally intervene in the Earth system by technological 'fixes' on a global scale (Blackstock et al. 2009; Shepherd et al. 2009; Stephens/Keith 2008). The more difficult political attempts to limit global GHG emissions at various levels turn out to be, the more tempting it will become to think about these risky geo-engineering options (Ott 2010). Post-carbon ambiguities result from the persistent and inherent complexity of the Earth system, rendering risky re-inforced attempts of deliberate global human intervention (geo-engineering).
- The core criterion for a post-carbon society is a technical but at the same time a very minimal one: to substantially reduce the atmospheric emissions of greenhouse gases, measured in carbon dioxide equivalents. Many concrete technological and social development pathways – some of which mutually exclusive – are in-

ternally consistent and comply to that condition, even without referring to the 'magic bullets' of radically new technologies (Pacala/Socolow 2004). But the proponents of a post-carbon society disagree about the basic character of the transition process. How much efficiency (e.g. increased energy productivity), how much subsistence (e.g. lifestyle changes), and how much consistency (e.g. based on zero-emission technologies) will be feasible and necessary (Huber 2004)? And what concrete technological pathways should be chosen to reach the 'blue economy' based on environmentally adapted technologies (Pauli 2010)? Post-carbon ambiguities result from the tension between the narrow target definition and the wide and in part conflicting pathways to reach that target.

- Environmentalists tend to believe that only the technologies of the fossil age – including nuclear power in many views – can be termed risky technologies, while 'green' solutions are often regarded as 'clean' or intrinsically unproblematic. This may be true with respect to the problem they are intended to solve – first of all to reduce GHG emissions. But this is in no way true with respect to all other kinds of risky side-effects. Biofuels are a good example: one could substitute fossil fuels by fuels from plants, thus mitigating against the causes of global warming, while at the same time reduce both food security and the biodiversity of the planet. Reforestation projects to sequester carbon can lead to more monocultures, new land conflicts, and the marginalization of local forest users, especially if they are poor and/or politically weak (Gerber 2011). Electric cars run on zero emissions during the operation phase (if electricity is generated from renewable sources), but the chemical cocktail in their storage batteries might create a new toxic waste problem. The establishment of a renewable energy system across Europe and North Africa might substantially reduce Europe's energy related GHG emissions, but at the same time could lead to centralized economic structures with new North-South divides. And so forth. Post-carbon ambiguities result from our tendency to ignore side-effects once our 'favorite' problem has been solved – or, put more technically, from our reluctance to apply the principles of precautionary risk assessments to the brave new post-carbon world (Hulme 2009).
- Even if humankind managed to reach a post-carbon society, given the historical emission and the inertia of the Earth system, additional global warming is already underway and unavoidable. Adaptation to a changed climate is necessary – and has to be funded. While both adaptation and mitigation measures are economically and politically compatible (even mutually beneficial) to some extent, given the limited financial and organizational scope of modern societies trade-offs may arise (Fankhauser 2009; de Bruin et al. 2009). It is also open to debate what adaptation priorities might be preferred, and what instruments and measures should be applied (e.g. technological, organizational, financial compensation). Post-carbon ambiguities result from the limited funding for mitigation and adaptation, as well as from the value dependency of adaptation priorities.

The intention of this most probably not comprehensive list is not to create 'artificial' problems, or to debunk the post-carbon society, which we think has to come about. However, social scientists – as scientists in general – must not lose their analytical skills and duties only because – under the auspices of a 'new' CCD – a post-carbon society takes shape. The evidence of newly emerging conflicts and ambiguities should have removed the idea that a low- or post-carbon society would be

a 'harmonious' society. Post-carbon ambivalences do emerge, and science will be needed to deal with them. But what kind of science, and how?

5 New challenges for climate science

The master frame of the 'old' CCD was one of 'analyzing the climate system', or more precisely: explaining major observed effects by tracing them back to complex causal patterns. Although IPCC did have three Working Groups (WG) right from its beginning, Working Group I did take the lead in the 'old' CCD. WG I members typically are atmospheric scientists, climatologists, physicists, chemists, or climate modelers. The examples of Galileo, Newton or Einstein illustrate how physics did play a leading role in the evolution of modern science, and that physicists have often been endowed with a consciousness of forming the top end of scientific discovery. This is one reason why the more physics-oriented body of research reported in WG I assessments has been officially termed 'The Scientific Basis'. Due to their higher complexity and lower degrees of predictability, biological systems seem to be less able to be conceived in a unified and consistent theoretical framework, based on first principles. It seems to us that this is the reason why biologists are perceived as being a little 'less scientific' than, say, physicists. As biologists (and geographers) make up the majority of WG II members, the results of this group do not count as 'scientifically basic' as WG I results. And this despite the fact that the scope of WG II, dealing with impacts of climate change and the vulnerability of biological and social systems, covers more or less the reasons for social concern about climate change: most social actors worry about the impacts of climate change, not about climate change 'as such'. WG III finally, dealing with mitigation options and adaptation to climate change, has many members from the social sciences, as well as some engineering an energy modeling people. Again, their work is very important if we consider that future climate change is heavily dependent upon future anthropogenic emissions and its social and technological drivers. But the scientific character of economics or sociology is disputed among 'hard core' scientists, may be even more so than the work of biologists and geographers. The least one can say is that for the core question of the 'old' CCD – is there anthropogenic climate change? – the social sciences did have little to contribute.

Under the 'new' CCD, the decision problem within the Earth system has become center stage. This discourse shift translates into a shift in the relevance of the sciences involved, giving the social sciences in general a much more prominent role. WG III is on its way to lay the new 'scientific basis' of climate science. In the days of the 'old' CCD, the social sciences did not have much to contribute to the attribution problem. Their main task was to calculate impact costs as well as adaptation and mitigation costs. Under the auspices of the 'new' CCD, these latter costs have still to be calculated, if not gained importance. However, the important point now for the social sciences is that various options (scenarios) have to be figured out, including technology choices and governance structures, as well as risk assessments for mitigation and adaptation options in the 'reflexive' mode of climate politics described above. Whether or not the climate science community in the wider sense lives up to that challenge depends upon the way it perceives itself, and to the concepts and models it applies accordingly.

Actually, climate related decisions are dominantly analyzed by economists and their cost-benefit assessment tools (Helm/Hepburn 2009; Nordhaus/Boyer 2003). The climate economics community has improved both the quality and the salience of its models by model comparison efforts

(Edenhofer et al. 2006), and some important developing country scientists have followed that exercise (CMFI 2009). More and more, the facts and models of the natural scientists in climate change research are used as ancillary input into models that economists have developed. But this gained relevance of (mainstream) economics does not suffice when it comes to adapt the science-society interface to the challenges of the 'new' CCD with a post-carbon society as a possible future, for a number of reasons:

- Mainstream economics can be seen as an attempt to de-politicize decisions by seeking neutral ground, e.g. by quantifying outcomes in terms of Gross Domestic Product (GDP). However, the conceptual framework of costs and benefits does neither capture the broad variety of (potential) climate damages, nor does it reflect the fact that it is difficult, if not impossible to deduce a consistent welfare measure (such as GDP) from heterogeneous preferences (Jaeger/Jaeger 2010; Spash 2007).
- Even if the dominant mode of cost-benefit analysis would be overcome, the scope of economics would be too narrow to cover all decision relevant questions of climate policy. Economic institutions and mechanisms find themselves embedded in social and cultural institutions, and a scientific account of what options need to be researched in favor of a viable post-carbon society needs to cover the whole range of these other social sciences as well. Climate change has become a cultural, not only an economic task (Leggewie/Welzer 2009; Welzer et al. 2010).
- The widespread self-concept of scientists as impartial and objective observers still informs their understanding of policy advice as 'speaking truth to power'. This self-understanding, reinforced by powerful institutional settings and role models, does not reflect the co-production of science and society in knowledge-dependent issues (Jasanoff 2004), with climate change being a clear case of choice dependent nature-science interactions (Jasanoff/Wynne 1998).
- As a consequence of the indicated ambivalences of the 'new' CCD, science would also have to institutionally reflect the co-production of science and society. More participatory approaches together with a higher degree of transparency of the procedures that generate knowledge should be established, especially with respect to the nomination of IPCC scientists, the review process itself, and the process of communicating its results in policy relevant summaries (S. Beck 2010).[8]

To illustrate this point one has to look a little more carefully at a core question of the 'new' CCD: What is dangerous climate change? This question arises upfront when dealing with climate change. Nobody is affected by or interested in climate change as such, i.e. independent of the impacts on natural and social systems it might have. In addition, given both the climate change history of the planet and the adaptive skills human societies have displayed over centuries, one cannot conclude a priori that *any* change of the Earth's climate (say: + 0.1° C) is harmful or dangerous. So what exactly *is* dangerous about climate change? Fortunately, this basic question is also enshrined in the leading document of international climate policy. Article 2 of the United Nations Framework Convention on Climate

[8] Some of the recommendations of a committee to improve IPCC's work (IAC 2010) hints to that direction (e.g. the suggestion to include non-scientists in to the Executive Committee, a new body suggested by IAC), while others try to reduce the influence of stakeholders (e.g. in preparation of the Summary for Policymakers). Instead, one could have thought about making the negotiation process public, so that the general public (and citizens of particular countries) can learn about how their governments argue in climate science.

Change (UNFCCC) specifies the purpose of the Convention by stating that humankind should prevent 'dangerous anthropogenic interference with the Earth's climate', but leaves the interpretation of 'dangerous' more or less open to further debate. Many climate scientists have tried to answer that question (Schellnhuber et al. 2006). It has emerged as a sort of scientific and political consensus that an additional warming of + 2° C against the pre-industrial level seems to be a good operational definition of 'dangerous climate change', a 'focal point' shaping our expectations and actions (Jaeger/Jaeger 2010). The 'Copenhagen Accord', as flawed as it is in many respects, confirms that goal.

However it is not possible to define from a purely scientific point of view what dangerous climate change is, and how many degrees of global warming this would entail. Scientists can say what will happen to various systems once global mean temperature reaches or exceeds two degrees. For example, coral reefs might die back over time once this threshold is taken. But why would this be dangerous? The very concept of danger lies beyond the scope of pure scientific observation. It is an expression of values: we shift from 'A influences/impacts B' to 'B is at risk from A impacting it' due to a valuation process that expresses our attachment to and/or concern about B. Coral reefs for example. They offer hotspots of biodiversity – which most of us prefer over less diverse environments – , they create economic income for fishermen and tourist agencies – which at least they will prefer over a non-income situation – , or they simply are beautiful to many people. This is why the probability of coral reefs to vanish under climate change is framed as risky or dangerous.

Usually, lay people and policy makers make value statements as a normal mode of operation. So one might wish lay people and/or policy makers to provide science with a notion of dangerous climate change. As good as those actors are in making value judgments, they usually lack a deeper understanding of impact mechanisms and system thresholds. To conclude that 2° C is dangerous one needs to have *both* – an impact mechanism provided by science, *and* a valuation statement provided by social actors. The statement '2° C is dangerous climate change' thus is a hybrid statement, generated at the science-society interface, not by science alone (Luhmann 2010).

The decision making problems we are facing today do reinforce this type of co-production between science and society. It is no more sufficient to simply define what dangerous climate change is (e.g. by a temperature threshold), we also need to know how to avoid it, and we need to understand the risks of options that may help doing so. This inevitably brings the problem of evaluation to the fore, as well as the problem of future uncertainty with respect to the side-effects of new options (Carolan 2008).

Evaluation questions arise when it comes to the concrete path of socio-technical systems we should implement in order to meet specific emission paths. And as the historical emissions as well as the future-binding trajectory of particular societies vary substantially, these questions are intrinsically linked to moral and economic issues of equity and burden sharing – not only between (Grosso 2007; Narain 2010), but also within nations (Chakrawarthy 2009; Schlüns 2007). Operating closer at the science-policy interface and cooperating in a transparent manner with stakeholders does inevitably 'charge' science with social values. It is the particular task of the social sciences to rationally deal with the social values and preferences entailed in stakeholder propositions. According to Max Weber, science can only *reveal* the value orientations it is committed to. A *rational discussion* of values is impossible. Not subscribing

to the decisionist view on values Weber adheres to (Ambrus 2001; Daniel 2000), we assume that 'values' and 'facts' are richly intertwined – much closer than Weber (or Hume) and many others have thought (McDowell 1998; Putnam 2002). Other than Weber we also assume that a rational discourse on values is possible (Habermas 1981). Science cannot prescribe the values that should govern our (climate) choices, but it can discuss which consequences might flow from these choices, which social and environmental implications particular choices might have, and which moral principles are involved in particular ethical choices (Longino 1990). Scientists alone cannot come to a conclusion about moral choices, not even together with philosophers. But they can, together with stakeholders, decide whether or not real choices are compatible with the goal to avoid dangerous climate change. As beings endowed with limited, but self-reflexive and socially embedded rationality humans not only have preferences (e.g. about a particular energy system), they do also have second-order preferences, i.e. they can and often do reflect, rationalize and correct their first order preferences (Frankfurt 1971; 1988). We smoke, but we might wish to give it up. Instead of weighing future climate change induced damages higher than actual benefits from activities that contribute to climate change, we might as well wish to abandon harmful activities that we are engaged in due to our first order preferences. Rational self-constraints can arise from anticipated damages, but they can also arise from preferences for a more equitable and more beautiful world. Reconstructing these second order preferences, revealing not only the negative side effects of first order preferences, but also the internal contradiction between our first and second order preferences, and searching for viable (e.g. cost-effective and equitable) ways to translate second order into first order preferences – all these are challenging tasks of science in the new CCD.

Given the narrow timeline when it comes to avoid a global warming of +2° C technological and social options to reduce GHG emissions can probably not wait for too long (Meinshausen et al. 2009). If a stabilization is not achieved until 2020, irreversible climate change effects may well have been triggered – most prominently sea level rise. Climate science, in becoming aware of the risks of non-action, pushes for a rapid de-carbonization of our economies. On the other hand, as has been mentioned in section (4), new risks arise from new solutions. In this situation, we would like to propose a stance of 'reflexive interventionism'. By this term we mean that (social) scientists, in the light of urgent action against dangerous climate change, should engage in activities of social actors that aim at reducing the carbon footprint of societies. In other words: we propose to actively engage in attempts to bring about a post-carbon society. We see this as a clear consequence of their social responsibility, perceiving science at least as an early warning system for society.

There clearly is a normative element in reflexive interventionism: Given the risks of unmitigated climate change, we value the climatic and other environmental conditions of human societies that have historically evolved within the 2° C temperature window (Behringer 2007) as a precious good, including the lives and livelihood conditions of many people, especially the poor and those living in low-lying coastal areas. As the continuation of the carbon-intensive pathway of modern societies threatens these and other stakes, we take it to be imperative to avoid dangerous climate change, and thus to significantly and rapidly decarbonize modern societies. Scientists do already play a crucial role in this process, e.g. by developing low-carbon technologies or designing post-carbon urban structures and related social

organizations. As we have shown in section (2), climate policies have been brought on their way intending to achieve this goal – how fragmented and tentative ever. Pleading for interventions thus does not necessarily mean to initiate de-carbonizing processes from scratch. It rather means to actively participate in an *ongoing* process of socio-technical change (Reusswig 2010).

In the previous section we have highlighted the *risks* of climate solutions. Scientists can clearly contribute in increasing these risks, and in fact many of them already do so, as our examples from section (3) should have made clear. However, the answer to this cannot be to simply refrain from intervention and instead to take a back seat as 'pure observers'. This position has been cultivated by the social sciences – especially, but not exclusively by sociologists following systems theory. Societies cannot be changed, just observed, and the only meaningful task of sociologists is to observe social observations. This position – a point of indifference between modesty and superiority – has been reinforced by the loss of utopian energy after 1990. However, we argue that social scientists cannot afford to stick to this attitude when it comes to such big problems as climate change (Adam/Groves 2007; Lever-Tracy 2008). Instead, we see the role of (social) scientists in critically reflecting the interventions they – together with others – engage in. This would, for example, require to actively put on the floor the critical voices that oppose a particular option. Given the technological bias of many geo-engineering options, it would be crucial to be critical here, as many proponents of geo-engineering are not only driven by concerns about global warming, but also by the perceived difficulty (or even: the perceived danger) to change social institutions and power structures. It seems easier to technologically 'fix' the atmosphere – and keep the carbon intensive modern society untouched – than to address the underlying causes of power structures, interests, institutions, cash flows, and the like. The suspicion seems realistic to us that many scientists engaging in such experiments (e.g. the iron fertilization of oceans, which is ongoing, but hardly perceived by the public: Wiertz and Reichwein 2010) play around with the ecology of the globe – risk seekers – because they shy away – risk averse – from its sociological realities.

Here, as in any other case (e.g. personal trading schemes of household emissions, or changes in the urban form), the new CCD requires a critical reflection (including transparent and participatory risk assessments) of the various options is urgently needed. But it is not the role of social scientists as pure (critical) observers that enables them to participate in such deliberation processes. It is only the role of critical and scientifically skilled participants in a social discourse that both enables and entitles them to bring their expertise in.

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Let's Disagree!

Talking Ethics in Technology Controversies

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Abstract

The central concern of this contribution is the question of whether discursively stabilised disagreement among experts leads to problems of legitimacy for science in its advisory capacity or for the taking of political decisions. In considering this question, it seems initially plausible that a failure to build consensus will endanger science as an important resource and as a basis of political decision-making. In my view, this conclusion is justified in respect of such science and technology controversies which can be understood as problems of risk. Where questions such as climate change, cellular radio, or transgenic crops are concerned, debate crystallises around the question of which claims to truth can be shown to be justified, and a consensus on the disputed issue between the experts involved is seen as the ideal way of ending the conflict (cf. Weingart 2006: 162-3).

However, I want to argue in this contribution that an absence of consensus cannot be understood *in principle* as a deficit in terms of legitimation, or indeed as a general weakness of expert knowledge. On the contrary: to the extent that controversies about science and technology are understood and negotiated as problems of ethics rather than risk, disagreement becomes an indicator of quality as politics seeks to manage uncertainty.

In order to demonstrate why ethics is currently such an important factor in conflicts about science and technology, I begin (1) by presenting a short discursive history of the ebb and flow of ethics during the process of modernisation. It becomes clear (2) that many of today's conflicts about technology are being negotiated with the help of explicit reference to ethics. My main thesis (3) is that from the perspective of conflict theory, this appreciation of ethics means disagreement is being recognised and stabilised. In ethically framed value conflicts, no-one can – with good cause – expect a genuine agreement to be reached on the level of personal moral reasoning (apart from basic values such as those expressed in the universal declaration of human rights). The next section (4) shows that this cultivation of disagreement has considerable implications for the political management of controversies about technology. The empirical analysis is then centrally concerned with the question of how politics deals with expert disagreement in ethicised controversies. This analysis is confined to the case of Germany. It shows (5) that political references to ethics expertise express a recognition of disagreement which opens up legitimatory possibilities for political action. In the conclusion (6), I recapitulate the central points of the argument.

1 The ups and downs of ethics

This section deals with ethics as an expanding discourse of reflection and regulation in the sphere of science and technology and with the political implications of this development. The issue of ethics as an "ethicisation" of technology controversies is therefore explored.[1] This is the perspective from which sociology has reacted to an unexpected "renaissance of ethics" (Pruzan and Thyssen 1994). However, there is a need for a more detailed historical treatment of the view that ethics has been revalued or is undergoing a revival. The following sketch of a sociology of ethics is designed to provide this treatment. It serves to identify clearly the point at which my analysis of science and technology controversies makes its intervention in the field, and what additional contributions it makes. The ebb and flow of ethics in the process of modernisation is traced via an examination of the works of Weber, Gehlen, and Giddens.

Max Weber emphasised the significance of ethics for the development of capitalism. In his famous study of Protestantism from 1904, Weber reconstructs in painstaking detail the effects of ethical-religious motives on the developing practice of capitalist logics of action (Weber 1992). The central feature of this analysis is the ascetic-protestant conception of the calling, in which work is treated as a moral test of the individual. In order to establish itself successfully, this imbuing of work with moral content required religious motives in the form of the Calvinist doctrine of predestination, according to which untiring professional work is the best way for individuals to reassure themselves that they are in a state of grace. For protestant ethics, work is no longer a necessary evil; it becomes a duty which requires a systematic method according to which life is to be lived. In the final analysis, work becomes largely a matter of working on oneself; the puritanical work ethics appears as an early form of modern "technologies of the self" (Foucault 1988). It denies the worker any respite from his drudgery and does not allow the entrepreneur to consume his wealth. One could describe this kind of ethically motivated establishing of a morality of work as the cultural conditions in which modern capitalism can develop. What makes Weber's account so striking is his description of the way in which actors become accustomed to the practices of capitalism as an unintended consequence of efforts directed towards ethical reform. Weber sees very clearly that in developed capitalism there is no longer any need for this kind of religiously-charged conception of professional work. Before long, the protestant work ethic only continues to exist in a secularised form, for example in 18th-century utilitarianism. Once capitalism has become established, it emancipates itself from its religious foundations.

Arnold Gehlen, in his classic study of Man in the age of technology (published 1957 in German language), also addressed the relationship between ethics and capitalism. Gehlen examines this question against the background of developed postwar capitalism (Fordism). He portrays modern industrial society as a form of society that systematically seals itself off from ethical questions (Gehlen 1980).

[1] According to Luhmann (1993) and others, I understand ethics basically as a way of reflecting moral issues along the differentiation between "good" and "bad". Ethics is considered to be a matter of rationality and reason in contrast to moral, which is considered to be a matter of tradition and habit. In addition, it may be fruitful to define the difference between moral and ethics with regard to the expectation of consent and dissent, respectively. In this view the rise of ethics, in short, indicates that dissent becomes predominant. I will discuss this point extensively in section 3. In a nutshell, ethicisation means that the main discursive frame in a technology controversy is ethics rather than risk, see section 2.

Gehlen's diagnosis of contemporary society can thus be read as a thesis about the loss of the function of ethics, and he argues that there are both (a) material and (b) structural reasons why this has happened.

(a) In material terms, Gehlen sees a connection between this loss of function and the institutional progress for which he uses the term "superstructure". This progress is based on scientific-technical developments, organised by the state, and supported by industry. It leads to a linear rise in the general standard of living, and there no longer seem to be any natural limits to this. Once the belief in the possibility of unlimited growth has become established, ethical imperatives that might serve to set limits ("asceticism") carry less and less conviction. Why should there be any limits to what research can be allowed to do when it is the source of the general improvement in the quality of life? Why should the individual behave ascetically when everything is available in excessive quantities?[2]

(b) Gehlen's second point is that ethics no longer has any role to play because the rationalisation process leads to the development of functional spheres operating according to their own laws, and these spheres are no longer significantly structured by personal relationships. Modern societies have been differentiated into a variety of spheres of action with their own logics, and for this very reason they offer no target towards which ethics could be directed. Science is an example of this. Gehlen argues that research in the natural sciences cannot be ethically regulated because its experimental epistemological logic leads to an automatism: relevant research questions are formulated on the basis of scientific progress (what is already known), not by the researcher (as a moral subject). This also applies in principle to the economy, politics, and the law. Weber's suspicion that advanced capitalism no longer needs ethics is thus given a more radical twist by Gehlen. As far as the goals of governance and regulation are concerned ethics is not just superfluous, but inadmissible as a matter of principle.

Anthony Giddens has coined the concept of life politics, and uses it to put forward the thesis that ethics has been rediscovered during the process of reflexive modernisation (Giddens 1991: 209-31). In today's conditions, a new type of politics is emerging to replace the traditional politics aligned with predefined class interests and ideals of emancipation. The new politics, argues Giddens, is shaped by the fundamental question of the good life (for all). This life politics is strictly individual, and is based on ethical-moral rather than theoretical-ideological reflection. Giddens sees the environmental movement, and especially the women's movement, as forerunners of this kind of ethicised politics. It is true that the political demands put forward by these movements are not determined by a specific ethical programme. However, the specifically ethical aspect of this life politics arises from the politicisation of spheres that are normally considered to have more to do with values than with interests. Decisions about reproduction are the best example of this. This sphere can serve as a typical example of an area in which questions which are no longer subject to traditional routines have been opened up to individual decisions (about values) in the course of modernisation. Giddens' concept of life politics may be rather

[2] The only sphere in which Gehlen sees ethics as having any role to play is in cultural and intellectual circles where individuals are looking for ways to surpass themselves by means of voluntary asceticism. Indeed, the formulation of ethical demands as demands on the self is the criterion Gehlen uses to identify elites. In this respect, the loss of function he attributes to ethics is an indicator of cultural decline in the sense of the loss of individuality ("Vermassung").

vague, and it has weaknesses as a way of drawing distinctions. Nevertheless, there is no doubt about the value of his insight that ethics is becoming more significant as a major point of reference for political action in a period in which the problems of class and interests generated by industrial society are becoming less important and processes of individualisation and the retreat of the state are becoming more prominent.

Nikolas Rose has put forward the concept of ethopolitics, and in doing so has suggested a more precise way of grasping this aspect of political change (Rose 2001). For Rose, ethopolitics is a modernised or democratised form of biopolitics, in which biopolitical optimisation is realised not through state commands and control by experts but rather via a kind of individual self-optimisation which employs a variety of technologies of the self. One way in which this asserts itself is via a radically modernised and individualised discourse of risk. Unlike eugenics and ideas of racial hygiene, which treated certain stigmatised groups as dangers to the fitness of the population, modern genetics identifies the individual as the potential bearer of risks. This also means, though, that individuals who are aware of their own genetic risk factors are required to take precautions in managing their lives. Instead of (compulsory) state measures to improve the biological quality of the population, the individual is now expected to be constantly making an effort to shape his/her genetic "fate" by means of checks and precautionary measures. In this way, what could be described as a puritan ethics of the body becomes established, a certain "asceticism" of biopolitical behaviour, the goal of which is to regulate the body in an optimal way. This does not necessarily mean taking part in competitive sport, far from it; it does, though, mean controlled enjoyment which takes specific risk factors into consideration.[3] Ethopolitics therefore describes a subjectification of biopolitics, at the centre of which is a bodily ethics aligned with medical-genetic discourses of risk. This concept is similar to Giddens'; the main form taken by ethics is an individual one, i.e. it manifests itself as an individual regime of checks and regulation.

My short excursion to the sociology of ethics has revealed that – in spite of all differences regarding their historical background and their theoretical perspective – the authors referred to have one major point in common: they all are interested in ethics as a way of shaping life-world practices, as a form of informing and (self-)controlling social action. However, the significance of ethics today is by no means limited to forms of individual biopolitics. Focusing on ethics as being relevant for the individual is no longer sufficient. Already Giddens stated that ethical and moral categories have become politically relevant. Today, they are part of many governance discourses, in particular those where technology conflict management is of importance.

As Jürgen Mittelstraß observed at the beginning of the 1990s, it is impossible to overlook the general trend towards ethics (Mittelstraß 1992: 195). This means that ethics has now become a major criterion of reflection and legitimation in many different spheres of society. Let us take, for example, the economy. Nico Stehr (2007) has recently spoken of a "moralisation of the markets". Even though this should not be taken too literally, one can hardly deny that there has been a certain ethicising of individual decisions about what to buy or that businesses are basing their strategies on this development (see Moorstedt 2007). Supermarkets advertise the fact that they sell "fair trade" bananas, and banks set up

[3] This is precisely the context in which the problem perceptions that have in recent years been discussed in connection with the concept of obesity become relevant.

ethical investment funds. Ethical categories are just as relevant in politics. The enemy-image rhetoric of the likes of George W. Bush ("the axis of evil", "rogue states") provides tangible evidence of what one could describe as a moralisation of politics: the construction of political opposition no longer takes place along the coordinates of left/right or above/below, but rather, as has been emphasised by the political scientist Chantal Mouffe (2005), in the ethical-moral categories of "good" and "evil".

If one also takes into account the establishment and professionalisation of special fields of applied ethics such as sport ethics, environmental ethics, and media ethics, it becomes clear that ethics has now filtered into almost all spheres of society. Ethics is no longer just an academic discipline and part of the scholarly world; it has developed well beyond these narrow limits. We now come across ethics in places where no-one would have thought of looking for it a short while ago. FIFA, the governing body of world football, has an ethics commission since 2006. Against this background, one could argue that we are not simply observing a renaissance of ethics, but are witnessing both an institutional differentiation and a debordering of discourses about ethics.

2 Framing technology controversies

We also encounter ethics on the broad terrain of technology controversies. Today, many conflicts about technology are conducted with explicit reference to ethics and morality, rather than exclusively or primarily in terms of risk – as was the case for many of the discussions and debates about large-scale technologies from the 1960s onwards. In the recent past, controversies about the development of science and technology have become increasingly "ethicised" (Lindsey et al. 2001). In particular, ethics has become the main criterion of reflection, justification, and legitimation in controversies about biomedicine. In other words: ethics provides the dominant frame. However, "framing" has for some time now been a conceptually unspecific and overused term; there is therefore a need to be rather more precise when using it (see Dahinden 2006). I use the term "frames" to mean powerful organisational principles of interaction. The function of frames is to create a shared discursive basis on which conflicts can be conducted. The concept of frames therefore belongs to a level above that of the concrete arguments, objectives, and narratives that appear in the discussions themselves. In this sense, frames are principles which provide criteria of relevance and structures of orientation; they establish the relevant perspective that guide the discussion and determine the fundamental rules of the discourse to be conducted. At the level of concrete evaluation, frames do not anticipate any particular outcome.

This last point needs to be stressed, because frames are often associated with concrete, opposed positions in the political debate being conducted.[4] This conception fails to take account of Georg Simmel's insight that conflicts need shared criteria of relevance if they are to be conducted at all (Simmel 1958). Without shared frames, there is indifference rather than disagreement. In the development of controversies, therefore, it is the shared frames that are crucial rather than just the normative differences – and one could perhaps even say that the shared frames are much more important.

[4] This is particularly noticeable in political science, as you can see for example in the influential study of Schön and Rein (1994). This strongly normative component in the concept of the frame has been precisely formulated in Entman's (1993) definition of frame functions: frames define problems in a certain specific way, establish causal relations, anticipate evaluations, and provide guidance for action.

Only when we consider the question from this perspective are we able to appreciate the latent power effects of frames. On the one hand, frames direct and structure our habits of seeing, thinking, and acting; on the other hand, they determine controversies to the extent that adversaries must refer in a constructive way to established frames. If and when one frame becomes dominant, powerful rules for the organisation of conflict communication establish themselves. In the case of controversies about biomedicine, this means that politicians and researchers who are in favour of stem cell research cannot simply put forward economic arguments; they always need to offer an additional ethical argument. Advancing therapeutic promises has become very popular as a way of doing this (Rubin 2008). In the present context, then, ethicising means that questions relating to science and technology policy are understood as questions of ethics; the discourse of ethics, in the sense of its categories and concepts, is recognised as a legitimate form in which conflicts can be conducted and as the basis of conflict regulation.

The ethics frame refers to the fundamental distinction of "morally good" and "bad". Categories of (economic) usefulness and (scientific) truth, respectively, are not irrelevant in ethicised controversies but do not play an important role. However, one could argue that "moral frame" was a better term for describing the current controversies about science and technology. Why talk about ethics when, at best, the academic discipline of ethics provides the keywords for the public debates only? To give an answer, we should bear in mind that the term ethics as used here does not necessarily indicate elaborated philosophical approaches; rather, ethics is understood as a way of reflecting moral issues (but not necessarily according to disciplinary standards). Furthermore, the notion of moral does not correspond to the way how current technology controversies are negotiated. Moral is closely connected to the ideals of unambiguousness and truth as well as to the expectation of consent. "Moralised" controversies are associated with outrage, emotions and (often militant) protest; they are close to "wars on truth" and provide little space for compromises for politics. Ethicisation, instead, indicates that expectations of disagreement get predominant. Ethicised controversies, in principle, are open to building temporary compromises, to deliberation and participation of the many. This fundamental change becomes obvious when regarding the governance of technology conflicts, as I will show in section 4.

The ethics frame contains many possible framings of addressing issues in ethical terms, i.e. sub-frames. In discussions on research involving embryos, e.g. the frame of the "moral status" has been dominant within the ethics frame. Respect for autonomy, human dignity or beneficence are other sub-frames which are effective in current debates (though often in popularised versions of the original philosophical formulations).

It is not inevitable that science and technology controversies will take the form of ethical debates. Let us take, for example, agricultural biotechnology. In the debate about genetically modified crops, the argument is not about what is morally permissible but about what we know and do not know. The central question is: how great is the risk arising from an intervention in nature? What ecological dangers and dangers to human health result from the attempt to use genetic engineering to make plants resistant to pests? Agri-biotechnology is treated in the first instance as a problem of risk rather than ethics. The arguments here revolve around claims about security and assessments of risk, not views about the value of life.

The cases of agri-biotechnology and nanotechnology indicate that questions of risk are still salient, and this is so in ethicised controversies as well. Examples are the risk of egg donation for purposes of assisted reproduction or of biomedical research in general. However, in ethicised controversies such questions are negotiated within the broader context of what is deemed morally good or bad. That is, biomedicine, above all, is treated in the first instance as a problem of ethics.

Of course, criticism of agri-biotechnology involves not only alternative calculations of risk but also quite different attitudes to values, for example an alternative understanding of nature (Gill 2003). But the dominant expert discourse was and is still framed predominantly as a conflict about knowledge. The participatory technology assessment relating to herbicide resistance which was organised by the Social Science Research Centre Berlin in the 1990s was a good example of this (van den Daele et al. 1996). Conflicting truth claims were at the heart of the exchanges between experts and counter-experts in this instance, and normative principles were not at issue (van den Daele 2001: 10). There were similar exchanges over claims to be in possession of the truth in the case of nuclear energy. This conflict was (and is still) shaped by the assumption that decisions about the reliability of assumptions of causality and predictions concerning danger can (and must) be taken on the basis of scientific expertise and the use of scientific method. These controversies about risk therefore revolve around the quality of knowledge.

3 The legitimacy of irresolvable disagreement

If ethics has become the main way of framing technology controversies, what are the implications for governance? In my view, the rise of ethics indicates that there has been a change in legitimacy of disagreement. When conflicts are ethicised, the status of disagreement changes in a fundamental way: dissent is now – in principle – considered legitimate, and, above all, it is considered legitimate in a permanent form. The political function of the ethics frame is thus to be found in the way it stabilises and legitimises irresolvable disagreement. And of course, the reverse also applies: the status of disagreement is also constitutive of the stabilisation of a specific conflict frame – if the status of this value changes, so does the frame. In this respect, ethics as a conflict frame can be understood as an expression of the legitimacy of irresolvable dissent. Returning again to the case of risk controversies makes this clear.

Needless to say, experts engaged in risk controversies can and do also disagree with each other. In these cases, though, the expectation of consensus remains stable as a counterfactual ideal. One can see this in the dispute about transgenic crops, a controversy that is still on-going (Hampel/Torgersen 2010). The European Union permitted the cultivation of the genetically modified maize varieties MON810 and T25, but the EU's directive 2001/18/EC made it possible for member states to register scientific objections and on this basis to ban the cultivation of these varieties.[5] In other words, the possibility of a policy based on counter-expertise is opened up; because the latent consensus ideal retains its force, arguments put foward by a different expert can always postpone a final decision. If in risk controversies the expectation that a consen-

[5] France, Greece, Austria, and Hungary rejected the EU legislation and passed their own laws prohibiting the cultivation of these crops. The EU tried repeatedly to get these national laws repealed, but was never able to obtain the necessary two-thirds majority in the Council of Ministers. In 2008, pressure from the EU forced Austria to lift its ban on the import of transgenic crops, but the ban on their cultivation remained in force (Abbott 2009).

sus will be reached does not persist, the strategy of the counter-expertise would have no chance to succeed; and the dispute would not be conducted with such tenacity and without any real prospect that a scientific solution will be found. Thus, the belief in consensus turns out to be a counterfactual assumption.

This means that in risk controversies, disagreement can only be considered a temporary anomaly which can be corrected by means of greater objectivity. Disagreement is only legitimate when it is temporary, i.e. when it takes the form of a mistake. Scientists are committed to logical-analytical procedures (e.g. experiments, modelling) which they believe will, if employed correctly, lead to answers that cannot be challenged. As Collingridge pointed out some time ago (1981: 189), risk conflicts are, like "normal" scientific debates, essentially debates about truth; consequently, the ideals of unambiguity and consensus guide action, even if these ideals will always remain out of reach. This ideal provides politics with specific options, as one can see in the case of agri-biotechnology: more wide-ranging research is financed, additional disciplines are taken into account, and in sum the process of scientification is advancing. All this can legitimise a political strategy of postponing a final decision. The postponement sends a signal: we need to carry on gathering knowledge until we can take a decision that is genuinely knowledge-based. This became clear recently in the case of the prolonged EU's moratorium on permission to cultivate genetically modifed crops. By way of contrast, it is hard to imagine a moratorium on disputed questions of bioethics – not because there is objectively greater pressure to address this problem and so to take decisions, but because the expectations are different.

To avoid misunderstandings: in parallelising risk and (scientific) knowledge conflicts I refer to the mainstream discourse in which risk is taken as an objective and calculable fact. This is what sociologists would call the technocratic term of risk. In contrast, they keep stressing that risk is implicitly value-laden and socially constructed. In fact, in the above-mentioned risk controversies the normative aspect usually does not come to the fore and if so, we can assume that ethicising is going on. Take for example the precautionary principle as established by the EU, which can be understood as a policy element indicating the transition from a risk to an ethics frame.

In ethicised technology conflicts, the ideals of unambigousness and consensus are abandoned. Ethicised problems cannot be solved by calling on expert knowledge, since it is perfectly evident that the experts are no more in agreement on ethical questions than is society as a whole. Ethicisation implies the societal expectation that expert knowledge, formalised procedures, and so on will not be able to provide the basis for an unambiguous and clearly preferable solution to a given problem. And there is absolutely no doubt about this. In this frame, there is no longer even the counterfactual ideal of a decision that will be seen by all concerned as the best option. Of course, ethical conflicts also involve disputes about the plausibility of individual points of view. The predominance of dissent within ethicised controversies, as already mentioned, does not mean that disputes are abandoned. In fact, the opponents keep debating, and these debates are necessary to draw the boundaries, to determine the canon of legitimate arguments, and in doing so to establish a well-ordered range of acceptable positions. Out of these debates politically inspired comprises may arise that sometimes lead to a shared recommendation of an ethics council. In other words, despite of irreconcilable positions a shared view on practical problems may be arrived at. Nevertheless, the quality of consent is different. Unlike discussions about interests or risks, participants ac-

knowledge rather than simply take note of fundamental disagreement on the level of values. This means that although there will be lively exchanges about ethical questions in expert bodies (such as national ethics councils), no-one expects these effort to lead to a value-based consensus. In contrast, in the case of a risk controversy participants have to agree on a shared perception of the significance of a risk involved.

The decisive point here is not the fact that different people give different answers to the same question (i.e. disagreement as such); the more important element is the specific form in which expertise is institutionalised, which always already expresses the attribution of a certain validity status to disagreement. The experts working on questions of risk live and work, in principle, in accordance with the classic-modern ideal of the scholarly search for truth. The expert council, on the other hand, which is made up of people from different disciplinary backgrounds and with different worldviews, expresses the consciousness of relativity that is an integral part of ethics. The political task of these councils cannot therefore be anything more than the coordination of disagreement; they cannot overcome disagreement.

Against this background, the rise and expansion of ethics ("ethicisation") can be read as the expression of a change in expectations of what science can do. Science is a major resource for reflection and justification in many spheres of society, but today it cannot lay claim to any monopoly on rationality (for early evidence of this, see Bonß/Hartmann 1985). This ambivalence may be a precondition of the way in which disagreement among experts no longer emerges inadvertently via studies and expert reports that come to different conclusions (in the case of risk), but can be publicly presented in a coordinated way (ethics). From this perspective, ethics would be a medium in which the contradiction between advancing scientification and generalised scepticism about science can be presented and negotiated, even if it cannot be resolved. In fact, in ethicised technology conflicts the significance of knowledge is not a matter of dispute (as a basis for normative positions); at the same time, the opinion of each individual counts as an opinion.

4 Ethicisation and technology governance

If ethics is now the main semantics of governance, what are the consequences for technology governance? This question can be opened up to reveal the expectation that the generalised obligation to refer in a constructive way to ethics makes a difference for technology governance. In this section, I use empirical material to show that this suspicion is justified. This material indicates that ethicisation is associated with changes in expectations which affect both politics and science in its advisory capacity.

4.1 Proceduralisation and participation

Bioethical questions have to be settled against the background of a stable pluralism of values in society. For this reason, the quality of the procedures employed in decisionmaking is crucial; discourse, as an open-ended process, is seen as the basis of a rational management of disagreement. In order for political decisions to remain valid for a reasonable period of time, all the competing groups must feel that they have been heard and their positions recognised, since it is in any case impossible for the substance of the solution adopted to convince everyone (and everyone knows this in advance). Conflicts about values cannot be solved by science. In conflicts where the main dispute is over the correct assessment of risk, one can hope that one day the right experiment will be developed and this will make it possible to test the different claims made to have provided the correct explanation, so that unsat-

isfactory disagreements can be overcome. Where ethical questions are concerned, though, disagreement is endemic. This explains the greater value attached to procedures as a source of legitimation.

In the context of bioethical value conflicts, we can therefore observe almost desperate attempts to get the silent or uninterested public to participate in this discourse.[6] So-called citizens' conferences, experiments with the involvement of laypersons such as we are now seeing more frequently in the sphere of biomedicine (Abels/Bora 2004), are procedures which are supposed to bring members of the silent majority into the discourse. This is something different from a method designed to canalise an explicitly formulated political demand to be allowed to participate. Lay participation typically materialises in the form of a laboratory experiment at present (Bogner 2010). That is, lay participation as currently organized by professional participation experts under controlled conditions rarely is linked to public controversies, to the pursuit of political participation or to individual concerns.

Bioethical controversies take place in the features sections of the newspapers, in discussions conducted between intellectuals, and at conferences, but not on the barricades. These controversies tend to start in discussions between experts rather than in criticism voiced by groups in civil society which then attracts public attention. Two examples of this are the debate about stem cell research, which was set off by the research proposal Oliver Brüstle submitted to the German Research Foundation (DFG) in 2001, and the German euthanasia debate, which started with Peter Singer's book Practical Ethics. When groups from civil society become involved, they do not do so as pressure groups; they are bodies organising a public discourse which is consciously seen as open-ended. One recalls, for example, the "1000 questions" project launched by the "Aktion Mensch" organisation (Klein et al. 2009).

4.2 The subjectification of political rationality

It seems to be the case that it is difficult for bioethical questions to be transformed into traditional questions related to party-political interests. Bioethical questions occupy a position beyond left and right on the political spectrum. This became clear once again in the spring of 2008 during the debates that took place in the German Bundestag about the liberalisation of the law on stem cell research. On this question, Christian-Social pro-life MPs joined forces with Green feminists to argue against liberalisation, and Christian-Social MPs in favour of this research entered into an informal alliance with some Social Democrats to argue in favour of liberalisation. Every party was split on the issue. Incidentally, we can observe political parties dealing with this problem of order in an active way where questions of ethics are concerned.

In the context of the strain this puts on the political order, one can observe a subjectification of the rationality of political decisionmaking: when important decisions have to be taken, political action is shifted into the sphere of individual decisions about values. In debates about embryo research, in particular, it has repeatedly been emphasised that MPs or governments have to make "personal" evaluations, or to "take a decision as a matter of conscience". Subjectivity and authenticity, not party discipline or rational arguments put forward by experts, provide the justification for a political vote. A good example of a politician

[6] In bioethical value conflicts, we thus see the largely indifferent pluralism which Vilhelm Aubert (1961: 31-32) describes as one course that can be taken by the conflict; the other possibility is that it takes an aggressive form.

expressing this view (though there are many similar ones that could be referred to) can be found in an interview given by Herta Däubler-Gmelin, the former Minister of Justice, to the Frankfurter Allgemeine Zeitung:

> "The basic questions about the place of the individual in biomedicine, and this does not happen very often, are genuine matters of conscience on which every MP has to make up his or her own mind, without any instructions from the parliamentary fraction." (Bahnen et al. 2002)

In Germany, the 2002 debates about the German stem cell research law, in which MPs spoke and voted on their own behalf without needing to follow party discipline, are still considered to be one of the Bundestag's finest hours. By way of contrast, anyone who is reluctant to treat parliamentary votes on legislation of relevance to bioethics as occasions when MPs can decide according to their conscience is likely to be the target of fierce criticism – both from the opposition and from their own side. The British Prime Minister, Gordon Brown, experienced this in the negotiations on the new British embryo research law. At first, Brown categorically rejected demands that members of the government should be free to vote according to their conscience, arguing that this was a piece of legislation of fundamental importance for research policy. After a series of public protests, he was forced to allow a free vote without party discipline on at least some parts of the legislation (BBC News, 25.03.2008).

4.3 Changing forms of expertise

In the complicated sphere of biomedical research and the application of the resulting technologies, politicians have no alternative but to inform themselves about the issues at stake. After all, there is a grave danger of legitimation deficits in hierarchical and politically centralised knowledge and decision procedures. In the case of stabilised disagreement, the quality of the collective development of an informed opinion is now more dependent than before on the quality of the knowledge that contributes to this process (Willke 2005: 48). In relation to current technology controversies, it is not really the experiments in participation described above that have become politically relevant; the more significant development is the role being played by new forms of expert-based policy advice, forms which involve a constructive reference to ethics in their own understanding of themselves, the political tasks they are asked to perform, and the names given to these bodies. They can thus be seen as ethics-frame-specific forms of expertise.[7]

In recent years, we have seen interdisciplinary expert bodies being set up in a number of western democracies under the designation "National Bioethics Council" (Fuchs 2005). In Austria, a council of this type was set up and attached to the Federal Chancellery in 2001; in Switzerland, the Federal Council established a National Ethics Council in the same year; and in Germany, the then Chancellor Gerhard Schröder also set up an National Ethics Council in 2001. Additionally, from 2000 to 2005 there were two Commissions of the German Bundestag in existence (called "Study Commission on Law and Ethics in Modern Medicine") which consisted of 13 members of the Bundestag and 13 experts. At the outset there was tension between these two different types of ethics commissions. At the end of 2007, the National Ethics Council was given a legal basis and renamed the German Ethics Council. A common feature of these bodies

[7] In accordance with this understanding of the field, the German Federal Environment Agency (UBA), the Robert Koch Institute, and the Central Commission for Biological Safety are among the bodies producing risk-frame-specific expertise. Technology Assessment (TA) is also an institutional consequence of risk conflicts; it bears witness to the fact that in early risk conflicts, knowledge that was of better quality, or more relevant to the problem at hand (interdisciplinarity), was seen as the best way of solving conflicts.

is the broad range of different disciplines and worldviews represented among their members.

Needless to say, calling on expert knowledge is a traditional instrument to which politicians turn when they need to justify and legitimise decisions. However, what is happening now does not just have to do with questions of knowledge; as we have seen, questions of values are now involved. The new element is the explicit labelling of expertise as "expertise about values". In addition, this expertise must be negotiated within a heterogeneous team. After all, in the national ethics councils Catholics and atheists, geneticists and representatives of disabled people's organisations, and representatives of all sorts of different positions are sitting down together around the table. What we have here is a case of institutionalised counter-expertise (whatever one's own position may be, someone who takes the opposite view will always be present in the plenum), and there is hardly any way one individual can claim to be in possession of authoritative knowledge. The ethics experts are seen as people who can convey points of view and ways in which issues can be interpreted, and this is also how they see themselves (Bogner et al. 2008). The logical consequence is that ethics councils do not really see themselves as political actors; their main function, as they see it, is the preparation and systematisation of knowledge. In some unusual cases, these expert bodies do not provide politicians with any policy recommendations at all (even diverging ones); the US President's Council on Bioethics, for example, restricted its conclusions on stem cell research and cloning to a differentiated systematic treatment of ethical positions, and did not go on to derive any recommendations for political action from this analysis. And even the ethics councils that do draw up policy options, for example those in German-speaking countries, are internally split – at least with regard to the "big" bioethical issues such as stem cell research or genetic testing. So they usually produce coordinated disagreement in the form of between two and four divergent recommendations.

The next question is: if expertise delivers a bundle of contending opinions, with arguments to back them up, rather than consensus, what are the consequences for political action? How do politicians deal with expert dissent?

5 How politics deals with disagreement among experts

We can only analyse the way politicians deal with disagreement among experts by looking at what politicians say when they refer explicitly to ethics expertise. For methodological reasons, it is almost impossible to measure anything like the actual "impact" of expertise on the political system. There is hardly any way of telling how the German Chancellor reacts when she reads the latest statement of the German Ethics Council. We can, though, analyse the form taken by politicians' references to ethics expertise. If we proceed in this manner, we have a sounder empirical basis on which to address the question of the actual latent functions of ethics expertise for politics.

The following microscopy of political utilisation of ethics expertise is limited in substance to the biomedical issues that have attracted public attention (stem cell research, cloning, preimplantation genetic diagnosis [PGD]), and the covers the 2000-2008 period. The relevant advisory bodies are, as mentioned above, the National Ethics Council and the German Bundestag's Study Commission on Law and Ethics in Modern Medicine. The documents consulted were: press releases issued by members of the German Bundestag;[8] important parliamentary

[8] Press releases issued by all party fractions represented in the Bundestag were identi-

debates on the topics identified;[9] and also, though without any claim to exhaustive coverage, speeches delivered by and interviews with leading functionaries of the executive branch of government.[10] This material was then analysed in accordance with the Grounded Theory approach (Glaser and Strauss 1967) modified by recent works of Meuser and Nagel (2005), with the goal of drawing up a list of types of political reference to expertise (on this point, see Kelle/Kluge 1999). I have explained my way of constructing types, and set out in detail the findings of my investigation, elsewhere (Bogner 2011). In the present context, the main point of interest is what these references reveal about how politicians deal with disagreement among experts.

In the framework of the empirical analysis, one notices that references by politicians to ethics expertise are first and foremost formal in nature, and also that they serve to express recognition and acknowledgment of disagreement among experts.[11] This means that most of the time, MPs and leading functionaries do not comment on specific, substantive aspects of the experts' views, but welcome in very general terms the range of views as an enrichment of political debate. They do not say anything about either the essential content or the majority and minority positions revealed. Individual ethical arguments put forward and points of view taken within the bodies are not acknowledged, and neither are any of the concrete positions adopted or recommendations for action (even though these may coincide with the politician's own position). What is acknowledged is the differentiated nature and variety of the experts' arguments, which are expressed in an agreement to disagree that is explained and is set out in such a way that it can easily be followed by the reader. It seems clear that the sub-

fied via press offices, party archives, and the MPs' home pages for the period from the beginning of 2000 to the end of August 2007. This search produced 272 relevant documents. 53 documents connected in some way with the work of the two bodies, and these were the main documents used for the analysis.

[9] The following nine parliamentary debates from the 2001-2008 period were selected: five debates on stem cell research (30.01.2002, 25.04.2002, 2.12.2004, 14.02.2008, and 11.04.2008), all of which were related to the struggle over the law on this subject; two debates on cloning (20.02.2003 and 16.10.2003), which took place in the context of attempts to ban cloning via the United Nations; and two debates on PGD (14.12.2001 and 17.03.2005), both of which took place because the FDP had introduced draft legislation on the issue. These nine plenary debates lasted in total for 15 hours, and 176 speeches were delivered. The written record, in the form of the Bundestag's stenographic transcript, is approximately 250 pages long in total. In these 250 pages there are 24 references to documents produced by the ethics councils.

[10] This material was identified by using the home pages of the ministries and the LexisNexis data bank. 10 relevant speeches were found, including speeches delivered by Chancellor Schröder on the occasions of the setting up and reconstitution of the National Ethics Council (8.6.2001 and 23.6.2005), to the "atatech" scientific conference (30.9.2003), and to the Fraunhofer Society (22.10.2003); the speech delivered by the Minister of Justice, Brigitte Zypries, to a forum organised by the Humboldt University (Berlin) (29.10.2003); and other speeches by the Minister for Research, Edelgard Bulmahn, and the Minister of Health, Ulla Schmidt. I also examined 9 relevant interviews with these leading politicians published in national newspapers and magazines (*Frankfurter Allgemeine Zeitung*, *Die Zeit*, *Süddeutsche Zeitung*, *Frankfurter Rundschau*, *Tagesspiegel*, *Der Spiegel*).

[11] This section gives an outline of the most interesting and dominant types of political references to ethics expertise. Apart from formal references there are other types which, in fact, focus on the specific contents of ethics expertise in different respects. There are references using expertise in a selective manner to consolidate already existing political aims ("instrumental reference"). Another less frequent type employs – at least rhetorically – certain arguments from the expertise ("analytical reference").

stance of the matter is seen as less important than the fact that the fndings have been published. Accordingly, the statements taken in their entirety are welcomed as important bases for political decisionmaking. A good example of this can be found in the following quotation from Andrea Fischer, the former Minister of Health. Fischer was known to be critical of embryo research, but she commented positively on the relatively contrary findings on the subject of the National Ethics Council and the Commission of Enquiry:

"The two votes by the Study Commission and the Ethics Council will enrich our parliamentary discussions. In January, parliament must come to a decision and pass legislation to regulate these matters." (Andrea Fischer, B90/Grüne, Press release 2.12.2001)

It is sometimes emphasised that because the reports produced by these advisory bodies are so well structured and succeed in clarifying the concepts involved, they furnish a good basis for the important decisions that have to be taken. In the present context, though, the main point to be made concerns the political interpretation of disagreement among experts. And what one notices here is that this disagreement is not criticised because it means an absence of agreement, but rather read as the expression of a genuine discourse between the experts which provides an authentic reflection of the range of views existing in society. When the reports are read in this way, they are seen as proof that democracy is functioning well and, in the end, as enriching politics. Disagreement among experts becomes a guarantee of the credibility of the body involved and of the political system that has turned to these experts for their advice. One can see these aspects very clearly expressed in a speech delivered by Chancellor Gerhard Schröder at the beginning of the National Ethics Council's public session on 23 September 2004:

"I have not seen any disadvantage in the fact that different positions exist within the Ethics Council and also emerge in public, in other words that here [....], unlike in parliament, where we have to vote, it is more a matter of making clear what issues are at stake, and also making it clear that the different approaches one can see in society are also, naturally enough, present in the National Ethics Council. I regard this as a positive aspect of the matter and not, contrary to claims I have sometimes heard, a sign of a failure to take the necessary decisions [....] And, incidentally, you have rendered a great service by showing that it was quite wrong to suppose, as some observers did, that the members of the Ethics Council were invited to participate in order to produce the results the government wanted. I think you have refuted this claim, which is sometimes made, in a very impressive way." (Gerhard Schröder, speech to the National Ethics Council 23.09.2004)[12]

What this means is that in the political discourse, the main goal is not to elaborate one's own position on the basis of the experts' vote, as a way of bolstering one's own view within the political spectrum by making it appear superior to all other opinions. The "essence", the specific content of the position taken by the experts, is not predominantly important;[13] much more important seems to be its "existence", the fact that now, on the basis of an informed disagreement between experts, politicans can act – indeed, that they must. One can see this being expressed in the following passage, in which an MP uses the statements on prenatal diagnosis issued by the two councils as an opportunity to call for a political decision:

"We can now read the comprehensive final report on this topic (PGD, A.B.) produced by the Commission of Enquiry from the last parliamentary term, and we also have the statement issued by the National Ethics Council. The arguments for and against

[12] http://www.ethikrat.org/dateien/pdf/Wortprotokoll_2004-09-23.pdf

[13] However, the content may be of a certain interest to the public, as one of the anonymous reviewers noted. In fact, the public (as a third player in this game) could check whether politicians just ignore the content or come to a decision that can be legitimised with regard to the ethical recommendations.

have been carefully examined. This means that the preparatory work needed for a decision has been completed. Now, each one of us must have the courage to vote on the issue." (Detlev Parr, FDP, Bundestag debate 20.02.2003, Prot. 15/28, p. 2143)

Here too, disagreement among experts is interpreted as something that enriches the political debate, but also – and significantly – as something that says to politicans, in no uncertain terms, that they must now take a decision. Attention is drawn to the fact that the opinions of experts who disagree with one another have been presented, and the ethical stalemate is interpreted as the starting signal for a decision politicans must take on their own – which makes it genuinely political. This means that when formal reference is made to ethics expertise, a credible moment for a political decision has quietly arrived. Political decisions are necessary and legitimate once the experts have spoken, and – because there is no consensus – they have spoken without pressurising politicians to act in any particular way.

If we look at this the other way round, the symbolic aspect of expert knowledge means that it is not acceptable to anticipate the views of the experts politically. If political initiatives are taken before the ethics experts' consultations have been concluded and their findings made public, a negative view of this will be taken in political circles. One example of such an initiative was the draft legislation designed to regulate PGD introduced by the FDP at the end of 2001, before either the Study Commission or the National Ethics Council had concluded their consultations on the subject. Across the political spectrum, from the CDU/CSU to the Greens, the verdict was that this was an illegitimate anticipation of politics – even though the ethical arguments were already well known at that stage.[14]

In a number of ways, therefore, disagreement among experts turns out to be not a weakness but rather a distinguishing feature of the quality of ethical advice. For one thing, disagreement among experts, which is the rule rather than the exception in ethicised discourses, is a sign of the authenticity of ethical expert discourse. Experts participating in disputes about biomedicine are no different from the rest of society – they are unable to agree. In this respect, the ethics councils can be seen as a gauge of the societal and political acceptability of disagreement: they exist because permanent dissent is considered to be legitimate in principle. The way ethics councils negotiate controversial issues is only comprehensible against the background of a generalised expectation of disagreement. Another indication of the quality of this disagreement is the fact that this is not a case of disagreement for disagreement's sake, but the outcome of a long process of internal efforts to draw up a structured position. This well-ordered disagreement is an expression of civilised methods of communication, and can therefore be read as a general indication of the civilising effects of ethical deliberation. This accounts for the hope that ethics councils may prove to be model laboratories for socially acceptable ways of dealing with value conflicts. The third element is the way in which this reference to the range of views held by experts underlines the autonomy of political action. Disagreement among experts makes it abundantly clear, once again, that politicians are free to choose any of the options made available to them within the frame of ethics expertise. Disagreement among experts thus represents a (limited) range of well-founded options, and so pro-

[14] The PGD procedure has been technically possible since 1990, though it was only in 2000 that a broader discussion emerged in Germany following a relatively liberal statement on the subject issued by the *Bundesärztekammer*, the professional organisation of German doctors (see also Kollek 2000).

vides a frame for legitimate political decisionmaking. Disagreement simultaneously makes it symbolically clear that the time for a genuinely political decision has now arrived.

6 Conclusion

This chapter has argued that the ethicisation of technology controversies presents clearly identifiable opportunities for the legitimation of political action. This ethicisation is one expression of a wave of ethics which, as Niklas Luhmann (1990: 10-17) once observed ironically, has appeared with considerable regularity at the end of every century ever since the invention of printing. We are currently confronted with controversies within biomedicine which are being conducted in ethical terms and concepts. I have argued that this ethicisation indicates that there has been a change in the significance of disagreement: where questions of value are concerned irresolvable, permanent disagreement is considered legitimate, but this is not the case for questions of risk. The analysis showed, via an examination of the revaluation of participatory procedures and the subjectification of the rationality of political decisions, that this is of considerable significance for the governance of technology controversies. It also showed that there has been a change in the form of expertise: in the context of its political organisation, ethics expertise is becoming a product that must be negotiated between representatives of different disciplines and worldviews.

To avoid misunderstandings: Ethicisation refers to the fact that presently, the keywords, concepts or distinctions provided by the ethical discourse are of predominant importance for the negotiation of technology controversies. That is, it is not ethics as an academic discipline; rather it is ethics in a popularised (some philosophers would say: degenerated) version, which becomes influential for the framing of the public debate.[15] One could argue that such a notion of ethicisation blurs the boundaries between ethicisation and moralisation, but I have stressed that this difference is clearly indicated by the predominance of dissent and consent, respectively. Furthermore, there is a complex interdependency of ethicisation and the predominance of dissent. Talking ethics in technology controversies renders dissent legitimate. But that's only one face of the coin. From a sociological point of view it is just as well the other way round. Only if dissenters acknowledge dissent to be legitimate they can lead an ethically framed discourse on technology. Taking this argument a step further, from a social theoretical standpoint the ethicisation of technology controversies can be taken as an indication for the revaluation of heterogeneity, divergence and disagreement in modern societies, i.e. for an increasing need to deal with a balanced disorder instead of the futile strive to establish a strong order (Willke 2003). Thus, we can understand the phenomenon of ethicisation as an indicator that pluralistic societies start to take pluralism seriously.

The empirical analysis of this contribution focused on the question of the political utilisation of expert knowledge, i.e. how politics deals with disagreement among experts. In the end, the question that is of interest to a sociologist is whether and in what form the change in the legitimacy of disagreement (which has only been set out here in theoretical terms) affects the level at which ethical questions are negotiated politically. By means of an examination of a range of different materials (parliamentary debates, press releases, speeches, interviews) the analysis showed that political references to ethics expertise are dominated by a form which quite clearly

[15] Not even in ethics councils academic ethics play a major role, as I have shown elsewhere (Bogner 2009).

expresses a recognition and appreciation of disagreement between experts – at least in Germany (for a comparison with Austria see Bogner 2007). Votes split along many different axes are read as an authentic reflection of a pluralism that actually exists in society. It is not individual ethical positions, but the range of opinions as such that is welcomed as an enrichment of politics. It is seen to be extremely important that the experts' votes should be made available to political decisionmakers, but the precise content of these positions is not particularly important. In this sense, disagreement between experts is understood as the prelude to a fundamental political debate in which one of the main ways of generating legitimation is via the quality of the procedure (relaxation of party discipline, decisions made according to the individual's conscience). In this connection, the significance attached to ethics expertise is primarily symbolic: it establishes the legitimate frame of political action, and the moment of its publication marks a credible point at which a decision has to be taken. Deliberations about the ethical point at issue have shown that there is no point hoping for consensual solutions, so the disagreement among the experts represents a decree to the effect that a political decision must now be taken. There is no way in which disagreement among experts determines the political decision, but it is constitutive of the political sphere's claim to be acting autonomously.

Unlike in controversies about risk, in this situation normative insecurity and a failure to reach consensus should not be seen as endangering the role of science as a major resource and basis for decision-making. On the contrary, political action seems to be possible precisely on this basis of a discursively stabilised disagreement. To overstate the case slightly: disagreement among experts is not the problem for politics, it is the solution. Politicians can act thanks to the disagreement among experts, not in spite of it. This does not just mean that irresolvable disagreement forces politicians to find compromises. It means more than this – that political action can use a positive reference to this very disagreement among experts in order to legitimise itself. It is the political acknowledgment of disagreement itself that renders politics as a process of parliamentary decision-making visible once again. This acknowledgment thus becomes a stabilising element which serves to mark the dividing line between expertise and politics.

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Is Science Based Consumer Advice Prepared to Deal with Uncertainties in Second Modernity?

The Role of Scientific Experts in Risk Communication in the Case of Food Supplements

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Abstract

The paper discusses the contribution and the functions of scientific experts in risk communication and consumer counselling under conditions of a 'world risk society'. It investigates how scientific advice is formulated on the exemplary issue of food supplements which are becoming a part of everyday life, although risk experts assess them to be unnecessary and sometimes even risky. The paper especially reconsiders various modes of how the risk of food supplements is communicated in modernity. It argues that in Second Modernity (scientific) experts in consumer counselling have to develop new modes of reflexivity in order to open up multifaceted dialogues between science, public and regulation in a wider context.

1 Introduction: New Challenges of Risk Communication

In the first industrial phase of modernity science, technology and progress were regarded as a salutary triad which assured continued advancement of Western societies and their welfare. Ulrich Beck (1992; 2008) made the diagnosis that this modern self-understanding has slowly given way to 'Reflexive Modernization' over the past few decades, due to modernity's self-confrontation with its own side-effects. Challenged by the manufactured uncertainties, by unseen risks and especially by the unintended ecological consequences of the techno-scientific progress-paradigm, since World War II Western societies have gradually shifted from 'First Modernity' into the age of 'Second Modernity'. Under these new conditions, techno-scientific progress is suspected to rather increase risks to human health and natural environments than to substantially improve current living conditions. Even though scientific knowledge is considered to be the fundamental basis of advice in questions of nutrition, health and illness, at the same time, increasing scientific knowledge is no longer expected to automatically lead to better solutions (Braun/Kropp 2010; Beck/Lau 2005; Maasen/Weingart 2005). On the contrary, there is growing awareness of scientific and technical uncertainties which leads to a generalized "feeling that our ignorance is more important than what we know" (Callon et al. 2009: 19). In the shadow of the unintended side-effects of modern technical successes – keywords here are nuclear waste, climate change and health risks in the aftermaths of chemical products – faith in science and technology and the doctrine of progress, constitutive for First Modernity, is slowly eroding. In Second Modernity expert judgement is no longer considered to be beyond doubt. On the contrary, experts' arguments have become suspiciously eyed, also when experts are giving consumer advice (cf. Stilgoe et al. 2006). This is especially true when focussing on food technology and food safety. Rapid, global scientific and commercial development of biotechnologies made it nearly impossible for consumers to determine which products are useful and safe, and which are not. When dealing with scientific uncertainty, policy makers, risk managers and stakeholders affected by the outcome of risks or by risk management efforts to control risks face an interdependent world with complex, unclear and far reaching relationships (cf. Dreyer et al. 2008). It's hard to know what to do.

Against this background of a 'world risk society' (Beck 2008) and focussing on the disputed use of food supplements, the paper deals with the question of what the contribution of sciences in risk communication can be. We use Ulrich Beck's distinction of First and Second Modernity (Beck 1992) to focus on the changed role of science and technology and to investigate how risks and manufactured uncertainties are framed. Our considerations emanate from four empirical points of departure: First, there is a great amount of evidence that all efforts of consumer counselling face growing difficulty in reaching consumers at all (cf. Spiekermann 2006; Kropp/Wilhelm 2007). Secondly, these efforts often become impeded by the interplay of today's expertise and tomorrow's counter-expertise disagreeing with yesterday's recommendation. As a result, consumers more and more distrust science-based advice hoping instead that "a balanced diet may compensate the different hidden contaminations" (cf. Kropp/Wilhelm 2007). Thirdly, when asked to give advice in risk issues, science can often provide only limited evidence flanked by huge uncertainty and ambiguity, instead of the expected certainties. Nor is the role of science confined to problem solution alone as science is often seen as a risk producer as well. Moreover, many

of the science-based recommendations remain contentious, diffuse and context-insensitive (cf. Irwin 2008). Finally, in the last three decades many of the realised harms (for instance caused by asbestos, BSE and acrylamide) have not been suspected to be risky before and thus escaped risk communication at all, even though they resulted from technological applications of science and were the object of several scientific evaluations. As Jerome Ravetz and Silvio Funtowicz (1992) summarize, lack of knowledge and unrecognised ignorance do not spare scientific assessments.

Given these limitations of science to foresee, to predict and to control risks we will reconsider sciences' functions in consumer counselling and the modes in which science-based advice is transmitted to those asking for risk assessment. Our hypothesis is that in an Age of Uncertainty (Nowotny et al. 2004) science-based consumer advice is also in need of new "technologies of humility" (Jasanoff 2003):

> "Policy-makers need a set of 'technologies of humility' for systematically assessing the unknown and the uncertain. … [that are] methods, or better yet institutionalized habits of thought, that try to come to grips with the ragged fringes of human understanding – the unknown, the uncertain, the ambiguous, and the uncontrollable" (Jasanoff 2003: 33).

Jasanoff criticises conventional science and technology policy as "technologies of hubris" and characterizes them as policies crafted to reassure the public and keep the wheels of science and industry turning. Instead, she pleads for new approaches which acknowledge the partiality of modern science, recognize the context within which research is conducted, and respond to new ways of generating scientific knowledge.

Accordingly, in the following we shall discuss the different interface-roles sciences have in boundary processes of risk management and risk communication. We will reconsider the common modes of science-based consumer advice and explore new 'reflexive' ways of risk communication. In doing so, we will refer to an internet based tool which we call "risk cartography" (cf. Beck et al. 2009; Beck/Kropp 2011)[1]. It is based on a mapping strategy for representing heterogeneous, contested and sometimes even contradictory knowledge claims in risk controversies in order to empower users to access risk debates from various perspectives and according to their own needs.

2 The Functions of Sciences in Risk Communication

When dealing with risks the functions and contributions of science and its representatives are manifold and sometimes contradictory. On the one hand science and expertise are assumed to provide authoritative assessment and practical orientation. Science is the most authoritative reference in risk assessment, risk communication and risk management. On the other hand the risk society is mainly driven by the paradox of scientific advising consisting of the confrontation of expertise and counter-expertise, the continuous falsification of previous assessments, and the proliferation of risk claims with every new expert involved (Weingart 2003; Stilgoe et al. 2006). Instead of assuring certainty and confidence in decision making, scientific advice plays a major part in producing uncertainty and ambiguity. For this reason we first want to investigate the various contributions of science in risk debates in general before

[1] We are grateful that the German Federal Ministry of Research and Education made possible the prototype-development of Risk Cartography as an innovative strategy in order to deal with systemic risks by its funding. We also want to thank the entire research-team, Stefan Böschen, Jens Soentgen, Simon Meissner, Martina Erlemann and Astrid Engel for cooperation and the fruitful discussions we had about this aim.

going into closer inspection of science-based consumer advice.

When risks are set on the political agenda as anticipated threats to human health or the environment, this easily opens up complex arenas of political debates. In addition to scientists and experts such debates involve various risk professionals from national and international agencies, policy makers, stakeholders from food production and trade, members of the affected and non-affected public, and, last but not least, the media. In the majority of cases they all differ considerably in their assessments of risks because risk perception is intrinsically linked to respective concerns, interests, and practical knowledge bases. Furthermore, it depends on value-based judgements of what is desired and undesired, tolerable or intolerable, attributable or fateful (Beck/Kropp 2007). In consequence, political decision making is a huge challenge in risk debates, a challenge that calls for new modes of risk assessment, risk management and risk communication as interrelated parts of risk governance (cf. Renn/Walker 2007).

In Germany, risk governance[2] in the domain of consumer protection has been re-organized in the aftermath of the BSE crisis. This re-organization was oriented at the European Commission's "Health Strategy". The new organisational landscape, which Dressel et al. (2007) have described and critically evaluated, is based on the functional separation of risk assessment, risk communication and risk management. *Risk assessment* is defined as the scientific estimation of a risk in terms of hazard identification, exposure probability and distribution. The International Risk Governance Council (IRGC) sees three major challenges to risk assessment: complexity, uncertainty and ambiguity (IRGC 2005: 28). *Risk communication* does not only mean to educate the public about the results of scientific risk assessment but also to enable citizens to better handle uncertainties (IRGC 2005: 54). *Risk management*, the third element of the triad of risk governance, is defined as the task to take measures to prevent risks from causing actual damage, control the implementation of measures and even to identify new risks that have not yet been assessed (Renn et al. 2007: 97). Even though an institutionally separated processing of risk assessment, risk communication and risk management has been chosen in Germany, all three parts of risk governance are inherently linked to each other.

Public risk debates anticipate possible future harm as "mental constructions" (OECD 2002: 67); they represent what different groups in society perceive to be of potential danger with respect to their hopes and expectations. Thereby early framing assumptions about the risk in question affect all subsequent steps of risk assessment and risk management. For example, it leads to completely different strategies of risk assessment, communication and management whether the potential risks of dietary supplements are addressed under the judicial frame of "food" or under the medical frame of "treatment". To deal with such inevitable socio-cultural framing effects of risk perception the IRGC argues for a participative "design discourse" selecting the appropriate risk assessment policy before starting any activity. The Council "believes strongly that effective communication has to be at the core of any successful activity to assess and manage risks" (IRGC 2005: 54) from the early framing of the problem to the later strategies of risk management. Thereby, the IRGC overrules the separation between risk assessment, risk management and risk communication implicitly. Instead it assumes that expansive risk communication has to be

[2] We use a simplified model. The original IRGC model is more detailed and defines e.g. risk assessment only as one part of risk appraisal (cf. IRGC 2005: 13).

part of any risk assessment and risk management strategy. Risk communication is rather seen to be the essential basis upon which any societal strategy to deal with an uncertain world and to deliberate on tolerable futures need to be formulated. Therefore, the IRGC plans to invest much of its future resources and efforts to improve current risk communication practices (Renn/Walker 2007: 52). These practices are considered to be of particular importance in debates where there is a variety of heterogeneous risk claims, a range of different stakeholders and where the risks call for the consideration of diverse contextual factors. Irwin (2008), Stilgoe et al. (2006), Callon et al. (2009) argue in the same tenor as well as this paper: Different, heterogeneous and even contradictory perceptions of risk together with controversial assessment and management claims should be reconsidered as valuable resources handling techno-scientific developments and the potentially associated uncertainties, harms and risks. They have to be made transparent and public rather than being locked into blackboxes to enable quick conclusions. Only then, controversies can become valuable sources to explore what the societal dimensions and side-effects of techno-scientific developments might be (cf. Latour 2005: 52ff.). In consequence risk controversies need to be explored rather than to be closed!

Let us take a closer look at the forms of knowledge that science brings into risk debates. At first science appears not as one of the conflicting parties but is expected to take the role of a neutral arbitrator, a representative of the natural world or even an omnipotent constructor in the realm of techno-scientific possibilities. None of these roles suits its self-characterization. They merely reflect First Modernity's expectations in science. Moreover, it is less "science" in itself, but scientific experts who combine elements of scientific analysis with political, economic, technical and social judgements in risk debates (cf. Jasanoff 1990).

The public arena of debates about risks is typically structured by three types of actors: there are commercial actors seizing economic opportunities for the use of products or technologies, administrative and political actors who are responsible for societal safety and, last but not least, public actors and their medial spokespersons who ask for the evaluation of the potential benefits and harms. Thus the debate develops at the first level between "decision makers" and those "affected" by these decisions (cf. Luhmann 1993). In case of food additives these roles are assigned to manufacturers, merchants and their lobbies, political authorities, risk professionals, and consumer organisations.

Consumers themselves do not take an active part in the risk debate on dietary supplements. As the use of supplements is voluntary consumers merely underestimate the potential risks and mainly trust in administration to provide for safety. Consumer organisations, however, devote a great deal of effort in order to reach stronger preventive regulation for food supplements which they esteem to be useless but risky. Scientific experts had their part in having served all those actors to produce, to evaluate and to use food supplements. In risk debates they will be drawn on especially in the role of experts giving advice for safe use and articulating warnings in order to avoid or at least to reduce risk. Thereby different disciplines are involved and faced by different expectations:

Economic actors, having realised techno-scientific solutions, need scientific experts to better control possible risks once these solutions are suspected to cause negative outcomes. This is why they are especially in need of *operative management knowledge*, offered above all by applied sciences,

especially engineering sciences. Political actors who are expected to decide on admissions, norms and rules of action and to define liability ask for *evaluative knowledge* which is provided by law, administrative and social sciences. These experts are often asked to speak beyond their immediate area of specialist knowledge but their status as scientists resists challenge. Also, the public shows growing interest in *evaluative knowledge*, but seems to especially trust in problem-oriented, transdisciplinary sciences like ecology or dietetics as well as in transdisciplinary procedures like technology assessment which inform about the different scientific perspectives on a meta-level. When considering the function of science in risk debates, one has to take into account the heterogeneity of this broad range of involved scientific disciplines.

Generally, there is growing concern in Western risk societies to involve a plurality of expertises. Faced by complex, far reaching and contested issues, many of the spokespersons of civil society ask for integrative analyses, for more circumspect risk evaluation procedures and for context-sensitive diagnoses when risk decisions are to be made. This is why the public is regarded to have an absolute right to be at the table when health risks and environmental challenges are discussed. Moreover, it became normal to bring science and the public into dialogue about potentially risky developments at an early stage. At the same time, civil actors are considered responsible for educating themselves on the issues before taking that seat. Despite this expectation there are no adapted strategies to prepare the public for this aim. The pure number of consumer conferences and similar participative settings accompanying modern processes of risk regulation and decision making may prove a widespread estimation that societies no longer feel well equipped following scientific voice alone. The need for more multi-perspective and integrative risk assessment has been expressed several times (cf. Funtowicz/Ravetz 1992) and in its consequence the need of meta-knowledge able to also assess, evaluate and deliberate the various judgements. Since the 1990s, "political rhetoric across all sorts of policies points towards more participation – more voice, more choice" (cf. Stilgoe et al. 2006: 22). As a result, democratic participation requires firstly democratizing expertise (Fischer 2003; Trute 2005) in order to enable the public to intervene and to blow the whistle when it is worried that things might go wrong (Hajer/Waagenar 2003). To enable citizens to profit from their right to investigate what the possible side-effects, unintended consequences and future risks may be, a kind of "knowledge politics" (Böschen 2005; Wehling 2004) is precondition. It should not only explain what the various risk assessments are all about, but also how the experts' disaccord is to be understood and whether public needs and techno-scientific interests suit each other or not (cf. "technological citizenship"; Frankenfeld 1992). This is why democratizing expertise and experts' risk assessments in those participative approaches require still another scientific contribution which we call *interpretative knowledge.* This kind of knowledge draws together operative knowledge about technologies and evaluative knowledge about the conditions of its application and about potential risks and harms as well as "meta-criteria" to judge differences and boundaries of the involved expert evaluations (cf. Collins/Evans 2007; Stilgoe et al. 2006).

To sum up, risk controversies typically consist of a triangle of economic, political and civic actors who refer to very different functions of science as more or less involved auxiliaries. In this triangle scientific expertise is separated into specialists who procure operative knowledge, those who formulate evaluative knowledge and those who

contribute interpretative knowledge. In risk evaluation processes scientific experts often are faced with the expectation to provide all three types of knowledge at once. But this expectation may turn out to be the kind of trans-science question which Alvin Weinberg (1972) qualified long time ago, as a type of questions "[…] which can be asked of science and yet which cannot be answered by science" (ibid: 209).

3 Risk Communication in First Modernity

In the previous section risk communication has been defined as a possibility to enable citizens to act in uncertainty. This rather recent notion of risk communication is still rarely found in practice. One commonly referred definition coming initially from the U.S. Environmental Protection Agency (EPA) describes it as a science-based approach for communicating effectively in high concern and low trust situations and/or sensitive or controversial situations and thus addresses the problems of controversial assessments (Covello et al. 2004; Scherer 1991). These controversial assessments in situations with high stakes and low trust characterize many modern risk debates and basically ask whether risk communication should be authoritative and confined to the task of educating the public ('First Modernity'), tailored and convincing to inspire target groups with trust ('Postmodernity') or reflexive and dialogue-oriented ('Second Modernity') to sustain commitment and build a common future (cf. Irwin 2008; Leiss 1996; Covello et al. 2004; Bennett/Calman 1999; Scherer 1991).

In the following we will discuss different risk communication styles as intellectually rooted in First or Second Modernity and the respective convictions regarding the relationship between science and the public.

3.1 Risk Communication and Scientific Expertise

First Modernity has been characterized by some social scientists and especially by Ulrich Beck and Antony Giddens (Beck 1992; Giddens 1991) as a period in which reliance on economic growth, techno-scientific progress and security (or at least insurance) provided by the nation state built the background for conceptualising uncertainty in terms of a merely rational calculation of risk. Under these conditions, scientific expertise had an outstanding position. It was presented as the enunciator of truth bringing rationality to human decisions; there has been nearly unbroken trust in its superiority over lay knowledge, a belief which only eroded when public attention was turning to non-intended side-effects like first drug risk scandals and the ecological crisis. In the first-modern science culture, however, science was expected to *speak truth to power*, which meant at the same time, that the wider public had to be educated by science to behave accordingly and could play, if at all, a very restricted role in deciding about risk issues (cf. Irwin 2008: 203).

Accordingly, William Leiss (1996) identified a first phase of risk communication between 1975 and 1984 in the mood of "educating the public about risks". Thereby risk communication is based on comparative statements, following the "underlying message" (Leiss 1996: 88) that "managing opportunities and dangers on the basis of comparative risk information is an inescapable duty of intelligent life" (ibid.). Coming from the early modern, rationalist conviction that there is a necessity to convey experts' probabilistic thinking to the general public, the main strategy is to put the risks of new technologies in quantitative relation to everyday risks like traffic or smoking. Actually, the related risk communication strategy concentrates on the question of how to communicate expert assessments to the public best and

how to bridge the gap between expert knowledge and laypersons' perception and behaviour. Alan Irwin (2008) calls this risk communication model a 'deficit approach', in which a language of certainty is ruling and in which science is presented as absolutely central to the risk issue. (Deficit) consumers, on the other hand, "are to be protected, rather than consulted" (ibid: 201) and, as most top-down-communication models do, this science-centred "first-order" approach, as Irwin coins it, takes little account of diverse contexts or knowledge resources.

Leiss (1996: 88) goes on to identify in the middle of the 1980s the arrival of a new strategy, the phase II of risk communication. The educating-model seemed no longer successful, mainly due to the socially blind "arrogance of technical expertise" (ibid.) that was crucial part of it. The lack of uncontested knowledge, the ever changing expertise and counter-expertise and last but not least the experiences with unintended consequences and side-effects made uncertainties obvious and questioned the conviction of "first-order" understandings in which the risk perceptions of laypersons had been correlated with irrational and false understanding. As a result, laypersons' evaluations and their more socially embedded rationalities slowly became appreciated (cf. Krimsky/Golding 1992; Wynne 1996). Retrospectively, the first mode of risk communication could not succeed in convincing the public, which on its part either continued to insist that alternative risk prevention practices are needed or ignored communication efforts at all.

Leiss (1996) identifies three "phases" of risk communication. In a similar way Irwin (2008) differentiates between "first-, second and third-order" approaches when thinking about risk, science and public communication. Both authors are discussing, as we do in this paper, the ways in which the public gets either involved in risk management strategies or is considered to be just the passive receiver at the very end. Together, we notice a movement from mainly monological top-down-communication efforts in a first period of risk communication to growing emphasis on more dialogue-centred modes of risk communication. However, there is no "out with the old and in with the new" change in risk communication but a co-existence of persuasion-oriented and dialogue-oriented strategies, provoking sometimes uneasy contradictions. Leiss' historical periods, which will be further explored below, should be seen as periods in which new practices of risk communication emerge and not where older practices vanish. Until today, there is the problem of how to acknowledge plural expertise and uncertainty and nevertheless assuming responsibility. Moreover, there are risks just demanding education and persuasion, as smoking does for instance. Our discussion, however, aims at sensitizing on the shortfalls of any science-first-approach in risk communication.

According to Leiss (1996: 89), the second phase lasted until the 1990s and can be described as "persuasive", because the strategy was then to persuade the public with the tools of marketing. The break between phase I and phase II is represented by the realization that, in the second phase, statements about risks were regarded as acts of persuasive communication. The most important target was to gain trust. While risk communication was still conceptualized as one-way communication for conveying a message to the public, the focus shifted to target group oriented public relations efforts to convince people to change behaviour. The ruling paradigm of persuasion was geared to marketing communication approaches and propaganda studies and developed a broad range of techniques for enhancing trust and credibility for messages. Public worries, nevertheless, were still regarded

as irrational and considered to lack better information.

Both strategies are clearly based on a "language of certainty" (Irwin 2008: 201), on the superiority of scientific expertise and on its capability to discern between fact and fiction, rational and irrational, and between benign and risky. Whereas the first period focuses on education, the second emphasises persuasive communication strategies, but neither the first nor the second mode opened up risk debates for any cooperative decision making between science and the public. At the same time, both admittedly have difficulties getting through to the public and do not succeed in convincing the majority of consumers.

3.2 Risk Communication on Dietary Supplement Safety

To relate our discussion to empirical cases we will focus on risk communication concerning the safety of dietary supplements. In the following we refer to an example which illustrates First Modernity's risk communication as discussed above. It takes its starting point from experts' unquestioned superiority, whereas more reflexive third order models (cf. Irwin 2006: 205) as well as phase III in Leiss's model pick up the challenges of Second Modernity's risk communication, driven by the recognition of scientific uncertainties and its impact on industrial evidences, institutions and core believes. The chosen distinction according to Beck's typology is not a strong chronological distinction. First and Second Modernity coexist in his world risk society, but First Modernity's principles, which are based on trust in progress and ongoing modernization, are subject to increasing pressure to legitimise and can withstand this pressure less and less in Second Modernity (Beck/Lau 2005; Beck 2008).

Let us first see what is at stake in this empirical case. Food supplements or dietary supplements are products in form of pills, capsules or powders that contain vitamins, minerals or secondary plant substances which are supposed to enrich the daily diet in case of insufficiencies like, e.g., vitamin deficiency. At least this is the official definition. From a marketing perspective, in contrast, they are useful to "enrich" our lives because they will help to optimise modern bodies and personal performance under conditions of acceleration, competition and stress. In Germany, food supplements are legislated under the food law. That means that there are no special tests necessary prior to the introduction of new products to the market like those required in the case of new pharmaceuticals. Nevertheless, the EU health-claim-regulation necessitates scientific evidence for any health effect claim.

Food supplements are gaining increasing relevance in everyday life. The boundaries between doping and nourishing become fuzzy as modern life is characterised by rising expectations and the pressure of self-optimisation (Foucault 1982). This trend makes it easy for producers to position their food supplement products as part of the modern way to organize and make the most of one's life. To give an idea of this practice, we cite below one producer, advertising his products as "stress management":

> "Managing stress is vital for healthy living. Herbalife's Stress Management products balance mood, lift spirits, calm nerves and promote peaceful sleep. De-stress and enjoy a better quality of life with these herbal helpers."[3]

Others again state that our modern lifestyles do not give us enough time for a balanced diet or that industrial farming has exploited the stocks of vitamins and trace elements available in Western soil and therefore we need extra po(r)tions. Nevertheless, most German consumer organisations advise against the use of food supple-

[3] Cf. http://herbalife.com/catalog/catalog.jsp?cid=120975, downloaded April 2008.

ments because their positive impact compared to a balanced diet has not been proven scientifically. At the moment, experts can hardly determine whether potential benefits outweigh the potential risks of using food supplements.

With regard to the market success of food supplements, the widespread diffusion of known and unknown, natural and technical substances and products can be seen as a 'large scale experiment' (Krohn/Weyer 1994) eventually provoking unforeseeable risk to the health of consumers and in some cases to our environments as well. Scientists and regulators are just starting to think about new patterns of risk assessment and decision-making and to reconsider the different contexts of the use of dietary supplements. The common patterns consist of producing ever more detailed scientific knowledge. Mostly this does not lead to an assured set of criteria but rather to more ambiguity and more contradictions. Almost every scientific argument on food supplements has its antagonist and every expert opinion its counterpart (Hahn 2006). New risk management approaches try to base the assessments of food supplements in different contexts of their use and sometimes even to integrate means of user participation in evaluating benefits and risks of the various products.

Whereas in the everyday lives of consumers food supplements can be found on increasingly spacious supermarket-shelves and in promising commercials, the media in Germany present them mainly under a risk-perspective. They are framed as useless, costly products that have a marginally positive impact and might even cause health problems. Every potential user of food supplements reading media articles about their benefits and risks is reminded between the lines of his responsibility to care for his health and to eat a balanced diet. The leading protagonists of this debate are regulating institutions, consumer organisations and trade associations.

The resulting gap of risk perception between official institutions, consumer organizations and the practical use of food supplements by consumers is one crucial element in this case. Another element is the contradictory practices that scientists and regulators have for their routines of risk assessment, which are at risk of easily becoming challenged once a serious harm is realised. Here again practical use and scientific analysis have divergent matters of concern: science and regulation is about risk, about isolated substances and try to define safe upper intake levels – consumers regard food supplements under the frame of potential benefits and as part of their daily diet according to their life-styles.

This phase of risk communication ends with the insight that knowledge which is derived from consumers, their practices and their tacit knowledge is more important for handling risks than had been expected. As long as the given hierarchy between expert and lay knowledge is taken for granted, these knowledge domains remain unused and are therefore unable to contribute to risk communication processes.

As illustrated by the following example, most German consumer counselling is based on one-way information in order to prevent risks by changing consumers' behaviour, but does not pick up uncertainties and ambivalences. Risk communication takes the role of an authoritative advisor and thus aspires to communicate ultimo ratio-statements, either by making clear recommendations or by suggesting selected evaluative criteria. Laypersons' viewpoints, their various and hardly medical reasons for using dietary supplements as well as all context-sensitivity of risk judgments are mostly ignored in these assessments and risk communication efforts.

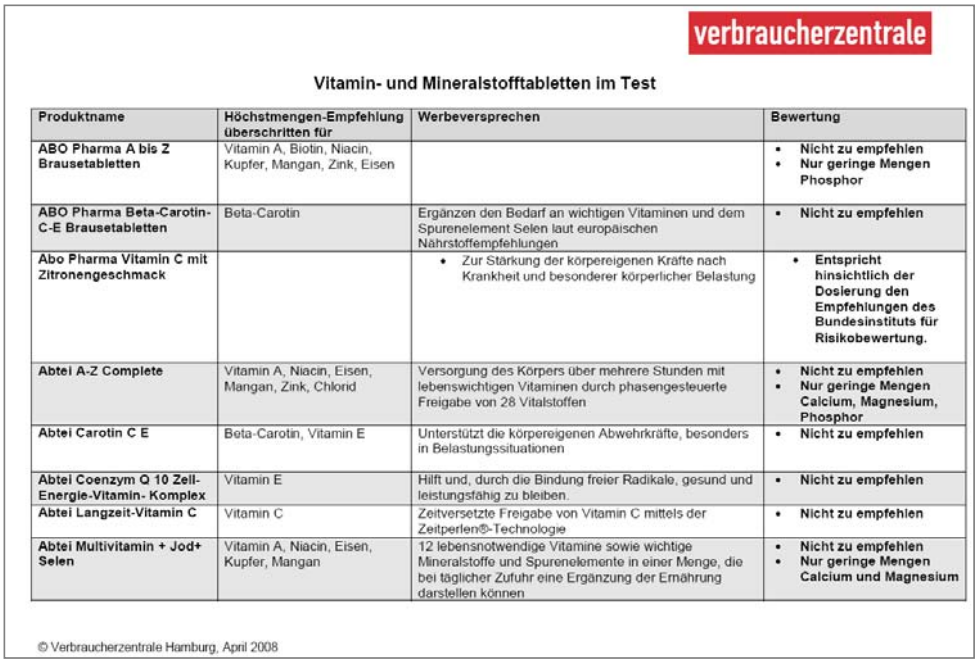
The selected example (see figure 1) stems from the „Verbraucherzentrale“,

one of the most prominent German consumer advice centres. This organisation sees its task in providing independent consumer advice that is mostly critical toward the market. Much of its work is dedicated to consumer protection against unfair marketing practices.

provide upper intake levels for every substance that is allowed as a food supplement.

The third column provides the marketing promise attached to the product in its producer's communication material. This column does not seem to have any impact on the rating in column

Figure 1: consumer advice centre table for food supplements



verbraucherzentrale

Vitamin- und Mineralstofftabletten im Test

Produktname	Höchstmengen-Empfehlung überschritten für	Werbeversprechen	Bewertung
ABO Pharma A bis Z Brausetabletten	Vitamin A, Biotin, Niacin, Kupfer, Mangan, Zink, Eisen		• **Nicht zu empfehlen** • **Nur geringe Mengen Phosphor**
ABO Pharma Beta-Carotin-C-E Brausetabletten	Beta-Carotin	Ergänzen den Bedarf an wichtigen Vitaminen und dem Spurenelement Selen laut europäischen Nährstoffempfehlungen	• **Nicht zu empfehlen**
Abo Pharma Vitamin C mit Zitronengeschmack		• Zur Stärkung der körpereigenen Kräfte nach Krankheit und besonderer körperlicher Belastung	• **Entspricht hinsichtlich der Dosierung den Empfehlungen des Bundesinstituts für Risikobewertung.**
Abtei A-Z Complete	Vitamin A, Niacin, Eisen, Mangan, Zink, Chlorid	Versorgung des Körpers über mehrere Stunden mit lebenswichtigen Vitaminen durch phasengesteuerte Freigabe von 28 Vitalstoffen	• **Nicht zu empfehlen** • **Nur geringe Mengen Calcium, Magnesium, Phosphor**
Abtei Carotin C E	Beta-Carotin, Vitamin E	Unterstützt die körpereigenen Abwehrkräfte, besonders in Belastungssituationen	• **Nicht zu empfehlen**
Abtei Coenzym Q 10 Zell-Energie-Vitamin- Komplex	Vitamin E	Hilft und, durch die Bindung freier Radikale, gesund und leistungsfähig zu bleiben.	• **Nicht zu empfehlen**
Abtei Langzeit-Vitamin C	Vitamin C	Zeitversetzte Freigabe von Vitamin C mittels der Zeitperlen®-Technologie	• **Nicht zu empfehlen**
Abtei Multivitamin + Jod+ Selen	Vitamin A, Niacin, Eisen, Kupfer, Mangan	12 lebensnotwendige Vitamine sowie wichtige Mineralstoffe und Spurenelemente in einer Menge, die bei täglicher Zufuhr eine Ergänzung der Ernährung darstellen können	• **Nicht zu empfehlen** • **Nur geringe Mengen Calcium und Magnesium**

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The centre tested 60 distinct food supplement products. The result is a table that contains four columns for each product with the respective headings: product name, upper intake level exceeded for, marketing promise and rating. The upper intake level of a substance is the highest recommended dosage per day for an adult as suggested by the Federal Risk Assessment Institute (BfR). It is the determinative factor of risk evaluation in this example, which is strongly oriented toward building the capacity "to manage opportunities and dangers as duty of intelligent life on the basis of comparative information" – as cited below (cf. Leiss 1996: 88). The numerical values themselves are not mentioned in the table, only the names of the substances that exceeded the level. Nor is it mentioned that the BfR does not

four. Column four shows the consumer advice. There are basically two values in this column: „not to be recommended", or „follows the upper intake levels of the national risk assessment institute"[4]. For most products, there is no further explanation and it remains unclear which criteria the binary rating takes into account.

The consumer advice centre thus uses a simple yes/no grid to counsel the public. Individual lifestyles or circumstances of usage are excluded from this assessment. The consumer advice is monologic and based on a technocratic and positivist understanding of science and nutrition. Uncertainty and non-knowledge, for example concern-

[4] The upper intake levels relate to the study of Domke et al. 2004.

ing missing upper intake levels or the process in which upper intake levels are being defined, are blinded out as well as all non-scientific judgments of substances and their claimed benefits.

The problem with this kind of scientific advice becomes clear as soon as the black-boxed uncertainties strike back in form of counter-expertise. The 'ping pong game' between expertise and counterexpertise forces reductionist risk communication to change its consumer advice at the speed of scientific progress, followed by the media and their reports on disputed expert advice. Thus, consumers are more and more skeptical with every bit of revised advice, and in the end they stop taking risk communication efforts seriously (Covello et al. 2004; Bostrom 2003; Bennett/Calman 1999). So the paradox of scientific advice means that expert advice presented as authoritative assessment – with no discussion of its own limitations, selectivity and uncertainty – will in the long run undermine its own authority when it appears to be contested, situated in its testing methods and bonded to some contexts of application and not to others. In contrast, incorporating consumer knowledge, producer knowledge and further resources of knowledge as well as judgement about modes of use and potential harm could be helpful to better explore the uncertain, if only risk communication abandons the one way communication model and moves towards a more dialogic and symmetrical mode.

The hope that science and technology alone will generate the solutions for all problems has been mentioned above as a basic assumption of First Modernity (Beck 1992). It is grounded on modernity's divide between nature and culture and puts science into the position of acting as a divine creator towards a natural world considered as passive and external 'environment'. As Bruno Latour (1993) points out, by this divide facts and values, experts and laymen as well as science and politics are separated into antagonistic realms, thereby enabling sciences to speak for facts and politics to speak for values. Bruno Latour questions this assumption and argues that „we have never been modern": In his analysis this modern divide becomes visible as a contra-factual but constitutional construction, which opens up ways for scientific development without urging sciences to take responsibility for these developments and their potentially negative outcomes. Nevertheless, as adverse reactions and unintended consequences reveal, these outcomes travel through the nature-culture-divide and turn unintended health-effects as well as ecological problems into society's internal threats. Risk communication cannot ignore the problem of experts acting as if they were outside of, disentangled from and above nature and society while at the same time manipulating the same and thereby causing internal effects connected to all spheres simultaneously. Scientific risk communication could instead be regarded as an attempt to just dissolve these hidden connections and black-boxed associations by making them visible in forms of dialogues with consumers and their hybrid worlds of practical use. Thus: entanglement is central to an expert's action in risk communication and should be treated as that!

4 Risk Communication dealing with the challenges of Second Modernity

The well-known problem of authoritative consumer counselling is that all too often consumers face a plurality of (contradictory) risk assessments, with yesterday's expertise no longer valid tomorrow and with suggestions lacking experience of modern life. Consumers who realize that scientific warnings are somewhat innocent and come and go – whereas ambivalence and uncertainties stay – not only stop acting on this type of advice but even dispute or ignore scientific risk com-

munication altogether. As a result consumer protection agencies and risk professionals are looking for ever more pleasant, courting, low-threshold and clear-cut formats to at least capture the attention of their target groups in a postmodern age. But persuasive and authoritative formats are under conditions of multiplying points of view even more likely to be contradicted and cannot bridge the gap between contexts of use and contexts of analysis. Together with the plurality of risk advice and the manifold interaction effects of substances in everyday life, risks and uncertainties also increase.

In Second Modernity the public realizes that neither science as the privileged actor of First Modernity's enlightenment promises nor politics or administration as its guiding institutions can protect it from unintended consequences of modern progress. None of these systems can ever control the risks and manufactured uncertainties they are held responsible for. In consequence, much of the recent sociological literature on risks assumes a particular social change in which a sense of generalised uncertainty undermines institutional modes of managing risks as well as public expectations towards expertise (Renn et al. 2007; Renn 2008a/b; Bostrom 2003; Collins/Evans 2007).

Risk communication has to take into consideration this generalised doubt to meet the new requirements (Bennett/Calman 1999; Covello 2004). In the last decade many consumer organisations and decision makers have therefore successfully demanded dialogue-oriented methods of risk communication. Representatives of both sides request the consideration of other voices in risk assessment procedures, and especially public participation is seen to be cornerstone to include the heterogeneous contexts of application together with the various perspectives of different users.

Public participation has the aim to enrich risk assessment procedures. The every day practices of consumers are easily ignored if risk assessment is performed in isolated laboratories from the purified perspective of scientists. The risk assessment on beta carotene can be used as an example here. The questions of scientific risk assessment are if there is a lack of beta carotene and if there can be a risk when taking too high dosage of beta carotene as food supplements. The every day use of beta carotene by consumers is far away from this question. Consumers take beta carotene in food supplements because they hope to protect their skin and to get a nice tanned skin. This gap of perspectives cannot be closed by simple dialogue in risk communication. It has to be addressed already in the risk assessment to allow a risk communication that can take into account societal phenomena together with pharmacologic aspects.

This is what William Leiss (1996) identifies to be central in phase III: the recognition that the lack of trust will be "pervasive in risk issues and that, because of this, risk communication practices must move away from a focus on purely instrumental techniques of persuasive communication" (ibid: 90). This appreciation of two-way communication processes indicates the emphasis on "dialogue" in risk communication in which not only laypersons are expected to engage in social learning processes, but all stakeholders and risk managers as well. Accordingly, Irwin (2008) finds a "move towards greater transparency and engagement" (ibid: 204) connected to "the merits of deliberative democracy" (ibid.) as a practical necessity of second-modern institutions, which might present themselves as being 'in control', but which are constantly disproved by the evidence of risk scandals. Even though many risk issues remain relatively uncontroversial, dialogic modes of risk management juxtaposed to first-modern styles can help

to examine critically the operational assumptions of experts. Moreover in contemporary concepts of risk communications „balanced judgement" is a new keyword which aims at reflecting factual evidence about the matter at hand together with linked interests and values (OECD 2002, IRGC 2005). In addition, many of the involved actors advocate the need for more "reflexive" attitudes in risk communication, which means reconsidering the inherent limitation and selectivity of any risk assessment procedures and in consequence more sensitivity towards unexpected consequences and present nonknowledge in order to not gamble away the remaining confidence and commitment. When the general aim is to help stakeholders to make informed choices about appropriate products and potential benefits and at the same time to create mutual trust and engagement in contested situations of high concern, means of risk communication are needed which make uncertainties and ambivalences transparent, which find ways to open up complexity also for those who are not used to it and which enable those who are likely to be affected by the respective risk to disentangle the various expert opinions related to the controversy. These at least are the challenges that we identify for risk communication in Second Modernity.

These considerations compromise many of the current practices of science-based consumer advice and add to the agenda the question of what humbler technologies – meaning especially more reflexive modes of risk communication that Irwin coins "third-order thinking" (2008) – might look like. When skimming the relevant literature on risk communication (Bennett/Calman 1999; Covello et al. 2004; Renn et al. 2007; Renn 2008b; OECD 2002; Stilgoe et al. 2006) one finds that a set of criteria for such reflexive modes seems to be consensual. Besides more participative procedures, transdisciplinary knowledge and enriched expertise are demanded in order to provide more circumspect risk deliberation. There is a recommendation that advice on risk reduction and safety precautions should be presented along with the context-sensitive analysis of potential risks and benefits. Additionally, more "reflexivity" is demanded. In order to deal with the recognition of expertises' partiality, contexts and blind spots, reflexivity is characterized by the ability of expert institutions to self critically review their prior, tacit commitments (Wynne 1993; Kropp/Wagner 2007; Callon et al. 2009). Consequently, (contradictory) methods and evaluation results should be overtly discussed as well as divergent interests and positions should be reviewed.

These aims are high, and up to now we find them hardly realized with regard to food supplements. In our empirical investigation only one agency explicitly highlights uncertainty and limited knowledge, the German Federal Institute for Risk Assessment (BfR). The Institute was set up in November 2002 to strengthen consumer health protection in reaction to the BSE experiences (Dressel et al. 2007). It is the scientific agency which is responsible for preparing expert reports and opinions on food and feed safety in Germany. The BfR has the statutory task of informing the public about potential, identified and evaluated risks which foods, substances and products may entail for consumers. The assessments are presented in a transparent manner and made readily accessible for the general public on its website. The example below (see figure 2) on iron in food supplements has been selected for our discussion because it addresses very explicitly the complexity and the related uncertainties thereby even questioning the possibility of setting "a maximum level for the use of iron in food supplements".

This example of science based risk communication clearly denotes several uncertainties. Its phrasing renders

clear the inherent limitations, the (medically) restricted points of judgement, and in how far ambivalences condition the expert's ability to give ultimate consumer advice. However, the price of this conscious dealing with uncertainty is still a highly expert oriented and authoritative language with

to follow cultural values and practices to a greater extent than those of physical food science. The same is true for food supplements which, as mentioned above, might even be considered as modern doping or witchcraft.

Learning from the manifold experiences in a world risk society with its

Figure 2: Risk communication on iron in food supplements (BfR 2009)

BfR
Risiken erkennen – Gesundheit schützen

Use of iron in food supplements and for the fortification of food

BfR Opinion, No. 016/2009, 2 March 2009

Iron is an essential trace element that has to be ingested with food. The main sources of iron are meat as well as some types of fruit and vegetables, pulses and cereals. The body needs iron to form haemoglobin and transport oxygen in the blood. For a few years now some breakfast cereals have been fortified with iron. Furthermore, several iron-containing food supplements are also on the market. In 2004 the Federal Institute for Risk Assessment (BfR) already spoke out against food supplements of this kind and fortified foods.

It still cannot be ruled out that a persistently high iron intake increases the risk of the onset of cardiovascular diseases, cancer and diabetes. Given the complex nature of the onset mechanisms of these diseases and the numerous contributory factors, no dose-response relationship can be established between iron and the above-mentioned diseases. Consequently, there is considerable uncertainty about the dose upwards of which negative effects are to be expected in groups in the population. Nor is it possible to set a maximum level for the use of iron in food supplements and fortified foods.

Furthermore, we do not know of any positive effects of elevated iron intake. As large sections of the population have an adequate iron intake and elevated intake would expose them to a health risk, BfR continues to advice against the fortification of food with iron. Iron-containing food supplements should only be taken in conjunction with an established iron deficiency and after consulting a doctor.

no discussion of chosen approaches and testing methods, various usage contexts and motives (lifestyle, pregnancy and others), implicit knowledge in these application contexts and the many linkages of iron as a dietary supplement to further interests, values and reasons. So it is sensitive towards ambivalences, uncertainties and complexities and hopes to enable consumers to make their own informed choices. Nevertheless it follows the frames of the old divides between facts and values, experts and laypersons and thereby does not reconsider the vast landscape of further points of reference and linkages outside specialists' rationalities and habits. But food and food safety have long been recognized

various risk scandals stemming primarily from the unseen relationships and linkages which escape expert rationalities – the keywords are BSE, asbestos, acrylamid – our plea is for greater investment in tools of risk communication which explicitly invest in particularistic and relational risk assessment and risk communication strategies. This means essentially to investigate how things relate to each other and how potentially invisible infrastructures become just blinded out by uni-dimensional evaluation and communication strategies. To adequately deal with risk controversies or science controversies we need a new culture of following linkages beyond the experts' viewpoints and experi-

ences. Such a *relational* approach can be learned by Actor-Network-Theory (Latour 2005, 1987). Refering to Latour, Jost van Loon (2008) suggests to "re-assemble risk communication" without taking for granted given experts' criteria and evaluation methods. Instead, one should re-visit "the scenes of the crime" and ask what this universality is made of and which entities are (obviously) part of the association to be analysed. In a next step different „risk-profiles" should be reviewed to identify which entities and which characteristics are connected, how and by whom, and finally "distinctive risk flows" should be "profiled" as scenarios of risk development and risk dynamics respectively mobilities.

Thereby, we do not want to refer just a new model of scientific governance or science communication that will be able to more effectively educate the public. Instead, our plea is for tools of risk communication representing plural and context-sensitive judgements from various concerned actors. The goal is to rather interrogate and relocalise the operating assumptions, to re-embed experts' judgments and counselling in the contexts of application and thereby to construct platforms, forums or networks for further creation of heterogeneous risk knowledge which transcend the restricted goal to only transfer experts' knowledge to the lay public.

When individuals or public decision makers are faced with possible health risks of food products in Second Modernity's complex worlds, they need to find strategies to deal with diffuse landscapes of information, confusing networks of interrelated claims- and product-making and the dynamic enlargement of value chains and life cycles with numerous interaction effects. This is why it is extremely difficult to come up with knowledge based consumer advice considering the complexity of the typical risk issues, the involved uncertainties and the limited availability of data. The more uncertainties, ambiguities and interdependencies there are within a particular setting (be it a value chain, a life cycle assessment or a product group like dietary supplements and their various applications and usages), the more experts run the risk of improperly reducing the complexities to one or two risk approaches to be able to handle the object of investigation. But dangers often pop up in those connections and interrelations which have been blinded out in previous risk assessment procedures to ensure the achievement of any result at all. Therefore societies need new strategies and integrative informational tools to become able to identify important sources of uncertainty and potential harm and to explore how sources of risk and uncertainty are related to the ways in which the compounding entities[5] of a risk controversy are connected and defined by their (relational) characteristics. We identify a growing need of consumers not to be "informed" or "protected" but to be empowered to decide on their own what is appropriate to any particular situation and at the same time being able to recognise the limitations and omissions as well as the strengths of different expert views. This need is accentuated if the risk to be dealt with is associated with competing interpretations (ambiguities) as to what type of assessment is best

[5] Thereby referring to the underlying concepts of "Actor-Network-Theory" (ANT; cf. Latour 2005; Law/Hassard 1999) we choose the term "entities" to immediately clarify that we will not distinguish between human and non-human elements in risk networks, but we assume that all elements enrolled can act and interact and are part of the continuous making and re-making of risks and risk control. Against the background of ANT risks can be considered as those invisible "quasi-objects" which are the strictly relational and historical products of actor-networks and which only become visible once a network breaks down and the search for responsibility starts distinguishing decision maker and those affected by the decisions made (Luhmann 2005, chapt. 6).

adapted between different epistemic communities or risk management agencies in order to deal with various knowledge and competing safety claims (cf. Renn 2008a).

In consequence, the function of sciences in risk communication in Second Modernity must be strictly relational, consisting of two very different contributions: the first is the application of *operational knowledge* about how to manipulate products along with their potential risks and benefits related to the concrete situations of application. The second is the kind of *intervention-oriented evaluative knowledge* directed to develop meta-expertises to relate specialist judgments coming from different perspectives (cf. Collins/Evans 2007). Thereby science takes the role of a well-prepared moderator deliberating evaluative knowledge from all stakeholders involved in risk controversies.

Facing these challenges of modern risk communication to deal with complex, uncertain and ambiguous risks and their hidden linkages and associations it is necessary to develop a broader understanding of risks and together with the evaluation of risks and benefits, to simultaneously provide (and gather!) a broader knowledge about their construction and their perception as embedded in networks of manufactured, interdependent and more and more global assemblages no longer in the hands of experts or (national) authorities alone (cf. Beck/Kropp 2007). In these fora specialist knowledge is still vital. It would be foolish to ask consumers or traders whether high doses of beta-carotene increase the risk of cancer and cardiovascular diseases. Expertise and science-based evidence are necessary to deal with these questions. But they are not sufficient to give us complete answers for policy decisions on risk regulation.

This is why "mapping strategies" (Beck/Kropp 2011; Venturini 2010) for dealing with risks follow an ANT-methodology "to render social connections traceable" (Latour 2005: 16). Mapping strategies focus on "following the actors themselves […] when they multiply entities and again when they rarefy entities" (Latour 2005: 227) and thereby focus on the building of network-like associations. They try to gather the various risk claims coming from different protagonists in a controversy, to collect statements and materials linked to them and to connect them to the related positions, issues and arguments in order to render visible the otherwise invisible network of risk and risk related operations and negotiations. This is why we, a team of ten scientists, have developed a prototype for visualising risk controversies named "risk cartography" (www.risk-cartography.org; Beck et al. 2009; cf. also www.demoscience.org). Visualisations are crucial parts of this strategy because visual representations allow gathering different forms of knowledge making from different viewpoints at the same time – in synchrony. Thus, the risk cartography relates all data following a visual strategy to represent at once information and illustration, historical routes and tables, textual information and access to its fabrication, statements, arguments, institutions and positions in order to afford deeper understanding of the different dimensions in controversies on science and technology. To give an example, the controversy on the food supplement beta-carotene is linked simultaneously to experts assessing its various effects, to producers' and retailers' advertising promises, to consumers and their everyday use of food supplements, to its effects as a colorant be it synthetic or natural, and to all claims made about beta-carotene, its benefits and potential risks. All this is being visualized in Risk Cartography which enables one to trace as far as possible the above outlined potentially transgressing outcomes and characteristics of beta-carotene when circulating in global value chains.

Figure 3: Exploring controversies of risk with Risk Cartography (for further information on how the risk cartography works see the video tutorial on www.risk-cartography.org)

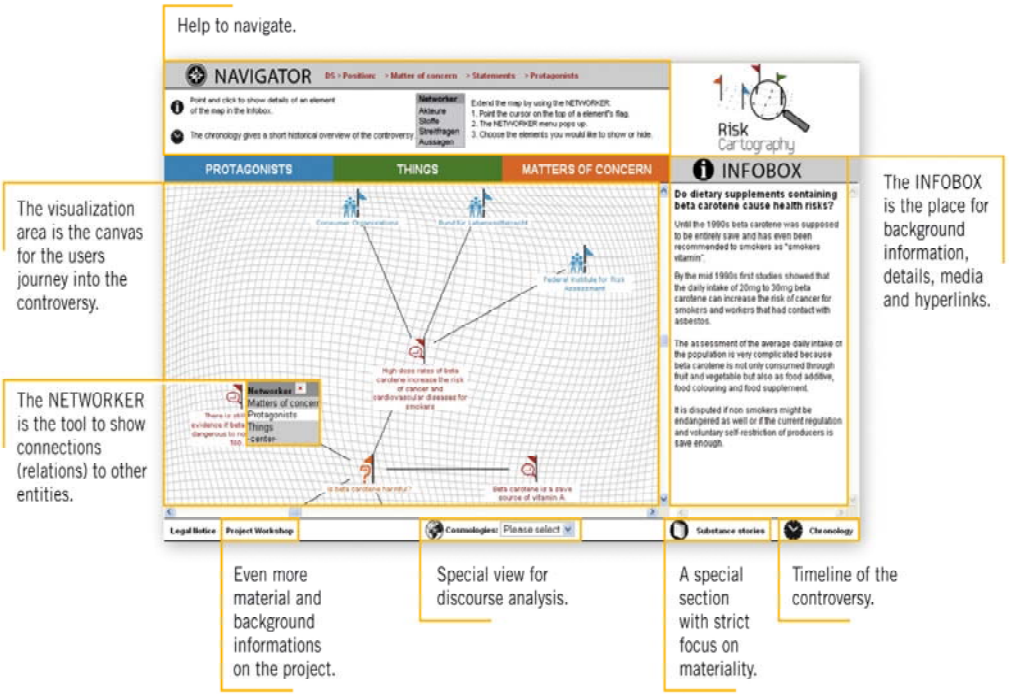
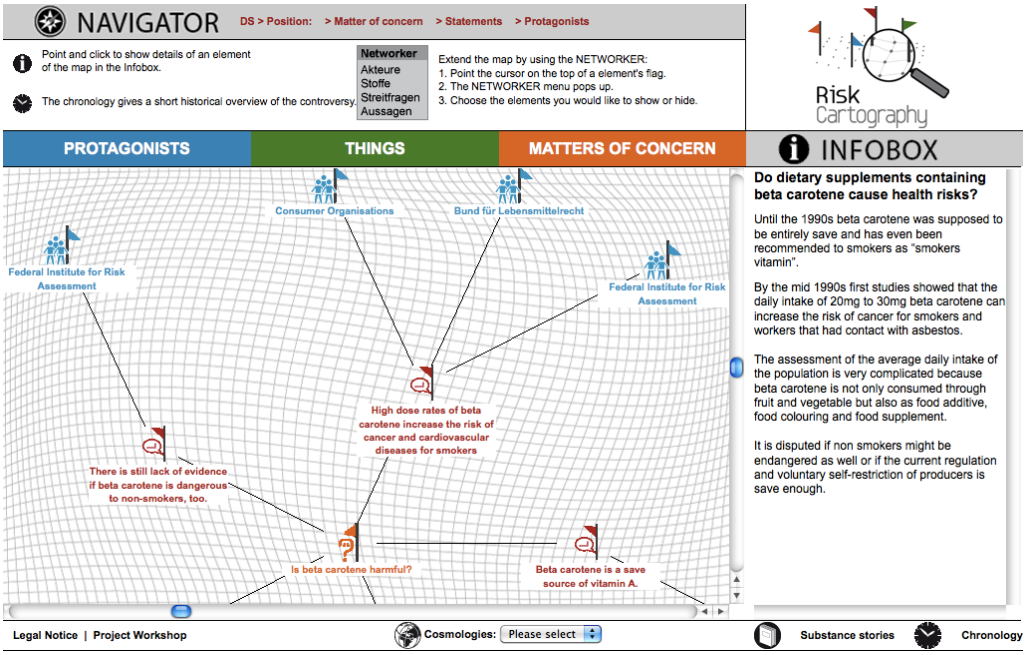


Figure 3 gives an overview of the features of the tool. Besides the mind map like visualization area, special views like substance stories or a chronology are available as well as an Infobox that provides background information in form of text, pictures or videos about the current view.

As a synoptic platform the risk cartography allows the presentation of risk controversies as network of anticipated material relations, of issues articulated from various stakeholders and protagonists related to positions and interests together with a description of related risk claims (cf. Figure 4). Thereby it aims at "thick" descriptions (Latour 2005: 148 referring to the anthropology of Clifford Geertz) of heterogeneous information which users can explore from various angles of the debate and relate to each other following their own multifaceted needs and interests. This kind of risk communication aims at empowering civil society and enabling any interested or affected individual or institution to engage in public deliberation and political decision making about the risk at hand. It represents hot spots of the debate; it opens items and links them to framing discourses, related responsibilities and interests. Thereby under-lying positions of evaluation and judgment are made transparent and knowledge and ignorance are considered almost symmetrically, not only as stabilized facts enunciated by experts but at the same time uncertain concerns of involved actors, contested knowledge claims and unsecured claims of benefit and risk are reassembled together with the related points of view.

The existing prototype of risk cartography is characterised by some limits as well. Firstly, there is its selectivity concerning the gathering of links and information partly because the current state of the art is the result of a research project directed to exploring the prototype and partly because representation is inevitably incomplete and biased. Meanwhile, a more participative experiment has been set up to collect risk perceptions, risk assessments and management strategies

Figure 4: Assemblage of actors, statements and matters of concern in Risk Cartography



via the moderated online-completion of risk cartography by various concerned actors themselves. Secondly, there are some technical restrictions related to the data warehouse, the limits of the screen and the complexity users can deal with. And finally, it is not clear at all whether users feel comfortable with this kind of risk communication providing insights into a vast and far-reaching landscape of controversial knowledge and judgement-making but without advice.

Consumer communication using such relational tools clearly has to dismiss all pretention to give unambiguous advice based on ultimate truth. This approach is much more directed to deliberate on risk issues in a more plural and context-sensitive way and to generate new risk knowledge by giving scientists, users and the public the possibility to relate to each other. This may overstrain the capacities of those consulters looking for quick answers to quick questions. Therefore, mapping strategies in risk communication can only be an additional offer, clearly directed to the critical public which is not looking for paternalistic yes-no-grids but which demands to be enabled to take its part in decision making in Second Modernity. These are tools to empower the citizen-sovereigns and the concerned experts all together to have a say in discussions of health risks and environmental challenges and to transcend existing limitations of not being prepared to step into the debates. It is a mode of risk communication which is open to contested knowledge and which is considering heterogeneity as a resource rather than a burden. At the same time, it is a very special type of representation addressed to empower politics to be able to absorb more diversity and plurality.

5 Conclusion

In First Modernity science adopted the future oriented welfare promise from religion by its claim to exempt societies from given coercions and to solve all "rational" and "technical" problems by systematic knowledge and methodically based approaches. Whereas "irrational" and "archaic" problems were left in the realm of church and tradition, better living conditions, higher efficacy, more welfare and the

end of physical constraints were expected for all those modern societies – respectively social systems – that decided to follow science instead of complying with pre-modern limitations. Consequently, scientists' and experts' knowledge and evaluation have been considered legitimated in themselves and, once they have passed the peer review, did not need to be justified anymore.

The situation changed with the growing public awareness that scientific technologies presented as a solution may simultaneously become a cause of new problems or of making the same problems worse. This reflexive pattern of scientific problem solving being at risk of entailing problems because of unintended consequences and adverse reactions also applies to the case of food supplements. They promise to optimize the physical performance and to overcome physical limits and psychological weakness. However, at the same time consumers have become familiar with the experts' worry that the same wonder drugs may cause illness, pain and health problems which worsen the constitutional conditions. But once dietary supplements and performance enhancing drugs are at hand, weakness and illness are no longer accepted to be naturally given and fate; they demand to be mastered by the competent individual. In consequence, food supplements play the role of modern permanent-doping, self-optimizing based in nutrition technologies is becoming a social norm and expert advice is indispensible, but questioned to be either instrumental or the first step into the next problem.

Under these conditions trust in science is not to be taken for granted! Science and expertise are now confronted with immense and infinite expectations together with far reaching and multifold doubts. To give science-based consumer advice under these conditions in the authoritative and self-reliant mode of First Modernity or in the campaigning modes of Postmodernity (chap.3) ignores the fundamental challenge of risk communication in Second Modernity. Nowadays scientific risk communication has to deal with the problems of contradictory expertise, of uncertainty and context-depending ambivalence and a world-wide-web offering lots of unclassified information which asks for "meta-expertises" to judge other expertises (Collins/Evans 2007: 45ff.). The risk cartography (chap. 4) may be regarded as a first conceptual step toward exploring these heterogeneous spaces of expertises and counter-expertise, offering at least a multi-perspective synopsis about different knowledge claims and their entanglement to actors, materials, issues and interests. But there is still a long way left to achieve new reflexive and dialogue oriented "third-order" modes of risk communication adapted for broader deliberation about competing knowledge claims with well-informed, "sovereign" consumers. And still more reflexive modes of risk communication which may succeed in dealing with the problems of science-based statements and legitimated evaluations will not recover trust in science and expertise, but they may empower the consumers to become citizens in a technological world (cf. Latour 2004; Frankenfeld 1992).

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