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Climate Change, the Social Construct of Climate and Climate Policy

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1 Introduction

The sensitivity of humans in modern societies to the impact of climate on their lives and, in particular, to possible future climate change abruptly entered the arena of public conciousness a few years ago and remains an issue that draws considerable public attention. In the natural sciences the view prevails that an effective response to the threat of a changing global environment has not been instituted mainly because society, or societies, failed to understand the physics of the ongoing natural processes. We suggest that this approach represents a flawed understanding of the dynamics of public discourse, to which problems are granted entry only as "social constructs" that compete for public attention with other environmental as well as other social problems. The attentiveness of the public and policy makers to such issues depends on the perceived threat they appear to represent to society. The required evidence for such an "immediate threat" of the climate primarily is supplied by extreme natural events which are independent of the real climate change (such as the US drought in 1988 or the intense storm season in spring 1993 in Northern Europe).

In our contribution we discuss the concept of the "social construct of climate", its dependence or independence of the physical climate and its impact on the design of climate policy. We illustrate our idea by comparing the present situation with historical analogues from the medieval time and from the first half of the present century.

This paper is organized as follows: First, physical aspects of climate and its natural variability are briefly discussed (Section 2) and then the state of our knowledge of expected climate change (Section 3). In Section 4 we present our definition of the "social construct of climate", and in Section 5 we discuss first the "technocratic" approach of designing a climate policy and contrast these ideas with actual developments in the past and presently. Finally, in Section 6 we discuss the options which we think are available for a specification of climate policy.

2 The climate system and its natural variability

The physical state of the climate, and in particular the state of the lower troposphere which affects society most significantly, varies on a wide range on temporal scales due to various natural processes. This variability is significant for two reasons: first, it may mask any possible man-made signal and second, this variability forced earlier societies to confront the threat of climate change - so that we may compare the response

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of the contemporary society with earlier ones.

The shortest time scales are days with "weather events" such as storms or blocking events. The frequency and intensity of these events are mostly randomly distributed. There is always a chance for a "1000 year" storm to happen. The probability for such an event is small but *not zero*. Also, on somewhat longer time scales of weeks droughts and floods may happen with small but non zero probability. More precisely, the probability that at any a-priori specified location a strong storm, a drought or a flood will happen are small. But the probability that at some location on the world there will be a strong storm, a drought or a flood is no longer small. (Hoyt (1981) offers an interesting statistic of the frequency of records.)

On time scales of years, decades and even longer the climate system also exhibits marked variations, as is exemplified by the "Middle England" time series of temperature (Figure 1). The dynamics of these "low-frequency" variations are not well understood so far, but a robust concept within which these variations appear sensible, is the "stochastic climate model" approach by Hasselmann (1976) who proposed the redness of the climate spectra to be a response of a slow system to high-frequency random forcing.

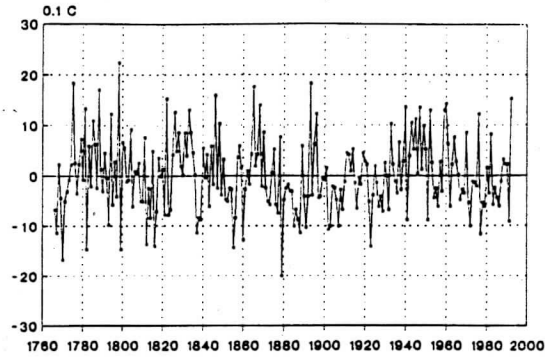

Figure 1: *"Middle England" time series of April-May-June mean temperatures since 1765*

3 Man-made Climate

Today, when the notion of "climate change " has become an "household term" (Ungar, 1992), is it well worth reminding us what the material basis of the scenario of "CO_2 induced climate change" really is. The state of the discussion has been summarized by the highly valued "Intergovernmental Panel of Climate Change" (IPCC, 1990), a committee made up by reputable scientists. This panel concluded that the dramatically increased atmospheric concentration of radiatively active gases since the industrialization has in fact taken place, and that this increase likely will continue unless political measures are instituted to reduce emissions. Theoretical reflection as well as extensive (and expensive) experiments with detailed climate models have lead to the prognosis that the increased concentration of radiatively active gases will produce an increase of the overall near-surface temperature on earth.

This expectation has not (yet) been unambiguously supported by observational studies because of lack of adequate as well as sufficiently long and homogenous observational data. In short, the "signal" of the greenhouse-warming has not (yet) emerged from the sea of "natural climate variability" described in Section 2. There has been a general near-surface warming on Earth in the last 100, or so years, which *could* be due to greenhouse warming, both in terms of pattern and intensity, but the increase in the warming in the few years is comparable to that in the 1920s. Because of these uncertainties the IPCC offered the following cautionary note in its 1990 report:

> *"... this warming is broadly consistent with predictions of climate models, but it is also of the same magnitude as natural climate variability. Thus the ob-*

served increase could be largely due to this internal variability... the unequivocal detection of the enhanced greenhouse effect from observations is not likely for a decade or more."

(IPCC, 1990).

It should be stressed that all global warming scenarios with some spatial detail are based on "climate models" that are the best available intellectual tools for the study and prognosis of possible (man-made or natural) climate variations. Such climate models *approximate* the real climate system and are based on detailed "general circulation models" of the ocean and the atmosphere and other components of the climate system. The oceanic and atmospheric components are relatively reliable elements in these complex climate models. Other components, such as the earth surface or the sea-ice are much less reliably represented.

All climate models are somehow conceptually related, not only through their basic "first principles" but also in their choices of which processes to take into account in a parameterized from. Therefore similar scenarios derived from two different climate models, say from GFDL or from the MPI, do *not* supply the scientific community with two *independent* evidences that these scenarios might be correct.

Because of limited observational data it is not really possible to rigorously *test* the climate models in order to demonstrate that the models are capable to simulate climate change realistically. Certainly, these models have been examined with respect to weather forecasting, El Niño forecasting and the simulation of the present day climatology. Their success in doing so together with the fact that a significant part of the models is based on "first principles" provides us with some confidence. We believe that the models describe the significant sensitivities in the climate system - but we do not really *know* it.

4 The Social Construct of Climate

Society obviously depends on climate. But what is the effect of climate *anomalies* on society? We claim that this dependency is largely conditional to the time scale. In the past, "slow" variations appear to have had little social and economic impact, with "slow" representing time scales longer than the *time horizon of everyday life* of something between 1 and 30 years. "Fast" anomalies, which comprise "normal extremes" such as a "100 year storm surge" and multi-year anomalies like the cold spell in Europe during the last third of 17th century (e.g., Lindgren and Neumann, 1981), have, in comparison, often a much more consequential impact on society. Such climatic events can produce irreversible social , economic and cultural changes either by virtue of their impact on the natural environment of a society (e.g., land lost to the sea, desertification) or, by demographic (e.g. rural exodus, mortality), cultural (emerging values) and economic changes (standard of living, trade patterns, the organization and location production, agricultural yields).

It is reasonable since we are concerned with the impact of and response to climate changes induced by human activities to restrict the notion of "climate" to slow changes. As a result, we encounter two competing images in the arena of public discourse: the (slow) "climate" and its changes and the (fast) "extremes" (including naturally occurring multi-year anomalies). These two cognitive entities are (physically) unrelated to each other. Our hypothesis is that the society is biased in its attention towards the extremes and mistakes extremes as climate change.

The almost monopolistic interpretation of climate variations by societal authorities also is an important factor for the social response to an observed real or imaginary climate change. Such authorities may be science or charlatans but also

the modern media, superstition or, religious institutions. As indicated, another important factor is, at any given time, the competition for public attention and solutions among rival social problems. In the contemporary world, as we know, potential rivals competing with the threat of climate change for scarce public attention and resources are many more or less urgent social problems. Because of these processes, the public never perceives the real climate system in an unmediated fashion but only through a filtered image of it, namely "the social construct of climate". We claim that the climate and its social construct can be independent entities or events (and we will discuss the famine in England 1314-17 as an example of such an independence later). The significant implication of distinguishing climate and its social construct is that it is only the social construct which ultimately shapes "climate policy" whereas the climate itself plays no or an insignificant role in the process of designing a climate policy. A schematic description of the interdependencies between the phenomenon "climate", "social construct of climate" and "climate policy" is offered by Figure 2.

5 Climate Policy

In the scientific community, discussion on how to respond to the perspective of man-made climate change economic concepts and perspectives have dominated. And in the intellectual tradition of economics, a perfectly informed society designs an "optimal" response strategy. A prototype is Hasselmann's (1990) "Global Environment and Society"-model which is sketched in Figure 3. Two entities, namely "climate" and "socio-economy" interact with each other via environmental parameters, such as precipitation or temperature, and the emission of radiatively active gases. The "costs" of a climate change ("damage costs") as well as the costs of changing the economy required to avoid or diminish climate change ("abatement costs") are, at least in principle, known and can be quantified in some units (money or moral units). This quantification is done according to social norms and political decisions that represents societal preference and utility scales. Then, an "optimal" climate policy is designed to minimize the total costs, as given by the damage costs and the abatement costs. Examples of such approaches have been presented by first Nordhaus (1991) and, among others, Tahvonen et al. (1993).

We contrast such a viewpoint which we call the "technocratic" approach with a perspective in which not climate itself but the social construct of climate is the dominant dynamic. We claim that society does not pay attention and respond to the real and thus slow climate change signal, instead society mistakes extremes as indicators of climate change. We illustrate our conception with three examples.

5.1 Example: England 1315-1317

In the years 1315 to 1317 the harvest in England failed - mainly because of persistent summer precipitation. As a consequence a famine developed in conjunction with the spread of diseases (with up to 10% of the population left dead (Bray et al., 1993)). The authorities, essentially the church, had warned the people prior to the insufficient harvests again and again that God would punish them if they would not adopt higher moral standards in their life. The actual climatic extreme was interpreted as a climate change. The (only) believable factor controlling climate was God, thus, this change in the climate reflected God's anger and revenge. Because of the life-threatening character of the implications of climate change (famine, death) "adaptation" was not an acceptable climate policy, instead the only available option was "abatement", which meant to put an end to god's wrath. And that exactly was the social response at the time (Kershaw, 1973):

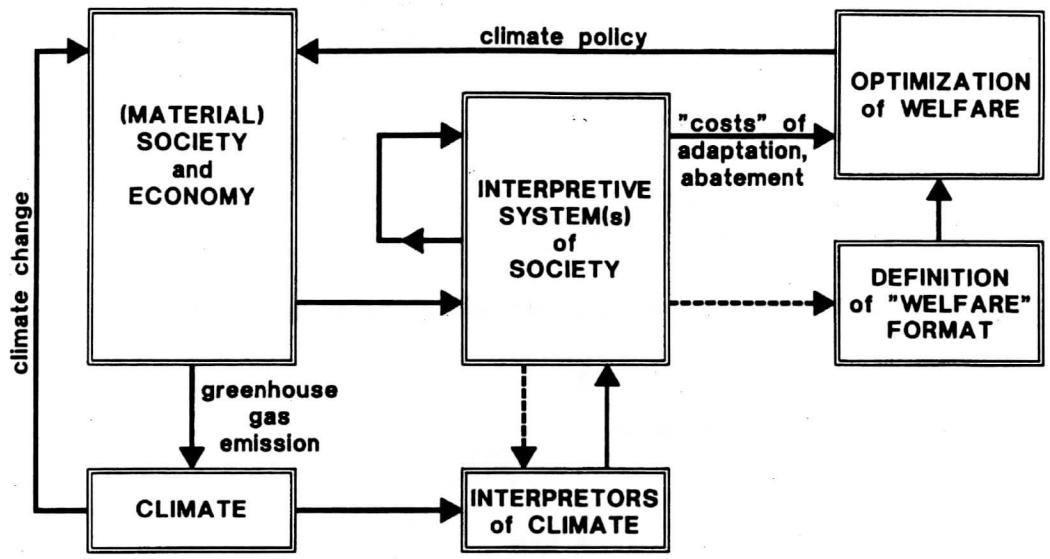

Figure 2: *Schematic representation of the interplay between climate, the social construct of climate and climate policy.*

> *"... the archbishop of Canterbury ordered the clergy to perform solemn, barefooted processions bearing the Sacrament and relics, accompanied by the ringing of the bells, chanting of the litany, and the celebration of the mass. This was in the hope of encouraging the people to atone for their sins and appease the wrath of God by prayer, fasting, alms giving, and other charitable work."*

This climate policy was successful: the climate anomaly ceased away, the harvests recovered.

Obviously, the social construct of climate and climate were unrelated in this case. Other examples for the medieval era might make reference to witches who were widely perceived to either directly modify climate through witchcraft or, indirectly by exciting god's anger about the people who failed to take action against the evil practice of the witches (cf. Behringer, 1988).

5.2 The Climate-"Catastrophy"

The idea that emissions of greenhouse gases might artificially change the global climate, with an increase of the near-surface temperature, was already proposed in 1896 by Arrhenius. For many years this notion was considered an intellectually appealing but practically unimportant thought. Only in the 1970s the possible impacts of the anthropogenic greenhouse effect were discussed more seriously (e.g. Kellogg, 1978). In the 1980s the "greenhouse effect" became the most important topic in the climate research with increasing funding ever since. The public appeared to suddenly accept the "greenhouse problem " as a relevant issue in the aftermath of extreme events:

- The North American drought in 1988 was crucial for the discussion in North America (see Ungar, 1992). During a hearing of the US Senate the well known climate researcher Jim Hansen declared the drought to be related to the anthropogenic climate change with "99% certainty" (see the de-

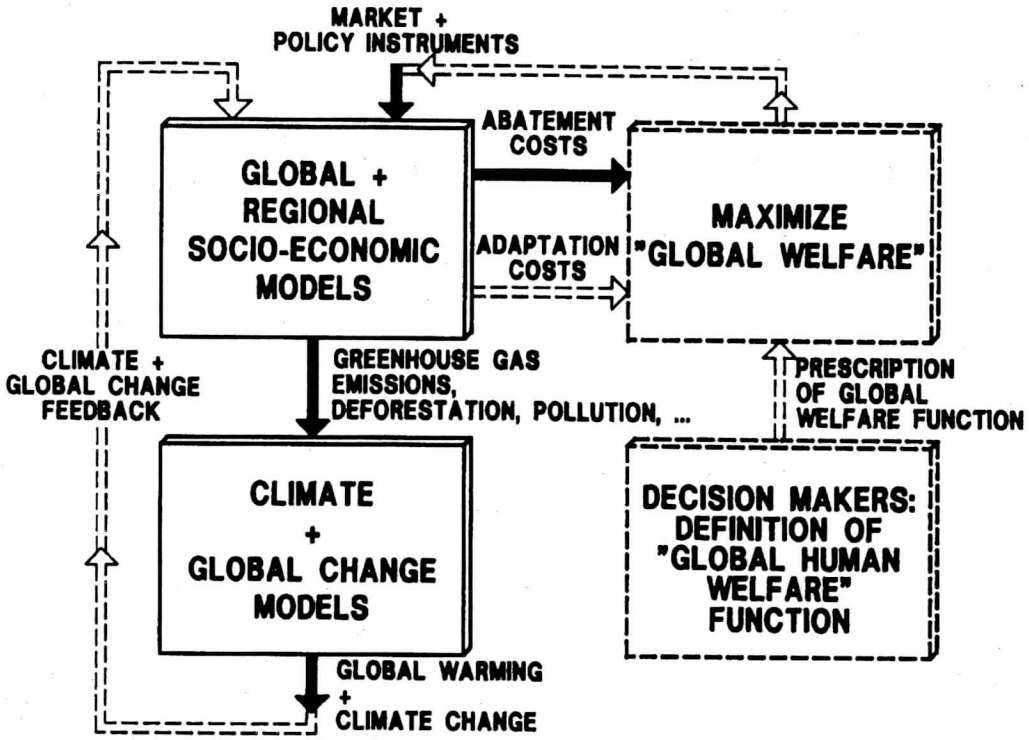

Figure 3: *"Global Environment and Society Model" after Hasselmann (1990)*

scription in Schneider, 1989). This statement had a poor substantive basis and appears dubious in view of the absence of further droughts in the following years (and the headlines in the summer of 1993 were dominated by dramatic flooding in the same regions). An alternative explanation for the drought, as the result of a response to a peculiar configuration of sea- surface temperature anomalies in the North Pacific, was put forward by Trenberth et al. (1988).

- In the spring of both 1991 and 1993, Northern Europe experienced a series of severe storms which caused significant damage. The series of storms were interpreted by the media as an indicator of the predicted climate change, and even scientist with considerable repute declared more or less openly that the frequency of intense storms has and would further increase as a response to human emissions of greenhouse gases. A statistical analysis of the frequencies of storms in the past 100 years did not support this, but were not taken seriously.

5.3 Example: The years 1920/30

Within two decades, from 1911-20 to 1931-40, the annual mean temperature on the North-

ern hemisphere increased by $0.3°C$ (Jones and Briffa, 1992; see also Figure 1). Local changes were as high as $1°C$ and more. The public did not take notice of this change although the magnitude is comparable to the present change (the northern hemisphere mean temperature change from the 1971-80 decade to the 1981-90 decade was only $0.25°C$ according to Jones and Briffa (1992)). We would suggest that climate change in those days failed to become a mayor public concern because of the competition from traumatic social problems such as the societal reorganization after the First World War, the economic depression and the formation of totalitarian regimes.

6 Options of a Climate Policy

We claim that any climate policy is subject to the following dilemmas:

- If a "slow" climate change is takes place and if the public is prepared for such a change by the authorities, then the real slowly evolving signal will hardly be noticed. Instead the public accepts extremes, which are consistent (but mostly unrelated) with the warnings, as "proofs" of the reality of climate change. An active abatement or adaptation policy can be designed - if this policy will be adequate is an open question.

- If the climate changes gradually and the public is not concerned about such a change, a passive adaptation will take place. The naturally occurring extremes are correctly accepted as unavoidable natural interruptions.

- If climate does not change, but the public expects a climate change, then any extreme (or multiyear anomaly) will be interpreted as evidence for the climate change and a climate policy will be instituted according to the norms accepted in a given society and historical period.

- If the climate is stationary and the society does not expect changes and extremes will create no demand for a climate policy.

The last configuration is the most frequent in history: In most historical reports the weather and the weather related catastrophes appear mostly for reasons of completeness (e.g., Weikinn, 1958-61). The case "England 1314-1317" belongs to the third category, the case "1920/30" must be attributed to the second category and the present situation may belong the first of the third group.

Conclusions of our discussion are

- The problem of climate change is hardly comprehensible for most of the public. The anticipated climate change happens on time scales longer than the "time horizon of every day life" so that people are confronted with the request of responding to threats they actually do not experience personally. Even social groups who closely depend on environmental factors sensitive to climate change, such as the agriculture sector or professionals concerned with coastal defense, find it difficult to deal with a slow but steady climate change.

- The notions of "climate" and "social construct of climate" are not contradictory but they are often independent of each other.

- A "reasonable" reaction of society to the notion of climate change induced by humans, which can at least in principle be controlled by political measures, is unrealistic. Such a reaction perhaps could be produced by a skillful manipulation of the "mis"-understanding of extremes - it appears that such an option does exist in the

minds of some natural scientists - or by a way of a vigorous public campaign.

In any case, there is a substantial need for interactions between the well separated science states of "climate research" and "social research" to understand the interactions between climate and the social construct of climate. We need more historical analogies of the present situations. Also empirical analyses of the perception of climate and weather are required to answer, among others, the key question of "What is special about the climate problem that it could appear as more serious than most other social problems?"

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